

Jews and Science in German Contexts

Edited by
ULRICH CHARPA
and UTE DEICHMANN

*Schriftenreihe
wissenschaftlicher Abhandlungen des
Leo Baeck Instituts*

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Mohr Siebeck

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Case Studies from
the 19th and 20th Centuries

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Foreword

In 2003 the Leo Baeck Institute in London (LBI) established a long-term project aimed at documenting and explaining the role of Jews in German-speaking academia during the nineteenth and twentieth centuries. From the beginning this project has been carried out in cooperation with the Sidney M. Edelstein Center for the History and Philosophy of Science, Technology and Medicine at the Hebrew University of Jerusalem. It is also closely connected to the *Modern Jewish History, Culture, and Thought* programme at the University of Sussex which gave the LBI an opportunity to integrate the topic into an educational framework. The project received its initial impetus from an exchange with Dan Diner (Jerusalem and Leipzig) which led to a conference organised by the Simon Dubnow Institute, Leipzig, in 2002, and the publication of a special section on science and the Jews in that institute's 2004 Yearbook. Apart from the editors, two other participants of the first meeting in Leipzig, Ruth Lewin Sime and Anthony S. Travis, contributed to the current volume. Other articles by members of the LBI research project have appeared recently in various journals and collected volumes. The present book is the first "home-publication" of the project and we owe great thanks to our colleagues at the LBI, especially Gabriele Rahaman for her careful editing of the articles, and the editors of the *Schriftenreihe wissenschaftlicher Abhandlungen des Leo Baeck Instituts*, John Grenville and Raphael Gross, for their advice.

In connection with the LBI project four workshops were organised, three in Jerusalem (one in 2003 and two in 2006) and one in Brighton (2004). The project is an integral part of current developments in the field of Jewish Studies as well as that of history and philosophy of science. As to the first, this is reflected in the foundation of *Aleph – Historical Studies in Science & Judaism* in 2001, an annual journal edited by Gad Freudenthal and published by the Edelstein Center at the Hebrew University. *Aleph* is devoted to the exploration of the interface between Judaism and science. Its appearance provided the motivation for a serious engagement with questions related to Jews and the sciences, especially since *Aleph* also publishes scholarly pieces on modernity by authors such as David Hollinger and Shulamit Volkov. However, the main emphasis has been on the mediaeval period, since here the interrelations are more clear-cut because Jewish proto-scientists and

scholars can be primarily conceived of as Jews who connect their scholarly work with religious or theological attitudes. In the realm of modernity, however, with scientists becoming increasingly secular, attempts to create a relationship between Judaism and science pose a problem. The current volume addresses these difficulties at various levels by, for example, reconstructing the way in which Jewish scientists were concentrated in particular disciplines as well as by analysing practical and intellectual issues, emphasising certain ways of practising science, and looking at the methodology and metaphysics of science.

In contrast to most of the increasing number of biographical studies related to German-Jewish scientists in the nineteenth and twentieth centuries, the emphasis here is on their science. The authors examine the relationships between the cultural and social situations on the one hand and various scientific activities on the other. The contributions document general tendencies as well as individual cases of research practices, achievements, attitudes and biases of Jewish scientists mostly in Germany and Austria but also in the United Kingdom and Palestine/Israel. At the same time, attitudes of non-Jews towards Jewish scientists are also considered.

The focus of the first section is on research practices, achievements, and their background.

Ute Deichmann analyses the work of Ferdinand Cohn, one of the founders of microbiology in the late nineteenth century. It is argued that the value which he attributed to empiricism, to the knowledge of literature in the field, to the outstanding research by others, his readiness to criticise and reject claims, and his predilection for reasoning can be related at least to some extent to his experience of the “testimonial” Jewish traditional education in his youth. In addition Deichmann draws attention to the possibility of drawing parallels between Cohn’s predilection for “discreteness” in nature – the individuality of bacterial strains – and the primarily legislative character of the Jewish religion and its classificational basis. This leads to the general problem of whether experience in religious practices may have at least in some cases contributed to a researcher’s predilection towards certain principles and methodologies in science. Questions of this type have been discussed extensively with regard to Newton and others, and there is thus every reason not to neglect them in this field.

In common with microbiology, chemistry was an area in which Jews played a major role in the nineteenth century. By focussing on Raphael Meldola, grandson of a chief Sephardi rabbi in London, and president of the British Chemical Society, who emphasised the achievements of German chemists in the English-speaking world, Anthony Travis explores the overrepresentation of German-Jewish chemists and entrepreneurs in the dye-making industry. He relates their success to craft skills, developed for centu-

ries in the Jewish communities, to existing occupation patterns as well as to new opportunities and restrictions on academic advancement. At the turn of the nineteenth to the twentieth century Jews were still among the most prominent contributors to chemistry in Germany.

Moritz Epple's article deals with the early activities in applied mathematics, literature and philosophical criticism of Felix Hausdorff, who (under the pseudonym of Paul Mongré) was a radical, Nietzsche-inspired critic of metaphysics and also a modernist mathematician engaged in set theory. Epple argues that the style of Hausdorff's later ground-breaking mathematical work was influenced significantly by his earlier intellectual outlook, with both being at quite a distance from cultural and scientific mainstream traditions in nineteenth century Germany. Whereas some aspects of Hausdorff's professional career can be easily related to his Jewish background, the question of whether or not, and to what extent, this background contributed to his remarkable – and in many ways singular – intellectual output remains an open question.

Deichmann's second contribution distinguishes between two different ways of working in biochemical research in early twentieth century Germany and analyses the backgrounds to both. She portrays Leonor Michaelis and his work as the representative of a group of highly successful, mainly Jewish, scientists who by a unique combination of (quantitative and exact) empirical research and theorising, as well as by possessing the abilities to bridge various scientific fields, became leading figures in novel research at the interface of medicine, biology and chemistry, in particular immunology, enzymology and intermediate metabolism. Emil Abderhalden here represents the majority of German – Jewish and non-Jewish – medical biochemists whose work was less scientific, lacking in rigorous experimentation and emphasising strongly medical application and concepts of colloidal chemistry.

The main theme of the second section of this volume is the impact of religious and ideological attitudes on scientific research and acceptance in society.

Raphael Falk portrays three Zionist scientists in the first decades of the twentieth century, Shneur Zalman Bychowski, Redcliffe Nathan Salaman, and Fritz Shimon Bodenheimer. Despite their very different religious and social backgrounds, they shared the seemingly contradictory aims of re-establishing a biological entity "Jew" while promoting universal humanistic values at the same time. Falk claims that this humanistic version of nationalism also allowed practising Zionists to maintain explicit racial and eugenic notions in spite of the developments in Nazi and post-war Germany.

Nurit Kirsh analyses the influences of Zionism as well as those of German antisemitic traditions on the research in human population genetic con-

ducted by three Israeli researchers who were former German or Austrian citizens, namely the physicians Chaim Sheba and Joseph Gurevitch and the geneticist Elisabeth Goldschmidt. Whereas their research complied with international scientific standards, the explanations they put forward were biased by virtue of excluding conclusions at variance with accepted Zionist views. Thus differences between Ashkenazi and Oriental Jews were established, but, in accordance with the Zionist ethos and German antisemitic traditions, they were also interpreted by the researchers according to the idea of a common biological origin of all Jews.

Yael Hashiloni-Dolev draws on her extensive study of attitudes towards reproductive genetics in Israel and Germany when examining the impact of religious cultures on the practical implementation of this science. She shows that Jewish and Christian religious understandings of abortion, eugenics, disability, suffering, and interference with nature (or God's creation) are relevant to the ethical dilemmas related to reproductive genetics in both countries, and even among citizens who claim to be secular. Whereas Jewish culture in Israel stresses the potential blessings of reproductive genetics, Christian culture in Germany emphasises its potential moral burdens, since it "plays God", has no respect for foetuses, and denies the value of suffering.

Ulrich Charpa attempts to shed new light on the question of Einstein's "Jewishness" as a scientist. He examines the view that most of what is widely cited in this regard – namely his political and social activities – can be characterised as actions *in favour of* Jews and not as features of a Jewish identity, and least of all as being decisive for his identity as a Jewish scientist. Even more disturbing in Charpa's view is the fact that Einstein's quasi-religious *Weltanschauung* which plays an essential part in his concept of science turns major traditional Jewish attitudes on their head. Charpa advocates the thesis that Einstein's way of looking at science and religion is an isolated anachronism, a very specific example of "Jewishness" mirroring central ideas of mid-nineteenth century German Reform Judaism. It was transmitted to Einstein by the prolific writer Aaron Bernstein whose books Einstein had read in his youth and about which he was still enthusiastic in his later years.

The third section focuses on Nazi Germany and the post-Nazi period, respectively, to examine the role of antisemitism in academia, though this topic enters into most of the essays.

The discussion about science and Nazi ideology has mainly focussed on "German" or "Aryan" Physics. In his contribution Aharon Loewenstein deals with an interesting but neglected international aspect to this topic, namely an article published in April 1938 by the German physicist Johannes Stark in the prominent English journal *Nature* entitled: "The Pragmatic and Dogmatic Spirit in Physics". Stark divides the world of physics into the "dogmatic" and the "pragmatic", the desired "pragmatic" sector being repre-

sented mostly by “Aryan” scientists, the undesired “dogmatic” one by Jewish scientists. Loewenstein analyses the background to the publication of this antisemitic article and the response it received from the scientific community.

Ruth Lewin Sime uses the post-war correspondence of Albert Einstein, Otto Meyerhof, and Lise Meitner with their former colleagues in Germany, Otto Hahn and Max von Laue, to analyse how some National-Socialist practices were continued after the end of the Second World War. In sharp contrast to the émigrés, Laue and Hahn played down the recent past because they regarded its memory as incompatible with their advocacy for German science and Germany and saw their émigré colleagues as permanent outsiders. Meitner and Meyerhof, sensitive to the prevailing mentality, refused offers to return to Germany.

The volume ends with a prosopographical overview by Simone Wenkel. Using a variety of sources, she gives a statistical overview of the participation of German-Jewish scientists in various fields of science and medicine in the nineteenth and twentieth centuries, and draws up an extensive list that includes names and some biographical data on German-speaking Jewish scientists and medical scientists.

London, July 2006

The Editors

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I. Introduction by the Editors

Problems, Phenomena, Explanatory Approaches

Who is a German-Jewish Scientist?

1. *The Einstein case and its paradoxes*

On 14 March 1929, Albert Einstein's fiftieth birthday, the *Soncino-Gesellschaft der Freunde des jüdischen Buches zu Berlin* (Soncino society of the friends of the Jewish book in Berlin), marked the event by publishing the booklet *Gelegentliches* (A Miscellany). Its thirty-two pages included pronouncements by Einstein on the relationship between science and politics, on being Jewish, and on certain prominent personalities. Some of Einstein's opinions included in the topic of "*konfessionelle Traditionen*" (confessional traditions) were those which he considered himself unable to accept other than in terms of historical or psychological issues.¹ Though the society of bibliophiles was enthusiastic about the "Jewish genius" the fact that they were an obscure body prevented the booklet from receiving attention. The "Soncinos" were named after Joshua Soncino, the most successful of those early printers at the end of the fifteenth century who set up Hebrew presses. His first printing in Hebrew was the first Talmud tractate, *Berakhoth*. It starts by tackling the question at which time one should utter the *sh'ma* – the central tenet of the Jewish "*konfessionelle Tradition*". Most likely Einstein's answer to the rabbinic problem would simply have been "Never!"

While there is no need for historians of science to discuss whether or not such an answer would have caused Joshua Soncino to turn in his grave, Einstein's attitude towards his Jewishness is intriguing, particularly in view of his mythic status. Historian Shulamit Volkov observed that "If anyone may be compared with Einstein, it is two famous non-Jews"², namely Wilhelm Conrad Röntgen and Wilhelm Ostwald. Volkov makes this point in the course of her discussion on the reflections by Thorstein Veblen and others concerning the success of Jews in modern science. Volkov decided to omit Albert Einstein from her analysis of the part played by Jews in Ger-

¹ *Gelegentliches von Albert Einstein*, Berlin 1929, pp. 9f.

² Shulamit Volkov, 'Jewish Scientists in Imperial Germany (Parts I and II)', in *Aleph: Historical Studies in Science and Judaism*, vol. 1 (2001), pp. 215–281, here p. 260.

man research institutions. Here we shall not go into the reasons for this exclusion.³

Nevertheless, no study of the role of Jews in nineteenth and twentieth century German academia can avoid dealing with Einstein. However “atypical” we may consider him to be, according to current perceptions he is not only the representative of twentieth century science, but also the icon of a Jewish scientist. It is not by chance that Veblen, whose essay initiated the socio-historical discussion of the “intellectual pre-eminence of Jews” was fascinated by Einstein⁴ – even though the real Jewish figure in the background of his essay was probably his close friend Jacques Loeb.⁵ Moreover Volkov’s assessment that “Much of what has been written about scientists in general and Jewish scientists in particular revolves, strangely enough, around this enigmatic figure.”⁶ draws on the bibliographic content of the *Yearbooks of the Leo Baeck Institute*⁷ through the years to make her point. We concur. In comparison to the Einstein literature, relatively little has been published on Paul Ehrlich, Fritz Haber, Hermann Minkowski, Otto Stern, Richard Willstätter and other prominent Jewish scientists. There is no alternative to taking the bull by the horns – and the horns are the horns of a pragmatic dilemma:

- (Aa) Einstein is the most prominent *Jewish* person of the twentieth century.
- (Ab) His fame is grounded in his outstanding contribution to *science*.

›contrasts with‹

- (Ba) Einstein would never have agreed to the thesis that being *Jewish* matters in *science*.
- (Bb) Those people who advocated the thesis that being Jewish matters in science were antisemites and opponents of his contribution to science (the representatives of *Deutsche Physik*).

³ Volkov adopts the widespread romantic idea of Einstein as isolated genius and outsider. ‘Genialism’ is criticised in Ulrich Charpa and Ute Deichmann, ‘Jewish scientists as geniuses and epigones – scientific practices and attitudes towards them: Albert Einstein, Ferdinand Cohn, Richard Goldschmidt’, in *Studia Rosenthaliana* (forthcoming). As to Röntgen and Ostwald, the story of outsiders can also be criticised for several reasons.

⁴ On this see William T. Ganley, ‘A Note on the Intellectual Connection between Albert Einstein and Thorstein Veblen’, in *Journal of Economic Issues* 31 (1997), pp. 245–250.

⁵ See Charles Rasmussen and Jacques R. Tilman, *Loeb: His Science and Social Activism and Their Philosophical Foundations*, Philadelphia 1998, (chap. V: ‘Loeb’s influence on Thorstein Veblen’), pp. 93–121.

⁶ Volkov, ‘Jewish Scientists’, p. 257.

⁷ *Ibid.*, p. 257, fn. 11.

2. *On connecting science to particular individuals and groups*

To commentators on science there seem to exist three possible reactions to the dilemma (that reflect in some ways Groucho Marx's paradoxical joke on his refusing to join a club that would accept him as a member). They mirror the well-known oppositions in history and philosophy of science connected to catchwords like "relativism", "objectivism", "internalism", "externalism" and so on. The three attitudes are the following:

1) Science is *not* an objective affair. Irrespective of whether Jews constitute a relevant and interesting sample, science is a matter of groups and it is driven by their interests. As to Einstein's objectivism, it is nothing more than a case of a philosophical self-deception on how scientific views are "fabricated". In the words of social constructivists the Theory of Relativity, "is a truth which came into being as a result of decisions about how we should live our scientific lives, and how we should license our scientific observations: it was a truth brought about by agreement to agree about new things."⁸ The usage of the word "truth" is only confusing if we consider the presuppositions held here. Said in a somewhat formal manner: to the relativist to describe a theory by a group *G* as true is a statement on the attitudes of *G* and not on the truth-value of the theory. What is meant by the social constructivist commentators in this case is that the Theory of Relativity is neither true nor false in the traditional sense. It is interpreted, and categorically seen, as something like a castle or a flag, a product serving the specific purposes of a particular social group.

The same holds true for the level of the *meta-scientific* evaluation of a researcher's contribution. Assessing a contribution to science such as Einstein's as excellent or outstanding is socially fabricated in the same way as is science. Einstein's fame is part of the ideology that accompanies the triumph of those theoretical physicists who "defeated" their opponents. There is no objective meta-scientific criterion that would prevent historians from writing the reverse story with Philipp Lenard and Johannes Stark and other representatives of *Deutsche Physik* as "heroes".

2) Particular contexts, orientations and human factors of all kinds do not have anything to do with the quality of scientific work. If the work of a scientist can be connected to those factors it is *bad* science, as for example Lysenko's genetics in Stalin's Soviet Union. If we consider Einstein as a great researcher we should avoid speaking of him as a Jewish scientist in the strict sense of the word. Instead, it would be more correct to say that we are dealing with a scientist who in a manner of speaking is "occasionally" Jewish,

⁸ Harry Collins and Trevor Pinch, *The Golem: What Everyone Should Know about Science*, Cambridge 1993, p. 54.

meaning that his Jewishness is detached from his universal contribution to scientific progress. And if there are any connections between the history of science and the history of the Jews at all, there are only those such as the well-known tendency of prominent scientists to take advantage of the fame of the specialist to promote some non-scientific, in this case “Jewish”, objectives.

3) The quality of scientific work can be influenced by characteristics of the individuals who carry it out. Scientific progress goes along with favourable human conditions, attitudes towards learning, being talented, being inclined to work assiduously, the existence of social surroundings that hold someone in high esteem because of his or her achievements as a researcher and so on. This does not exclude the idea of scientific truth.

Position 1) has the merits of drawing our attention to interesting topics, but the disadvantage of leading us into trouble if we have to explain the obvious superiority of some scientific views compared with others. We all share many “progressivist” intuitions, for example, the one that modern astronomy has a much *better* predictive and explanatory power than Ptolemy’s system. Seen against the background of what the relativist calls the “decisions about how we should live our scientific lives” this superiority is not explicable. Even more irritating for relativists is the fact that modern astronomy is superior even according to Ptolemy’s own methodological concepts.⁹

As to Relativity Theory – “our scientific life” in 2006 is vastly different from that of 1905, when Einstein’s and Poincaré’s first essays were published. Imperial Germany, the Berne Patent office, the French Third Republic, are long gone, but the robustness of Relativity Theory is evident. Researchers all around the world working in different social and political contexts agree on the same theory and its empirical support, a “miracle” to the relativists – and a matter of course to their opponents.

Position 2) mystifies scientific progress and collides with the “real story”. Progress is modelled as a self-regulated change somehow above and beyond the heads of the scientists. But researchers are human beings, living their lives not in isolation – and, as history of science has shown, scientific change is not an *optimal* advance at every point of the research process. In many cases theories and empirical techniques that were well suited to make their superiority evident in the long run were not necessarily the best choice from the beginning (heliocentrism was empirically seen not a well supported model of planetary motion in Copernicus’s epoch).

Position 3) recommends itself as a course between that of relativism and the one pursuing the isolation of science from scientists. In sociological terms

⁹ Cf. among others, G. E. R. Lloyd, ‘Saving the Appearances’, in *idem*, *Methods and Problems in Greek Science*, Cambridge 1991, pp. 248–277.

it has already been outlined in the writings by Robert Merton, Joseph Ben-David and others. Science insofar as it turns out to be epistemically¹⁰ reliable, relevant and excellent in some other respects is not merely a social product, but a social *achievement* – it comes into being under specific, favourable conditions. Among these conditions are the availability of material things like libraries and laboratories; but the main factors are the competences of learned human beings and their will to practice them.

Why has this simple approach along the lines of our commonsense thinking about achievements not flourished and why has it apparently lost its appeal in recent decades? At the philosophical level this goes along with the development of philosophical action theory, especially the influence of authors such as Elizabeth Anscombe, Donald Davidson and Georg Henrik von Wright. Summing it up in simple terms, modern action theory starts with differentiating between action and mere behaviour and identifies “volitional” factors (motives, intentions) as being decisive in this respect. The next philosophical step is to discuss the nature of such mental states and to determine their connection to these states, such as belief. The logic of action explanations varies the elementary structure of the “Practical Syllogism”: in the language of von Wright and others P does A, because P aims at B and believes A to be an adequate means to accomplish B.

This line of thinking on action and its explanation makes it easy to overlook that motives are *not* always the most *relevant* explanatory factors.¹¹ In the normal case, *achievements* – that is, actions of a good or even excellent quality compared with other actions – cannot be convincingly explained by motives. If, for example, a chess grandmaster defeats a trained amateur, this cannot be plausibly explained by his stronger will to win. According to our everyday experience, the “volitional” factor will be much more powerful for the amateur. To explain the grandmaster’s achievement one has to refer to “non-volitional” factors, such as his knowledge about thousands of chess sequences, his intelligence, his prior experience and so on, in other words his *competences*.

Considering the “human factor” – that is the scientists and their capabilities – is a priority task if we are interested in understanding science, particularly scientific progress. And if there are certain individuals or groups of individuals who disproportionately contribute to scientific achievements, such

¹⁰ On the respective philosophy of science see Alvin H. Goldman, *Knowledge in a Social World*, Oxford 1999, (chap. 8, ‘Science’), pp. 221–291; David Papineau, *Science and Truth*, Inaugural Lecture, King’s College London 1992; Ulrich Charpa, *Wissen und Handeln. Grundzüge einer Forschungstheorie*, Stuttgart 2001.

¹¹ Cf. John McClure and D. J. Hilton, ‘Because You Cannot always Get what You Want: When Preconditions are Better Explanations’, in *British Journal of Social Psychology* 36 (1997), pp. 223–40.

as seventeenth century Jesuits¹², Merton's seventeenth and eighteenth century Protestants and nineteenth century Quakers¹³, they are worthy of documentation and discussion. The narrative of the German-Jewish scientists cannot be excluded from this project. However, as the Einstein case already indicates, there are some serious difficulties with the expressions "Jewish" and "German-Jewish" of the type which do not trouble us when we deal with Jesuits or Quakers.

3. *On vague and classificatory usages of "Jewish" and "German-Jewish"*

(i) "German"

For reasons historical and otherwise we start with the word that does not cause many difficulties, "German". The main two usages are complementary: according to the first, Western tradition of understanding nationality as citizenship, the term in our context would refer to people who spent at least a considerable part of their scientific lives as citizens of Imperial Germany or the Germany of the Weimar Republic. The second understanding of the concept of nation, as developed by Herder and the Romantics, plays down such "external" features and emphasises the importance of language, culture and history. In this sense many citizens of the Habsburg Empire match the concept of being "German", because among other things, the German language was their first or at least their preferred means of communication, or they shared certain "German" customs, such as for example students being members of a *Burschenschaft*. Both usages provide perspectives to commentators that may overlap or coexist. Speaking of a "German-Xish" person is not necessarily burdened with many difficulties. This, however, does not have to apply in every case, as for example with émigrés. The legitimacy depends on the context, that is, the respective questions we are dealing with. There are many reasons to consider someone a German scientist such as, for instance, if the person in question has held an academic position in Germany or has received his or her scientific education there. The main problem, however, occurs with the word "Jewish".

(ii) "Jewish"

The adjective "Jewish" as found in phrases such as "Jewish scientists", "Jewish physicist" and "scientists from Jewish families" varies in its meanings. At one extreme it indicates a meaning in accordance with Stark's

¹² Cf. Mordechai Feingold (ed.), *Jesuit Science and the Republic of Letters*, Cambridge, MA 2002.

¹³ Cf. Geoffrey Cantor, 'Quaker Responses to Darwin', in *Osiris*, vol. 16 (2001): *Science in Theistic Contexts*, pp. 321–342.

(*Jüdische Physik*) and Bieberbach's (*Jüdische Mathematik*) views as well as with those of other representatives of so-called "German" science. Because of this paramount association with National-Socialist constructs it is advisable not to make use of expressions like "Jewish science". Moving away from that, we might as well simply refer to those kinds of science that were carried out by people whose Jewishness was relevant, in the same sense that it is sensible to speak of Jewish handicraft in mediaeval Spain. It might be appropriate, for instance, to describe the disciplinary position of religiously distinguishable graduates. This has distinct analogies in sociological studies of science based on the demarcation of a given population i.e. the classificatory usage of "Jewish". The representation of Jewish scientists in the academic world becomes in that way a quantitative fact in need of an explanation – as for example the apparent over-achievement of Israeli mathematicians.¹⁴ However, the basis of the classification of "Jewish" persons, which is indispensable for quantitative inquiries, is still an unsettled problem in as much as it cannot refer to a group sharing the same kind of label. One manages by following conventions, for example adhering to verifiable denominations, but the problems are obvious when looking at the insufficiency of the German Biographical Dictionaries ADB and NBD classifications (see the last chapter of this volume).

The origin of these problems becomes clear if we take into consideration the fact that the relationship between the components of phrases such as "Jewish physicist" in everyday usage is far more complex than is the case with a classification. Most of our everyday predicates are *vague* which means they include a comparison. For example we speak of hard wood as opposed to soft wood – but do not consider it hard compared to steel.

Adjectives such as "German" or "Israeli" seem to take on a special or unique status; we generally interpret them as classifying. In the case of the adjective "Jewish", matters stand differently: it is not established whether phrases such as "Jewish scientist" or "Jewish families" mark an *intersection between the set of scientists and that of Jews*. Matching other everyday phrases leads us to position an entity called Jew in a quasi-series, for example describing a certain building as a house. This alternative can be found again at the level of the usage of nouns. The English language offers two substantival matches for the expression "Jewish"¹⁵:

¹⁴ Thomas Schøtt, 'Scientific productivity and international integration of small countries: Mathematics in Denmark and Israel', in *Minerva* 25 (1987), pp. 3–20.

¹⁵ The Hebrew word 'yehudi' has an adjectival as well as a substantival usage.

(A) “Jew” or “Jews”¹⁶

(B) “Jewishness” (“Yiddischkejt”¹⁷ in Yiddish)¹⁸

Case (A) is connected to a predominantly classificatory usage. Divergences, that is the vague usage (which can be traced, among others, to Maimonides), will be dealt with later. Case (B) demands a *vague*, that is consequentially seen, comparative usage to maintain plausibility. In line with the classificatory usage of (A) someone is *either* Jewish *or* not; the vague use of (B) characterises a person as being *more or less* a Jew or Jewish, respectively. How both usages of “Jewish” allow or exclude phrases like “the Jewish contribution to science” will be discussed in the following.

(iii) *The classificatory usage of “Jewish” and “Jew”, respectively*

Classifying a person as “Jewish”, and respectively as a Jew, is a linguistic practice found in a multitude of more or less everyday contexts, such as the ordinary registration of parishioners. With the current context of discourse in mind, the two relevant classificatory usages are: the halakhic classification and the National-Socialist one.

The National-Socialist classification

National-Socialist classifications characterised certain individuals as “full Jews”, “half Jews”, “half-castes of first and second class”, and as “three-eighth-Jews” (Globke), which in many cases even led to confusion among National Socialists themselves.¹⁹ Despite the fact that these classifications now seem quite strange, one must not ignore the fact that they are absolutely relevant for contemporary scientific historical research, since certain biographical phenomena can only be explained by the nature of these National-Socialist classifications: it may be that a “three-quarter-Jew” as defined by National-Socialist terminology cannot – from the halakhic perspective – count as a Jew at all. Curt Herzstark is a case in point. He was a computer-pioneer, whose “ethnicity” appears far more comprehensible if a National-Socialist approach is

¹⁶ In Hebrew this usage would match relating someone to *am yisrael* or *yahadut*.

¹⁷ Somewhat differing from this appraisal as vague expression referring to a personality feature is Jacob Neusner, ‘Defining Judaism’ in *idem* and A. J. Avery-Peck, *The Blackwell Reader to Judaism*, Oxford 2001, pp. 3–18, here p. 4, who obviously acknowledges the specificity of the Yiddish expression (“refers more specifically to the folk elements of the faith”), but nevertheless identifies it with Judaism.

¹⁸ There is no analogue in modern Hebrew. It follows the categorical vocabulary of the old language. One could perhaps coin something like “*yehudiyut*” in order to express what at best is paraphrased as “*be-zurah yehudit*” (“in a Jewish way”). One should perhaps note that there is also an English usage of “*Yiddishkejt*” that is neglected here.

¹⁹ An overview on this is given in Jeremy Noakes, ‘The Development of Nazi Policy towards the German-Jewish “Mischlinge” 1933–1945’, in *LBI Year Book*, vol. 34 (1989), pp. 291–354.

considered. Otherwise connecting this individual with the word “Jewish” only works if the word is used in the vaguest sense possible.

The halakhic concept of “Jew”

A convenient approach to the “Jewish” preoccupation with the concept of “Jew” is often connected to the Law of Return to the State of Israel dating back to 1970, whereby every Jew has the right to immigrate and become an Israeli citizen. But the Law of Return is not in every way halakhic. It provides sanctuary of citizenship to any person who would be persecuted according to the National-Socialist classification. At first sight, this promises to free the Israeli legal system from the endless debate on the question “Who is a Jew?” (“*Mihu Yehudi?*”). But in practice, halakhic considerations do matter in many doubtful cases. Often unambiguous halakhic either-or-decisions are required regarding immigration applications. At this point various problems arise which do not fundamentally question the practice of the usage for classification but do place it under strain. They result from the fact that Israeli national legislation is tied to religious ordinances. It is important to note that the religious (rabbinic) policy is analogous to trials and dissimilar to demographical or sociological surveys – even if it has to deal with groups, as in case of the *aliyah* of the Falash Mura from Ethiopia. It does not aim at characterising such groups adequately but at providing the basis for a Yes-or-No-decision, for instance by offering conversion courses culminating in ritual conversion to the Falash Mura or individuals in a similar position.

This corresponds with the evaluation of Jewry as basically halakhic, as bound to proper regulations of religious *practices*, and, less dogmatic, as cultivating specific *opinions* referring to God and the Human World.²⁰ To what extent common ideas stand behind this judicial approach will not be discussed at this point. It is sufficient to state that – concerning the question of classification – the rabbinical judiciary relies considerably on anatomising paragraphs into distinctive units that are juggled in line with the hierarchy of terms.²¹ According to the halakhic ordinances children of Jewish mothers are counted among A (see above), as are converts observing certain rules formulated by Maimonides and in the *Schulchan Aruch* (see below).

²⁰ Only very small parts of the Talmud are devoted to questions of the right belief. The main topic is religious practice. The dogmatic contents of Judaism, as condensed in the *ikkarim* can be considered a reaction to certain challenges by Muslims, Christians and the Karaites. Cf. Menachem Kellner, *Must a Jew Believe Anything?*, London 1999, especially pp. 10–43.

²¹ Cf. the viewpoint of a leading member of contemporary rabbinic Judaism on category-formation and taxonomism in traditional exegesis: Jacob Neusner, *Judaism and the Interpretation of The Scripture: Introduction to Rabbinic Midrash*, Peabody, MA 2004, pp. 65–73.

Controversially discussed by the main directions of religious Jewry is the importance of patrilineage.²² In 1983 the Reform–rabbinate established a principle whereby a person is a Jew if at least one parent is Jewish, thus providing a sufficient identification in line with the “belief and nation” precondition. (However, part of the nature of Reform–Jewry is each rabbi’s authority, within limits, to set his/her own standards for a conversion.)

Concerning the Talmud, this precondition is irrelevant since as a genetic definition it neither refers to religious practices nor to mental states – and the rule for conversion, which must be consulted complementarily, demands the observance of practices required religiously, though no “inmost” attitude. The conversion–formula makes that point absolutely clear.²³ From the orthodox position the Reform regulation appears as “Protestantisation”. It should be pointed out that even though the strictness of matrilineage is weakened by Reform Judaism, matrilineage itself is not annulled. Again there is an uncoupling of the mere state of being Jewish from personal attitudes and religious practices which – considering the orthodox as well as the reformed position – makes it possible that there may exist Jews who do not attribute importance to Jewry at all, who might possibly disapprove of it or not even know that they are Jewish.²⁴ The conversion of many Jewish graduates to Christianity in the nineteenth century, does not, from a halakhic point of view, annul their Jewishness. This is not – as already alluded to – denied by Reform–Jewry either. Since this fact does not call for a decision it does not draw much rabbinic attention to it. A rabbi does not have to deal with the state of “staying Jewish” as a convert to Protestantism, for instance. And questions such as that of the identity of a descendant of a woman convert do not appear until a claim to membership of a Jewish parish is raised. This in turn requires the entry into the normative system of this parish and therefore the leaving of the Christian community.

*The religious meaning of the expressions “of Jewish origin”
and “of a Jewish family”*

In cases of doubt, writers, especially in Germany, often make use of phrases like of “Jewish origin” or “of a Jewish family”. As long as the phrasing “of a Jewish family” includes the fact that somebody is a scion of an adequate mat-

²² Whatever is said on ‘orthodox’ and ‘reformed’ positions is based on a simplification and leaves the terms used for organisations aside (for instance, British Reform Judaism does *cum grano salis* correspond to ‘Conservatives’ in the United States and so on).

²³ Cf. Menachem Kellner, ‘Heresy and the Nature of Faith in Medieval Jewish Philosophy’, in *Jewish Quarterly Review* 76 (1997), pp. 299–318.

²⁴ A spectacular case was that of United States Secretary of State Madeleine Albright who revealed her Jewish family background in 1997. Such examples are gathered in Barbara Kessel, *Suddenly Jewish*, Lebanon 2000 (the Talmud discusses the problem in *Shabbat* 68b).

rilineage, he is, as mentioned above and independent of his self-assessment and religious affiliation, to be classified as a Jew. The manner in which “liberal” Reform attitudes establish this relationship is subordinated. If the latter were of significance they would refer to the utopian case that there would always occur a new successful attempt for the state of being a Jew with each new link of an unbroken patrilineal chain – an idea beyond historical redeemability and also lacking religious plausibility.

Taking into consideration that phrases like “of a Jewish family” also imply a patrilineal relation without a separate own attempt for affiliation, the phrasing would also include non-Jews, referring to their religious classification. This would include the extreme example of speaking about a “Jewish family” in which the family consists of a Christian woman with her Jewish husband and their non-Jewish children. In the religious scheme of things this case is not viable unless one adopts a Reform-context that would make it possible for the grown children to “judaize” this non-Jewish family after having decided to do so.

The religious digressiveness of this idea is emphasised by the fact that a Jewish family (*mishpakhah*) does not represent merely a background bond; but a link that connects the individual with the parish (*kehillah*) as well as with the major group of Jews (*am yisrael*). The Jewish religion is basically practised by the family. This is made particularly obvious, for instance, by the importance of ceremonial domestic meals.

(iv) The vague usage of “Jewish and “Jew”, respectively

For Talmudic purposes it is absurd to claim that an individual is *more or less* a Jew respectively Jewish, as explained already. The case of conversion and thus the integration of personal attitudes modify this image. In particular Maimonides has recommended, in many respects, to treat the state of being a Jew as less a birth-characteristic than an association with special religious attitudes. He does not recognize a child of a Jewish mother as a “real” Jew as long as he/she does not observe certain religious ordinances.

Following the strictures of religious ordinances and prohibitions, a continuum of good or bad behaviour is formed; with apostasy representing the extreme example of an individual not living in line with the halakhah. This tacitly implies a comparative appraisal of individuals that runs parallel to the vague usage of the word “Jewish” and suggests the possibility of a connection between the classificatory and the vague usages.²⁵

²⁵ This possibility results from recursive definitions of “being Jewish”. One starts with a group of incontrovertibly Jewish people who every observer would agree on to be Jewish, for example, the representatives of an orthodox dynasty of rabbis. Then one enlarges this group by making use of the appraisal “core Jews”. Using the appraisal of

The vague usage is not due to inter-religious tendencies but to the differentiation between religious practices and opinions on the one hand and what may be called “Jewishness” in the broadest sense of sharing a “Jewish way of life”. It is self evident that seen from this angle an individual can be more or less Jewish, which allows the construction of contradictions as demonstrated by the well-known sorites (heap) paradox.²⁶ That the vague expression “Jewish” can be understood is due to our referring to objects we regard at least partly as beyond any question. If a statue of a saint is taken out in a procession this event is considered incontrovertibly as not-Jewish, while a Seder is just as well beyond any doubt something Jewish.

Now what might be the advantage of the idea of a “plasticity” of the sphere of Jewishness? The crucial points are the *openness* and the *fertility* of vague expressions. As argued above the not autonomously converted children of a non-Jewish woman and a Jewish man are not Jews even if they gravitate socially and culturally towards a straight or predominantly Jewish milieu according to the classificatory definition. However, as a result of its *openness* the vague expression of what it means to be Jewish would include the classificatory excluded subgroup described in this example. The *fertility* of vagueness comes from the disguised comparative character of vague expressions. We access research domains by juxtaposing and questioning individuals or facts in certain respects and in this particular case we wonder whether there is a comparatively strong or weak boundary to religious traditions; to which extent secular actions and reflections mirror religious structures; how significant the consequences of specific “Jewish” social restrictions or privileges are; and so on.

Thus the classificatory question as to whether converted scientists and others are Jews or not does not appear decisive, but in contrast when we ask the question whether among the many aspects that can be associated with being Jewish there is indeed one, then something demonstrative occurs, as for example regarding the course of a career, in education or in professional orientation, and so on. The initial vague idea of a possible Jewish factor in the lives of scientists brings about a process of investigation which leads to social or psychological contexts that turn the Jewish scientist convert in particular into an interesting subject. The position outlined above can be turned into a *methodological* catalogue. In our view it is justified to speak of a scientist as “Jewish” or “German-Jewish” if

subsequent groups one comes nearer to more peripheral individuals – the “cases in doubt” (an idea by Asa Kasher – unpublished).

²⁶ On its origin and logical reconstruction see Jonathan Barnes, ‘Medicine, Experience and Logic’, in *idem* et al. (eds.), *Science and Speculation*, Cambridge 1982, pp. 24–68.

- it is *efficient*. Often using phrases of the type “X as a German Jew did Z” saves time and does not distract from the issues at hand – as compared with more precise formulations such as “XY who had a traditional Jewish background, converted, and died as convinced secular Zionist, did Z”.
- it *unifies* in the sense that using such concepts helps us to collect widespread and varied phenomena, for example that of displaying a certain affinity to medical professions or being a trained reader.²⁷
- it is *fertile* in the sense that it helps us to direct our attention to phenomena that would otherwise have been overlooked. To allude to a well-known example, categorising winners of prizes as Jewish or not leads to interesting phenomena that need to be explained.

The phenomena – Over-representation, Disproportionate Achievements, uneven Distribution and Success

As we have seen, Einstein, in a paradoxical way, became the chief example of a Jewish scientist. His life is well suited to unravelling the problems of understanding what a Jewish scientist is. We begin this section with a short biography of another great scientist, the chemist and Nobel laureate Fritz Haber. Exceptional as his biography also was, it appears to be less problematic than Einstein’s for developing an “intuition” of the concept a German-Jewish scientist.

1. *The case of Fritz Haber*

Fritz Haber, born in 1868, was the son of a Jewish dye-merchant in Breslau, Siegfried Haber. Whereas Siegfried pursued goals that he considered appropriate for a Jew in Breslau, such as becoming prosperous and gaining a position of respect within his local community, Fritz had much higher ambitions. Previous impediments seemed to collapse everywhere. In particular, Reform Judaism was widespread in late nineteenth century Germany and Reform rabbis abolished many practices which separated Jews from Gentiles, such as dietary restrictions. More importantly, however, the new German *Reich*, founded in 1871, at least officially abolished all restrictions on civil rights and access to academic positions based on religious differences. For these reasons Fritz Haber belonged to the first generation of German Jews who could imagine that they were free to choose any career and way of

²⁷ Cf. Ute Deichmann and Ulrich Charpa, ‘Jews in the Sciences – Sciences and the Jews: The 19th and 20th centuries. Introductory Remarks’, in *Simon Dubnow Institute Yearbook* 3 (2004), pp. 149–159, here p. 151.

life. That way, as his biographers have pointed out, his Jewish heritage gave him the incentive to succeed.²⁸

And success there was, in plenty. Haber became professor, first at the Technical University in Karlsruhe, then at the University of Berlin. In Berlin he was also appointed first director of the newly founded Kaiser Wilhelm Institute for Physical Chemistry. His main scientific achievement, the high-pressure, high-temperature, catalytic synthesis of ammonia from its elements, earned him a Nobel Prize and success as scientific entrepreneur (in collaboration with BASF). He became a national hero during the First World War – his ammonia process was used to produce urgently needed ammunition and he organised and carried out chemical warfare. After the war he was co-founder of the funding agency of German science *Notgemeinschaft*, later *Deutsche Forschungsgemeinschaft* (DFG). Yet there were failures, too, most importantly his tragic end; he died in exile after having been expelled and disowned by his homeland. Accomplishments and failures render Haber both exceptional and at the same time typical of a large number of Jewish scientists of his time.

Haber is typical in socio-political respects. Most German-Jewish scientists came from the commercial, not the educated middle-class. Most were highly assimilated in German culture, and many – though by no means all – converted, like Haber, to Protestantism.²⁹ While among non-Jews, the first generation of university-educated men invariably decided to accept positions in the liberal or practical professions, talented Jews – including Haber – often moved directly into academic scientific careers.³⁰ As far as their political leanings are concerned, German-Jewish scientists were not radical nationalists, but many – like Haber – were loyal to *Kaiser und Reich* and the idea of duty to the goals of the state, an attitude which became especially evident during the First World War. The so-called *Gastruppen* (“gas troops”) Haber gathered to carry out chemical warfare on the battle field under his command included prominent

²⁸ Dietrich Stoltzenberg, *Fritz Haber: Chemist, Nobel Laureate, German, Jew*, Philadelphia 2004; Margit Szöllösi-Janze, *Fritz Haber 1868–1934. Eine Biographie*, Munich 1998; Daniel Charles, *Between Genius and Genocide: The Tragedy of Fritz Haber, Father of Chemical Warfare*, London 2005.

²⁹ The topics of the social backgrounds of Jewish scientists, and the role of conversion and academic antisemitism for their careers will not be discussed here further; they have been dealt with extensively elsewhere, for example in Monika Richarz, *Der Eintritt der Juden in die akademischen Berufe*, doctoral dissertation Freie Universität Berlin 1970; several contributions by Shulamit Volkov, most recently, ‘Jewish Scientists,’ contributions by several authors in Michael A. Meyer et al. (eds.), *Deutsch-jüdische Geschichte in der Neuzeit*, vol. 3 and 4, Munich 1997.

³⁰ Volkov, ‘Jewish scientists’, pp. 265–266. That such a fast social change within a generation was often accompanied by psychological difficulties is exemplified by Haber, too, who throughout his life was suffering from anxieties and several times looked for treatment in institutions dealing with nervous ailments.

German professors, for example James Franck, Otto Hahn, Gustav Hertz, Hans Geiger, and the neurologist W. Westphal. Franck and Hertz were Jews, and like Hahn, became Nobel laureates. Renowned Jewish scientists such as Adolf von Baeyer (whose mother was Jewish), Paul Ehrlich, Franck, Haber, August von Wassermann, and Richard Willstätter were among the ninety-three German public figures who signed the notorious 1914 manifesto "To civilisation!". Famous non-Jewish scientists who added their signatures were Emil von Behring, Karl Engler, Emil Fischer, Ernst Haeckel, Felix Klein, Philipp Lenard, Walther Nernst, Wilhelm Ostwald, Max Planck, Wilhelm Röntgen, Max Rubner, and Wilhelm Wien. The manifesto was an unprecedented and widely distributed piece of German nationalist propaganda drawn up shortly after war had broken out and German troops had conquered neutral Belgium. It depicted Germany as the victim and not as the aggressor in Belgium and defended German militarism. By contrast, a counter-manifesto by Einstein received only one signature, apart from his own, though many Jewish scientists (and some non-Jewish ones) were opposed to the war. It should be added that most German-Jewish scientists were, unlike many of their non-Jewish peers, confirmed democrats after the war.

Some characteristics of Haber's career and research are typical of many German-Jewish scientists at the time (though not necessarily as strongly evident as is the case with Haber): great ambition and drive; the choice of chemistry as a subject of study, with later specialisation in physical chemistry; an emphasis on empirical work combined with theoretical reasoning; talent for organisation and close ties with industry (beyond the role of consultant which was normal for all chemists); broad scientific knowledge and cultural interests; concern and care for students.

The following is an overview of some exceptional phenomena related to the research and achievements of Jewish scientists in Germany until the 1930s. The focus is on the disproportionate participation and achievements in various areas of science, differences within various disciplines, and the role of Jewish scientists in various newly emerging fields of research. The analyses mainly draw on the biological and chemical sciences because in these fields sufficient data is available. Physics is included wherever possible. For reasons of feasibility, mathematics is largely omitted, notwithstanding the outstanding importance of Jewish mathematicians in Germany from the very first in this subject. As has been explained above, we use a broad concept of Jewishness as a methodological tool. It is not based on self-definition and religious affiliation and includes converts and those with one Jewish parent (mother or father).

2. Over-representation in academia; uneven distribution in various sciences

The medical sciences were the first academic subject in which Jews participated in larger numbers. The study of medicine and the vocation of physician were highly valued in Jewish tradition from medieval times.³¹ Jewish communities in Germany encouraged young men to study medicine at secular universities well before legal Jewish emancipation took place. Such studies were possible at some German universities from the early eighteenth century, despite frequent discrimination against Jewish students. Even though antisemitic stereotypes of various, often contradictory, kinds were used against Jewish physicians right from the start, the importance of Jews in the history of medicine was acknowledged as well.³² The famous anatomist Jacob Henle – after whom the tubule in the kidneys is named – is an early example of a renowned medical scientist in Germany. Born in 1809 he grew up in Fürth as the son of a Jewish merchant; his mother was the daughter of a rabbi. The family converted to Protestantism when Jacob was twelve years old. He became professor at the universities of Heidelberg and Göttingen.

Chemistry was another field with a large early participation of Jewish practitioners and scientists.³³ An example of the latter is Heinrich Gustav Magnus, born in 1802, the child of a well-to-do merchant family. He started his career as a chemist and chemical engineer and later became an influential

³¹ This phenomenon has been frequently described and analysed; see for example Harry Friedenwald, *The Jews and Medicine*, Baltimore 1944. Concerning the relationship between Jews, Judaism and medicine in Germany see Werner Kümmel, 'Jüdische Ärzte in Deutschland zwischen Emanzipation und "Ausschaltung"', in Gert Preiser (ed.), *Richard Koch und die ärztliche Diagnose*, Hildesheim 1988, pp. 15–47; John M. Efron, *Medicine and the German Jews: A History*, New Haven, CT-London 2001. According to Efron (p. 3), there are only a few activities which can be so closely connected to a particular group of people as is the case with medicine and the Jews.

³² An example is Rudolf Virchow who talked with awe about the zeal and the knowledge with which Jewish physicians in medieval times committed themselves to the preservation of and progress in medicine (lecture about Morgagni at the International Congress of Medicine in Rome, 1894, cited in Friedenwald, p. 5).

³³ Jews frequently worked as expert colourists and later as scientists and entrepreneurs in the dye industry which flourished in the late nineteenth century. The topic of German Jewish chemists has been dealt with in Anthony S. Travis, 'From Color Makers to Chemists – A Jewish Profession Elevated', in *Simon Dubnow Institute Yearbook 3* (2004), pp. 199–219; *idem*, *The Rainbow Makers: The Origins of the Synthetic Dyestuffs Industry in Western Europe*, Bethlehem 1993; Alan J. Rocke, 'Pride and Prejudice in Chemistry: Kolbe, Hofmann, and German Anti-Semitism', in Yakov Rabkin and Ira Robinson (eds.), *The Interaction of Scientific and Jewish Cultures in Modern Times*, Lewinston 1995, pp. 127–159; Carsten Reinhardt and Anthony Travis, *Heinrich Caro and the Creation of Modern Chemical Industry*, Dordrecht 2000; Shulamit Volkov, 'Soziale Ursachen des jüdischen Erfolgs', in *idem*, *Antisemitismus als kultureller Code. Zehn Essays*, 2nd edn., Munich 2000, pp. 146–165; Ute Deichmann, *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker in der NS-Zeit*, Weinheim 2001.

experimental physicist in Berlin. His family converted to Protestantism when he was five years old.

There are no exact figures of Jewish participation in various sciences in late nineteenth century Germany. The following is an attempt to quantify differences in various fields by using the list of names in the prosopographical overview by Simone Wenkel at the end of this volume, and comparing the number of Jewish scientists born between 1820 and 1859 in various scientific fields. Suffice to say that the list is not complete; what matters here instead are only *differences* in participation. As expected, the earliest participation in larger numbers is in medicine – 112 of the scientists in this field were born between 1820 and 1859.³⁴ Chemistry followed with thirty-one individuals, mathematics with twenty-two, and physics with seven born during that period of time.³⁵ Jewish physicists thus entered academia later than the other three groups and in smaller numbers.

The fact that academic antisemitism prevented or delayed academic careers for many Jewish scientists even after 1871 and before 1933 – Leonor Michaelis and Otto Meyerhof are two examples – is well known and will not be discussed here. Yet, despite this fact, the number of Jewish students and academics grew continuously. In the early 1930s Jews made up around eleven per cent of all university teachers.³⁶ This is a strong over-representation in academia even if we do not relate to the small percentage (one per cent) of confessional Jews in the German population.³⁷ Though there were attempts to explain this phenomenon by the early over-representation of Jews among the urban middle classes, more recent studies have shown that Jewish students in Imperial Germany did not come particularly from the urbanised parts of Germany and they received more financial help than Protestants because of need and good scholarship.³⁸

Using biographical data of studies on the expulsion of Jewish scientists from Germany and Austria, the percentages of Jewish university teachers

³⁴ Ten Jewish medical scientists in this list were born in the 1820s, thirty-seven in the 1830s, thirty in the 1840s, and thirty-five in the 1850s.

³⁵ In chemistry eight were born in the 1830s (none in the 1820s), nine in the 1840s and fourteen in the 1850s; in mathematics four were born in the 1820s, five in the 1830s, six in the 1840s and seven in the 1850s. In physics two were born in the 1840s (none in the 1820s and 1830s), five in the 1850s (and three in the 1860s).

³⁶ Between 12.9 per cent (see fn. 40, Wolff, *Vertreibung*) and 14.3 per cent (Edsall Hartshorne, see Deichmann, *Flüchten*, pp. 107–8) of all university teachers (professors and *Privatdozenten*) were dismissed between 1933 and 1936. Non-Jews with Jewish wives were mostly dismissed in 1937 and are not included. 80–90 per cent were dismissed because they were Jews (including converts) or “half-Jews”.

³⁷ The figure is slightly higher if converts are included.

³⁸ Norbert Kampe, ‘Jews and Antisemites at Universities in Imperial Germany’, in *LBI Yearbook*, vol. 30 (1985), pp. 357–390.

can be compared for various scientific disciplines. Among the sciences, Jews were most strongly represented in chemistry. In 1932 around nineteen per cent of the academic chemists (not included are biochemists in the medical faculty) were Jewish.³⁹ Second came physics with Jewish physicists making up around fifteen per cent. Jews were least represented in biology, that is in zoology, botany and (non-medical) genetics, where they made up eight per cent.⁴⁰

Social reasons mainly account for these differences. Biology was a science without industrial applications and with few or no job prospects outside academia. Given the restrictions on land ownership for Jews in the German states for centuries, there was no Jewish tradition in applied fields of biology such as plant breeding. Jewish students interested in biology studied chemistry or medicine because academic antisemitism made it unlikely for them to receive one of the few academic positions, that is a professorship, in biology. The zoologist Richard Goldschmidt remembers the hopelessness Jews were faced with if they wished to study biology at the end of the nineteenth century:

In German universities only the full professors were paid, and the young scholars had almost no source of income until they arrived at a professorship, a success that was in no way certain. The situation was still more hopeless for a Jew for only in very exceptional cases could he hope for an appointment; in addition, the way out in case of failure was high school teaching, and this, too, was closed to him.⁴¹

Goldschmidt studied medicine and only later became a biologist. Similarly, other Jewish medical students later became renowned for their work in biology. Among them are Robert Remak (1815–1865), probably the first non-baptised Jewish university teacher in Germany, and Jacques Loeb (1859–1924).⁴² Remak contributed decisively to cell theory and embryology, Loeb

³⁹ This figure is based on the statistical evaluation of biographical data of university teachers and scientific personnel at Kaiser Wilhelm Institutes: 472 chemists and 63 medical biochemists in Germany in 1933 and at Austrian universities or the German University in Prague in 1938 (Deichmann, *Flüchten*, chap. 3). 141 of these were dismissed and/or emigrated between 1933 and 1939; 91 were Jewish chemists (in the broadest meaning of the term), and 29 were Jewish biochemists.

⁴⁰ For physics see Klaus Fischer, 'Der quantitative Beitrag der nach 1933 emigrierten Naturwissenschaftler zur deutschsprachigen physikalischen Forschung', in *Berichte zur Wissenschaftsgeschichte* 11 (1988), pp. 83–104, and Stefan Wolff, 'Vertreibung und Emigration in der Physik', in *Physik in unserer Zeit* 24 (1993), pp. 267–273. Wolff included physical chemists, too, so that there is some overlap with chemistry. For biology see Deichmann, *Biologen*, chap. 1 and *idem*, 'Erfolg und Fachdisziplin. Juden in Chemie und Biomedizin in Deutschland bis 1933', in *Simon Dubnow Institute Yearbook* 3 (2004), pp. 269–292.

⁴¹ Richard Goldschmidt, *In and Out of the Ivory Tower*, Seattle 1956, p. 39.

⁴² For Remak, see Heinz-Peter Schmiedebach, *Robert Remak (1815–1865). Ein jüdischer Arzt im Spannungsfeld von Wissenschaft und Politik*, Stuttgart 1995. For Loeb, see, for

to experimental embryology and, later, the physical chemistry of proteins. Leonor Michaelis, one of the founders of biophysics in Germany was strongly interested in biology but studied medicine for practical reasons (see the article “*I detest his Way of Working*” in this volume). Several non-Jewish biologists, too, had studied medicine, but unlike their Jewish colleagues succeeded in obtaining professorships in zoology.

The situation was very different in chemistry. As Anthony Travis has shown Jews had a long tradition in practical vocations such as colourist and dye chemist in nineteenth century Germany.⁴³ This social background made studying chemistry a more likely course of action for them. The father of Fritz Haber, for instance, was a dye merchant, that of Ernst Boris Chain (Nobel laureate for his work on penicillin) ran a chemical factory; and the physics Nobel laureates Eugene Wigner, Edward Teller and Otto Stern first studied and practised chemistry before they turned to physics. Richard Willstätter, chemistry Nobel laureate for 1915, studied chemistry because it was less expensive than medicine.⁴⁴ Willstätter was also interested in the question of the special Jewish accomplishments in science and general culture in Germany: he wrote the foreword (*Geleitwort*) to the volume edited by Siegmund Kaznelson in 1934 entitled *Juden im Deutschen Kulturbereich*.⁴⁵

The American chemist-turned-physicist Roald Hoffmann dealt with the relationship between science and Jewish tradition from a different perspective. Born in 1937 in Złoczow, Poland, he survived German occupation while in hiding. In the United States he studied chemistry, chemical physics, and the arts. In 1968 he became professor of chemistry, and later of physics at Cornell University. For his work in theoretical chemistry he shared the 1981 Chemistry Nobel Prize (with Kenichi Fukui). Hoffmann has written several popular books dealing with general questions of chemistry, for example its relationship to art and religion. One of his books was devoted to the relationship between science and Jewish tradition, in which he emphasised the favourable influence of Talmudic traditions on the conduct of modern sciences, in particular the empirical ones.⁴⁶

example, Philip J. Pauly, *Controlling Life: Jacques Loeb and the Engineering Ideal in Biology*, New York–Oxford 1987.

⁴³ Travis, ‘A Jewish community’.

⁴⁴ Richard Willstätter, *Aus meinem Leben. Von Arbeit, Muße und Freunden*, Weinheim 1949.

⁴⁵ Siegmund Kaznelson, *Juden im deutschen Kulturbereich*, 2nd edn., Berlin 1959. The first edition appeared in 1934. The “historical review on the contributions of Jewish scholars to the scientific, artistic, in short: cultural and social life in German-speaking countries [*auf deutschem Sprachgebiet*]” until 1933 (*Vorbemerkung* by Kaznelson in 1934) was a response to the first wave of Nazi antisemitism.

⁴⁶ Roald Hoffmann and Shira Leibowitz Schmidt, *Old Wine New Flasks: Reflections on Science and Jewish Tradition*, New York 1997.

There were also large differences in participation within scientific disciplines, with preferences changing over time, as the following examples show. In chemistry Jews were first well represented in organic chemistry and three Nobel Prizes awarded to Jews for achievements in organic chemistry demonstrate the extent to which they were successful.⁴⁷ In the 1920s and early 1930s Jews participated most strongly in physical chemistry; making up a third of all Germans engaged in this subdiscipline in 1932.⁴⁸

The preference for the relatively new science of physical chemistry can best be explained by a combination of intellectual and socio-political factors.⁴⁹ Physical chemistry opened up new ways of experimenting and theorising and new areas for practical applications. This challenge required a mastery of physical techniques and mathematical methods rare among German chemists at the time, because the needs of preparatory organic chemistry dominated chemical education. Jewish chemists, like Jewish scientists in general, seem to have had a greater interest in mathematics than their non-Jewish peers.⁵⁰ In addition, from around 1900 onwards academic careers for Jewish chemists were more readily achieved in physical chemistry than in organic chemistry⁵¹, and the founding of the Kaiser Wilhelm Society in 1911 was instrumental in providing positions for Jewish physical chemists (and biochemists, see below).⁵² Fritz Haber and Reginald Herzog became direc-

⁴⁷ Adolf von Baeyer (1905), Otto Wallach (1910), and Richard Willstätter (1915).

⁴⁸ They are part of the group of ninety-one Jewish chemists in 1932 (see fn. 39). It should be noted that even in the "classical" subdisciplines of organic and inorganic chemistry, the percentage of Jewish scientists (seventeen per cent and fourteen per cent respectively) was much higher than in biology and about the same as in physics.

⁴⁹ Deichmann, 'Erfolg und Fachdisziplin'.

⁵⁰ The example of Haber shows that this was not always easy; Haber needed the help of friends and he made strenuous efforts to learn mathematics.

⁵¹ Departments of physical chemistry at German universities, many of which were founded in the first third of the twentieth century, were smaller and less well financially supported than the large departments of organic chemistry. While in the nineteenth and early twentieth centuries Jewish chemists became directors of institutes of organic chemistry, for example Adolf von Baeyer, Victor Meyer, Otto Wallach and Richard Willstätter, this did not happen after 1916 (when Willstätter became professor of organic chemistry at the University of Munich). By contrast, in 1932 four of the fifteen departments of physical chemistry at German and Austrian Universities and three at Technical Universities had Jewish directors: Kasimir Fajans (Munich), Georg v. Hevesy (Freiburg), Otto Stern (Hamburg), Hermann Mark (Vienna), Gustav Bredig (TH Karlsruhe), Franz Simon (TH Breslau), and Emil Abel (TH Vienna).

⁵² The society whose aim was the promotion of basic and applied scientific research by creating and funding large research institutes, provided a disproportionately large number of positions for chemists. This reflected the national importance of chemical research; see Jeffrey A. Johnson, *The Kaiser's Chemist: Science and Modernization in Imperial Germany*, Chapel Hill 1990, chap. 7. During the founding phase a (non-Jewish) chemist, Emil Fischer, was the scientist with the greatest influence on the society's choice of subjects and its employees. Largely because of Fischer, who harboured no antisemitic senti-

tors of Kaiser Wilhelm Institutes (KWIs) for Physical Chemistry, and Fibre Chemistry, respectively, which were mainly devoted to research in physical chemistry; several of their scientific workers were Jewish as well.⁵³

Physics has not been scrutinised concerning these issues to the same extent as chemistry. According to the available data, Jewish scientists in the 1920s were most strongly represented in theoretical physics, where they made up a third of Germans in this branch in 1933.⁵⁴

As far as the various subjects in theoretical (non-clinical) medicine are concerned we focus mostly on research at the interface of biomedicine and chemistry, which in a broad sense may be called biochemistry. As in physical chemistry and theoretical physics, about a third of German medical biochemists were Jewish⁵⁵, with intellectual as well as socio-political factors accounting for this large percentage. A high concentration of individual scientific competences among Jewish medical scientists and favourable institutional conditions such as the appointment of Jewish biochemists as directors of several KWIs play a major role here.⁵⁶

3. *Disproportionate achievements; unequal success in various scientific fields*

The large number of Jewish scientists among the German Nobel laureates is often used in order to demonstrate the disproportionately high achievements of Jewish scientists in Germany. The figures are indeed impressive: eleven (31 %) of the thirty-five German Nobel laureates in chemistry, physics and physiology or medicine until 1933 were Jewish. When we extend the period to 1960 and include those émigrés who had received at least their scientific education in Germany, the percentage (36 %) is even larger with twenty-two of sixty German-born Nobel laureates being Jewish scientists.⁵⁷

The proportion of Jewish Nobel laureates differs substantially between research fields and over periods of time. In the period between 1900 and

ments, some excellent Jewish scientists such as Richard Willstätter (who rejected the offer), the physicist Lise Meitner, and (probably) the protein chemist Max Bergmann were offered leading positions at the society's institutes.

⁵³ In the case of Haber the Jewish banker Leopold Koppel, who financed the building of the KWI for Physical Chemistry, insisted on Haber as director as he was very impressed by Haber's ammonia work and in addition wanted Haber present in Berlin to act as a consultant to the Auer Company.

⁵⁴ According to Wolff ('Vertreibung'), twenty-six of sixty theoreticians lost their position under the Nazi legislation. As has been explained above, eighty-five to ninety per cent of those expelled were Jewish or "half-Jewish".

⁵⁵ See fn. 39.

⁵⁶ These factors will be discussed in greater detail in the essay '*I detest his Way of Working*' in this volume.

⁵⁷ Deichmann, 'Erfolg und Fachdisziplin'.

1933 it is particularly high among the recipients of the Physiology or Medicine Prize, where four Jews among eight German recipients were Jewish. Chemistry is next with four Jews among fourteen German recipients (28 %). Of the thirteen German laureates in Physics three (23 %) were Jewish. In the period until 1960 the proportion of Jews among the eighteen laureates in Physiology or Medicine is even higher at 55 % (ten of eighteen). It is followed by Physics, where six of seventeen recipients (35 %) were Jewish; in Chemistry it was four of fourteen, that is 28 %.

Even though the figures are probably too small to be used as the basis for a statistical analysis they make it clear that the scientific achievements of Jewish scientists in Germany (and after their forced emigration) were disproportionately high in general; particularly so in the biomedical sciences (most of the Jewish Nobel laureates in Physiology or Medicine until 1960 were biochemists); Jewish achievements in chemistry that were rewarded by a Nobel Prize were especially high at the end of the nineteenth and the beginning of the twentieth century, Nobel Prize awards to Jewish scientists in physics happened some years later: prior to 1933 Nobel Prizes to German-Jewish chemists were awarded in 1905 (Adolf von Baeyer), 1910 (Otto Wallach), 1915 (Richard Willstätter), and 1918 (Fritz Haber); to German-Jewish physicists in 1921 (Albert Einstein), and 1925 (James Franck and Gustav Hertz). That there are many cases of outstanding research which were not rewarded by a Nobel Prize is well-known.

An attempt to demonstrate and compare scientific accomplishments with the help of scientometric tools has been made for chemists and biochemists who were active scientists in Germany or Austria between 1920 and 1950 or had received at least their education in these countries.⁵⁸ This citation analysis shows that Jewish scientists (as a group) were more cited than their non-Jewish peers; that is their work was on the whole more influential.⁵⁹ Surprisingly the average citation of Jewish and non-Jewish scientists did not differ very much (with factors of less than 2) in all areas of chemistry (the classical subdisciplines organic and inorganic chemistry and the new field of physical chemistry), but was much stronger (in favour of Jews) in biochemistry.⁶⁰ Here Jewish scientists were significantly (by a factor of 5.3) more cited than non-Jewish ones.⁶¹ Despite the fact that both, physical chemistry and biochemistry were relatively new fields and had a disproportionately high par-

⁵⁸ *Idem*, *Biologists; idem*, *Flüchten*.

⁵⁹ The method and its limitations and shortcomings are described in *idem*, 'Erfolg und Fachdisziplin'.

⁶⁰ The average number of citations of non-Jewish and Jewish scientists (numbers given in brackets) were 340 (285) in organic chemistry, 181 (112) in inorganic chemistry, and 225 (169) in physical chemistry.

⁶¹ Jewish scientists were on average cited 833 times, non-Jewish ones 157 times.

ticipation of Jewish scientists, the scientific accomplishments of Jewish biochemists as a group seem to have been even more impressive than that of Jewish physical chemists.⁶² The large number of Nobel Prizes awarded to Jewish biochemists in Germany and to émigrés confirms this finding.

4. Role in newly emerging fields of research

The above examples of physical chemistry and biochemistry in Germany are in line with the general observation that Jewish scientists were statistically over-represented (though with varying success) in new fields of research. In the following we examine and compare the role of Jewish scientists at the initial stages of a wide spectrum of scientific research areas; this overview is, however, not confined to Germany.

(i) Fields that were shaped entirely or mainly by Jewish scientists

From the late nineteenth century Jewish scientists were particularly influential and highly represented at the interface of biomedicine and chemistry. This reflects among other things the fact that chemistry and medicine were areas of activity in academia and outside of it, where Jews had participated in large numbers from early on. Immunochemistry and (dynamical) biochemistry are good examples of areas of research in which Jewish medical scientists who often had additional training in chemistry played a central role during the initial and early development phases. The foundations of immunochemistry were laid in the late nineteenth century by Paul Ehrlich in Germany who devised new experimental techniques as well as theoretical concepts. The (non-Jewish) American Oswald T. Avery, the Austrian Karl Landsteiner (who moved to the United States in 1922) and the American Michael Heidelberger were leading immunochemists in the 1920s.

As indicated above, Jewish medical scientists and chemists also played decisive roles in the founding and further developments of “dynamical biochemistry”, the biochemistry of intermediary metabolism as distinguished from the chemistry of natural products. In early twentieth century Germany, Carl Neuberg, Otto Warburg and Otto Meyerhof and, in the next generation, Hans Krebs, Fritz Lipmann and Rudolf Schönheimer, deserve particular mention; Warburg, Meyerhof, Krebs and Lipmann were awarded the Nobel Prize. Warburg was the son of the Jewish physicist Emil Warburg who later converted to Protestantism; his mother was Protestant.⁶³ Dynamical

⁶² In contrast to physical chemistry, where in Germany there were not only excellent Jewish scientists but also non-Jewish ones, in medical biochemistry the number of excellent Jewish biochemists by far exceeded that of non-Jews (for details see Deichmann, ‘Erfolg und Fachdisziplin.’).

⁶³ Otto Warburg appeared in an exhibit about Jewish Nobel laureates at the Berlin

cal biochemistry was an intellectually promising field of research that was conducted at many European laboratories, mainly in Germany, Britain and Russia. Particular abilities of Jewish biochemists, networking between themselves as well as others in other countries; the high standard of chemistry in Germany, the influence of Jewish role models and teachers, and institutional prerequisites in several KWIs contributed to the fact that in Germany this field of research became so strongly dominated by Jews. Interestingly, this fact in turn contributed to the marginalisation of biochemistry (*Physiologische Chemie*) at universities; most departments of (medical) biochemistry were created only in the late 1930s and early 1940s, after Jewish scientists had been expelled.⁶⁴ The internationally recognised scientific importance of (dynamical) biochemistry, and the existence of well-equipped KWIs where, as distinct from universities, many Jewish biochemists had leading positions, mean that biochemistry cannot be used as an example of the concept of a creative niche.⁶⁵

(ii) Fields that were shaped by significant contributions of Jewish and non-Jewish scientists

Jewish and non-Jewish scientists played significant roles in founding microbiology in the nineteenth century, and quantum mechanics and molecular biology in the early and mid-twentieth century, respectively. Among the founders of microbiology, in particular bacteriology and its medical applications, were the Jewish scientists Jacob Henle and Ferdinand Cohn and the non-Jewish Louis Pasteur and Robert Koch. Jews remained strongly represented in this field of research at least in Germany until the 1930s. Details may be found in the contribution ‘Empiricism and the Discreteness of Nature’ in this volume.

The main figures in the founding of quantum mechanics were Albert Einstein, Werner Heisenberg, Max Born, Pascual Jordan and Wolfgang Pauli in Germany; Louis de Broglie in France; Erwin Schrödinger in Switzerland; Niels Bohr in Denmark; and Paul Dirac in Great Britain. Einstein,

Jüdisches Museum. A family member intervened, claiming that Otto Warburg “would turn in his grave” (“würde sich im Grabe umdrehen”) if he knew that he were presented as a “Jewish Nobel laureate”, since he never wanted to belong to any group, neither to the Protestants, nor to the Jews but considered himself as a “man *sui generis*.” Subsequently Warburg’s name and picture were removed from the exhibit (letter of Maren Krüger from the Jüdisches Museum to Ute Deichmann, 28 June 2006). It is true that Warburg, for several personal reasons, was an outsider. Yet he became the role model of the mostly Jewish biochemists in Germany. He is a perfect example of a German and a Jewish scientist and demonstrates the usefulness of our concept of Jewishness as a methodological tool irrespective of a scientist’s self definition or religious affiliation.

⁶⁴ Deichmann, ‘Erfolg und Fachdisziplin’.

⁶⁵ See section III of this introduction.

Born and Bohr were Jewish (Bohr had a Jewish mother; Pauli's grandparents were Jewish). Jews seem to have played at least similar or even more pre-eminent roles in the later development of quantum theory; two of the four founding fathers of quantum electrodynamics in the late 1940s, Richard Feynman and Julian Schwinger, were Jewish; the other two were Freeman Dyson and Sin-Itiro Tomonaga.⁶⁶

Molecular biology is a generic term for biochemical, biophysical, microbiological, and genetic research related to understanding the molecular structure of biologically relevant macromolecules and the molecular nature of genes, and their replication and action in the cell. Early fields of the latter, often referred to as molecular genetics, are phage genetics, founded in the early 1940s by Max Delbrück, Salvador Luria, and Esther Lederberg; bacterial genetics, founded by Joshua Lederberg and Edward Tatum in the mid-1940s; the genetic function and structure of DNA, elucidated between 1944 and 1953 by Oswald Avery, Erwin Chargaff, James Watson, Francis Crick, Rosalind Franklin, and Maurice Wilkins; DNA replication, elucidated in 1958 by Matthew Meselson and Franklin Stahl; general properties of the genetic code, deciphered between 1954 and 1961 by among others, Francis Crick, Sydney Brenner, Marshall Nirenberg, and Heinrich Matthaei; and genetic regulatory mechanisms, research initiated in 1961 by François Jacob and Jacques Monod. Nine of these eighteen scientists were Jewish.⁶⁷

(iii) Fields that were shaped by non-Jewish scientists but in which Jewish scientists played a significant role in the early phases

Examples for the above are organic chemistry, physical chemistry and classical genetics. Scientists who played a significant role in the development of organic chemistry in the mid-nineteenth century included (the non-Jewish) Adolphe Wurtz and several other chemists in France, Justus von Liebig, August Wilhelm Hofmann, and August Kekulé in Germany. Though non-Jewish chemists such as Emil Fischer continued to play a major role in organic chemistry and the chemistry of natural products in the late nineteenth and early twentieth centuries, German-Jewish chemists such as Adolf von Baeyer, Carl Liebermann, Victor Meyer, Otto Wallach, and Richard Willstätter contributed greatly to all the early developments as well. However from around 1920 most of the major achievements in these fields in Germany were made by non-Jewish chemists who between 1925 and 1939

⁶⁶ Silvan S. Schweber, *QED and the Men who Made it: Dyson, Feynman, Schwinger, and Tomonaga*, Princeton, NJ 1994.

⁶⁷ Sydney Brenner, Erwin Chargaff, Rosalind Franklin, François Jacob, Salvador Luria, Esther Lederberg, Joshua Lederberg, Matthew Meselson, and Marshall Nirenberg.

gained five Nobel Prizes for their work in natural products chemistry.⁶⁸ There is no clear-cut explanation for this sudden decline in the influence of Jewish organic chemists; as they made up a large percentage (17 %) of all German organic chemists. But it is instructive to consider institutional and intellectual causes for this change: After 1916 Jewish chemists were no longer appointed directors of the most prestigious organic chemical institutes. A comparatively large number of Jewish organic chemists moved to physical chemistry, a fact which again, as was pointed out before, can be explained by institutional reasons – it was easier to become director of a physical chemical institute – as well as by the intellectual attractiveness of the new field of research.

Physical chemistry was founded in the late nineteenth century by the non-Jewish scientists Wilhelm Ostwald, Svante Arrhenius and Jacobus Henricus van't Hoff. In Germany Ostwald and his student Walther Nernst succeeded in establishing the subject of physical chemistry at universities. As was mentioned earlier, a growing number of Jews participated in this field at universities and KWIs. Hermann Mark and Kurt H. Meyer, associated with both industry and academia, became pioneers in the physical chemistry of polymers after polymer chemistry had been founded as a branch of organic chemistry by the non-Jewish chemist Hermann Staudinger. Jewish physical chemists also participated in large numbers in colloid chemistry, another new branch of physical chemistry. It became, for example, a focus of research at Fritz Haber's KWI in the 1920s. Originally an area of research in inorganic chemistry, colloid chemistry was an empirical and applied field of research with no major scientific successes in the first half of the twentieth century.

The “rediscovery” of Mendel's rules in 1900 by Carl Correns, Hugo de Vries, and Erich Tschermak-Seysenegg marks the beginning of classical or formal genetics. In 1906 William Bateson in England coined the term “genetics”, and he developed major concepts and a large part of the early terminology of the emerging science. The term “gene” as the “genotypic” basis of a distinct “phenotypic” trait was introduced by the Danish researcher Wilhelm Johannsen in 1909. A second phase of Mendelian genetics was initiated in the United States where Thomas Hunt Morgan and his collaborators Alfred H. Sturtevant, Calvin B. Bridges, and Hermann J. Muller developed the chromosome theory of inheritance. Morgan and Muller were awarded the Nobel Prize, in 1933 and 1946, respectively. Except for Muller, whose father was Jewish, Jewish scientists did not contribute to this international development of classical genetics, but with Richard Goldschmidt and Curt

⁶⁸ Heinrich Wieland, Adolf Windaus, Hans Fischer, Richard Kuhn and Adolf Butenandt.

Stern they were among the first to conduct genetics in Germany (non-Jews including Erwin Baur and Hans Nachtsheim). Goldschmidt became known for controversial and questionable genetic research;⁶⁹ Stern was a renowned geneticist.

(iv) Fields in which Jewish scientists did not participate in the early phases of development

Among the important fields in which Jewish scientists, at least in Germany, did not participate in the early phases were evolutionary biology in the nineteenth century and genetic plant and animal breeding in the early twentieth century. As already mentioned, due to antisemitic restrictions concerning land ownership there was no tradition of farming among Jews and, consequently, a low proportion of Jewish scientists were found in applied biology which so strikingly contrasts with their prominence in applied chemistry, as described above.

An interesting topic which has not yet been examined in detail is the avoidance by Jewish scientists until about the mid-twentieth century of research in evolutionary biology. Wilhelm Weinberg in the early twentieth century and Richard Goldschmidt seem to have been exceptions though the latter's highly speculative anti-Darwinian theory of hopeful monsters (1940) which claimed to explain evolution by saltation was, in general, not taken very seriously.

This low percentage of Jewish evolutionary biologists can be explained in part by the already mentioned low number of Jewish naturalists or biologists in general. Famous Jewish biologists in the nineteenth century such as Jacques Loeb or Robert Remak had studied medicine and then focussed on areas of experimental biology, for example embryology and physiology. The botanist Ferdinand Cohn appreciated Darwin and his work personally but did not take up research on questions of evolution. (For the English chemist Raphael Meldola see the contribution by Anthony Travis in this volume). None of the founders of the theoretical and highly mathematical framework for the integration of genetics into Darwin's theory of selection in the early 1930s – Ronald A. Fisher and JBS Haldane in England and Sewall Wright in the United States – was Jewish. Likewise there were no Jewish scientists among the architects of the Synthetic Theory of Evolution which was developed some years later. It created a unification of biological knowledge, including genetics and population genetics, under the umbrella of the theory of evolution. In later years, the situation seems to have changed with Stephen

⁶⁹ Ulrich Charpa and Ute Deichmann, 'Vertrauensvorschuß und wissenschaftliches Fehlhandeln. Eine reliabilistische Modellierung der Fälle Abderhalden, Goldschmidt, Moewus und Waldschmidt-Leitz', in *Berichte zur Wissenschaftsgeschichte* 27 (2004), pp. 187–204.

Jay Gould and Richard Lewontin becoming outstanding researchers in evolutionary biology and population genetics.

Generally, as the examples of physical chemistry and biochemistry in Germany have shown, there were social and institutional as well as intellectual reasons for the participation, special successes and non-participation of Jews in various fields of research. We can conclude that Jewish participation was especially high in new scientific fields involving chemistry and mathematics to a high degree. One may argue that a large proportion of Jewish scientists, for example in quantum mechanics and molecular biology, does not necessarily show the importance of any “Jewish” factor. However, it is relatively easy to exclude several variables such as place – they worked at different departments or institutes – or social background. From the nineteenth century onwards Jewish scientists attained particularly important achievements in areas at the interface of biomedicine and chemistry.

Molecular biologist and Nobel laureate Sydney Brenner, who grew up in a Jewish immigrant community in South Africa before he moved to England, described the importance of Jewish culture regarding his abilities and motivations:

So I cultivated, probably out of necessity, but certainly combined with inclination, the idea that knowledge is out there, it's available. ... I had, fortunately, grown up in a culture where learning was very important. The Jewish immigrants to South Africa had brought this culture with them. This culture never said, “This sort of thing is nonsense.” So there was no stopping me. Of course my mother believed that if one could divert this learning to become a surgeon or a lawyer, that was even better. ... I decided to become a scientist because I thought it was something you could actually do.⁷⁰

A quotation by left-leaning Richard Lewontin in 2000 shows that the phenomena described above continue to exist in a world which has become increasingly secular. Criticising the frequent usage of the term “Holy Grail” in the context of genetics, Lewontin wrote:

It is a sure sign of their alienation from revealed religion that a scientific community with a high concentration of Eastern European Jews and atheists has chosen for its central metaphor the most mystery-laden object of medieval Christianity.⁷¹

⁷⁰ Sydney Brenner, *My Life in Science: As Told to Lewis Wolpert*, London 2001, p. 7.

⁷¹ Richard Lewontin, *It Ain't Necessarily So: The Dream of the Human Genome and Other Illusions*, New York 2000, p. 137 (in a review of Daniel Kevles and Leroy Hood (eds.), “The Code of Codes: Scientific and Social Issues in the Human Genome Project” (published 1992)).

“Saving the Phenomena” –
an Outlook on Explanatory Proposals

The idea of “saving the phenomena” is rooted in the ancient methodology of astronomy. As a result of the influence of Pierre Duhem the expression is usually meant to refer to “instrumentalist” thinking. In contrast to “realist” approaches, the instrumentalist perspective is relatively modest: It aims at explanations that involve empirical phenomena without claiming to identify “deeper” causes. In our case what demands explanations are the phenomena described in part II of this introduction. To which type of entities do they belong? Obviously, what has to be explained are the actions of researchers. This has led most commentators to seek out intentions which are usually considered sufficient to provide explanatory factors with regard to actions of all kinds. Research work is explained by the ambition to overcome discrimination or by other social and psychological motives. This has led to interesting insights into contextual determinants of science.

The American sociologist Thorstein Veblen, son of Norwegian immigrants, was one of the first to examine the intense Jewish intellectual activity and scientific pre-eminence in Continental Europe, explaining it, on the one hand, psychologically, by Jewish alienation, marginality, and separation from society, and on the other hand by hereditary endowment.⁷² According to Veblen, the sceptical attitude which Jews adopted in Christian societies has led to an unusual productivity in science which he termed “creative scepticism.”

Veblen was one of the few twentieth century commentators who took it for granted that genetic factors play a role in scientific success. The distinctive Jewish “traits of temperament and aptitude” and the “hybridisation” to which, in Veblen’s account, Jews in all the Gentile nations were exposed, have hardly been commented on by more recent historians (and when they were, were brusquely rejected as possible explanations). Given current assumptions that complex phenomena such as intellectual aptitude might have some genetic basis and that the different environments and values in which Jews and non-Jews lived for centuries might have served as selective factors, we suggest that Jewish scientific pre-eminence may have also a genetic basis.

But is such a perspective not racist? A problem here is that while every morally-minded individual rejects racism it cannot be overlooked that “rarely does anyone stop to say what it is, what is wrong with it” – to quote

⁷² Thorstein Veblen, ‘The intellectual preeminence of Jews in modern Europe’, in *Political Science Quarterly* 29 (1919), pp. 33–42.

Kwame Anthony Appiah.⁷³ Obviously racism has ties to ideologically motivated hatred, discrimination, and oppression of particular human groups, however defined. In contrast, the hypothesis that groups differ statistically concerning features which prove superior or inferior in regard to certain activities, for example sports or scientific research, is not a matter of ideology but can, at least in principle, be empirically tested. That the question of a possible biological basis of “Jewishness” is often mixed with strong ideological commitments is demonstrated clearly here in the contributions by Nurit Kirsh and Raphael Falk. In general, this topic is still a very speculative one, and, moreover, an explanation along these lines would not be covered by most of the phenomena dealt with in this volume, such as different participation and achievements in various sciences at different times.

In contrast to Veblen’s genetic explanation, his claim of alienation as one of the factors leading to eminence in science has been widely discussed. The sociologist David Preston accepted this explanation for Jewish scientific success in Germany, and Seymour Lipset and Everett Ladd for the United States.⁷⁴ Veblen’s explanation was challenged, however, by the sociologist Lewis Feuer, who showed that the least “alienated” Jewish community in Europe, namely the Italian one, was proportionately the most vigorous in its scientific contributions.⁷⁵ Shulamit Volkov, too, showed that most successful Jewish scientists in Imperial Germany did not fall into the category of alienated and sceptical scientists.⁷⁶ She explains their success mainly by anti-semitic exclusion. According to her, German-Jewish scientists during the *Kaiserreich* were forced into a form of scientific and institutional marginalisation. But they succeeded in turning it into a “creative niche” for bringing about innovations with the result that Jewish scientists were particularly successful in new and more “peripheral” fields of research.⁷⁷

In a more recent publication, Volkov points to an opposing phenomenon, the aim of a group of mostly highly assimilated Jewish scientists and scholars

⁷³ Kwame Anthony Appiah, ‘Racism’, in David T. Goldberg (ed.), *Analysing Racism*, Minneapolis, 1990, pp. 3–17.

⁷⁴ David Lawrence Preston, *Science, Society, and the German Jew: 1870–1933*, Ph. D. thesis University of Illinois, 1971. For Lipset and Ladd, see Yakov Rabkin and Ira Robinson, ‘The Interaction of Scientific and Jewish Cultures in Modern Times’, in *Jewish Studies* 14 (1995), p. 20.

⁷⁵ Lewis S. Feuer, *The Scientific Intellectual: The Psychological and Sociological Origins of Modern Science*, New York–London 1963, p. 307. According to Feuer, it was freedom and identification with the dominant secularism which stimulated scientific work, not a sense of alienation.

⁷⁶ Volkov, ‘Jewish Scientists’ (English versions of her papers in German of 1987 and 1997, reprinted as: ‘Soziale Ursachen des jüdischen Erfolgs’, in *idem*, *Antisemitismus als kultureller Code*, 2nd edn., Munich 2000, pp. 146–165; and ‘Juden als wissenschaftliche Mandarine’, in *idem*, *Das jüdische Projekt der Moderne*, Munich 2001, pp. 138–163).

⁷⁷ Volkov, ‘Soziale Ursachen’, (English translation ‘Jewish Scientists’, Part I.)

in Germany to become like the “mandarins” and not the “outsiders”, referring to the distinction Fritz Ringer made. Ringer, in his frequently cited *The Decline of the German Mandarins*, points to the large proportion of Jewish intellectuals among the critics of “mandarin orthodoxy,” whom he characterises as academic outsiders.⁷⁸ Volkov proposes that in order to overcome the outsider status most successful Jewish scientists in Imperial Germany strove to adopt the “comprehensive” style of the most renowned scientists, avoiding specialisation.⁷⁹

David Hollinger pointed to flaws and omissions in Veblen’s analysis, such as the high rate of literacy among Diaspora Jews, the universalistic epistemic ideal associated with science (which might have raised hope among Jews that science was an area of human striving in which their contributions would be assessed on the same basis as those of their non-Jewish colleagues) and their success also in other areas such as in the economic sector.⁸⁰

As these examples show, most twentieth century scholars in the field focus on social conditions and psychological factors, such as antisemitism and personal motivations, as explanatory factors for the decision of Jews to embark on scientific careers, their choice of particular areas and styles of research, and their successes. We believe that, however illuminating social factors and motivations are in this context, they do not adequately explain all the phenomena discussed in part II above. The uneven distribution and success of Jewish scientists in various scientific fields demonstrate that we are dealing with phenomena based on actions that are qualified as *superior*, be it related to the average contribution to science or to other “Jewish” achievements in particular fields. In the following we shall discuss the possible impact of non-motivational factors as explanatory factors for disproportionate and uneven Jewish participation and success in science.

The first author to place emphasis on non-volitional factors was Matthias Jakob Schleiden (1804–1881), who could be considered the founding father of all explanatory projects concerning the role of Jews in science.⁸¹ Schleiden

⁷⁸ Fritz K. Ringer, *The Decline of the German Mandarins: The German Academic Community, 1890–1933*, Cambridge 1969, pp. 239–240.

⁷⁹ Volkov, ‘Jewish Scientists’, Part II. Volkov follows a suggestion by Jonathan Harwood, *Styles of Scientific Thought: The German Genetics Community 1900–1933*, Chicago 1993, p. 304.

⁸⁰ David A. Hollinger, ‘Why are Jews preeminent in science and scholarship? The Veblen thesis reconsidered’, in *Aleph* 2 (2002), pp. 145–163. Hollinger does not provide a new explanatory concept.

⁸¹ Cf. Ulrich Charpa, ‘Matthias Jakob Schleiden (1804–1881): The History of Jewish Interest in Science and the Methodology of Microscopic Botany’, in *Aleph: Historical Studies in Science and Judaism* vol. 3 (2003), pp. 213–245; *idem*, ‘Judentum und wissenschaftliche Forschung – Einstellungscluster im späten 19. Jahrhundert und ihr Fortwirken’, in *Simon Dubnow Institute Yearbook* 3 (2004), pp. 175–198.

was a pioneer in microscopical botany, especially cell research, and the leading methodologist in his field who transformed botany from a discipline of natural history to a modern laboratory science. In 1877 he published a booklet *Die Bedeutung der Juden für die Erhaltung und Wiederbelebung der Wissenschaften im Mittelalter*, which, as the title suggests, is an essay focussing on medieval developments. But in fact it is a criticism of the academic antisemitism of his time and a direct rejoinder to the antisemitic attacks by the Viennese surgeon Theodor Billroth (1829–1894). Billroth's polemics, in summary, were based on the idea that the advancement of science was bound to the noble motives of "gentle" truth-seekers. In his opinion Jews were greedy people, careerists who practised science not for its own sake but for their own benefit.

The central argument in Schleiden's reply evolves in analogy to his methodology of botany and is far from being a simple answer of the kind that Christians can also be greedy, or that many Jews are "noble" persons in Billroth's sense. According to Schleiden, Billroth's view of *science* is based on poor argument. In Schleiden's opinion what differentiates good from bad research has *not* much to do with the motives of people involved but with the *competences* of the scientists.⁸² Science is seen as domain for *experts* whose motives appear coloured and – what is at least as important – whose volitional states cannot be reliably identified by any method. Expert knowledge and skills are to a large extent "objective" in the sense of "testable" (the whole academic system of examinations and denominations is based on this assumption) – volitional factors such as intentions and motives are not. We may pretend a lot to others and may even deceive ourselves as far as the noble character of the mental background of our actions is concerned but our scientific competences are demonstrable and testable.

It is easy to see how Schleiden's approach corresponds to what has been said earlier (see section I) regarding the differences between explaining normal actions and excellent actions (achievements). Schleiden's position, which is also in keeping with modern virtue epistemology and reliabilist philosophy of science, devalues many approaches that appear quite plausible at first sight, in particular those that stress *disadvantages* as explanatory factors. From a strictly competence-oriented perspective the interesting point is not the possible mental impact of marginalisation, alienation, antisemitism and so on, but the achievement *in spite of* such unfavourable conditions. A large number of people around the world suffer from discriminations of all kinds.

⁸² This is a common trait of many nineteenth century philosophies of science. It can also be found in the writings of Claude Bernard, the younger Herschel, Helmholtz and others. Cf. Ulrich Charpa, 'Mister Bixby, Claude Bernard, and other 19th Century Philosophers of Science on Knowledge Based Actions', in *Journal for General Philosophy of Science* 37 (2006) pp. 257–268.

But usually, the outcome is *not* some superior acting in science. If there are plausible theories that can help us explain the academic achievements of German Jews they will have to relate the phenomena to enabling factors, to *favourable* conditions.

This provides an opportunity to mention briefly the attempts of those authors who have dealt extensively with analogies and correspondences between scientific research and traditional Judaism, regarding structures of argument, characteristics of certain type of theorising, and other aspects.⁸³ It is far beyond the scope of this volume to comment on them – with one exception, since it provides a very helpful contrast: Menahem Fisch’s *Rational Rabbis – Science and Talmudic Culture*⁸⁴ in which the author unifies scientific and Talmudic thinking by imposing a “Popperian” perspective on both. This includes stressing the epistemic autonomy of rabbis as well as of modern rational individuals, above all scientists. As to the first group, Fisch himself admits that he focusses only on a particular tendency – as to the latter he generalises in a Popperian way. In line with the objectivist position (see p. 5), his book does not take sufficiently into consideration the social and personal reality of those involved in science. In our view, even excellent research is to a large extent epistemically *dependent* – it is the result of learning, of generally accepting what colleagues have reported without implying control by oneself, etc. Not even the most radical criticism of a received view in science can be formulated without the unquestioned acceptance of numerous opinions – not to speak of the chance of convincing others if someone does not integrate his deviant opinion into the cosmos of common views. Now we must turn back to non-volitional factors in the “socialised” view on science.

Schleiden’s proposal to connect scientific progress and Judaism (which he regards as a favourable factor) is directed to three issues:

1) Indispensable to a scientist’s success is his acquaintance with what Schleiden and his philosophical combatants called “leading principles”, maxims that direct the course of scientific orientation concerning relevant topics, methods and so on. Such principles are not theories, or even dogmatic beliefs that have to be considered true. Such principles are to be interpreted as *proposals* on how to act. They promise scientific success and they might be accepted in the same way as one accepts an agreement on a celebration of an

⁸³ Relevant recent literature is commented on in *Aleph: Historical Studies in Science and Judaism*. See also the overview by Gad Freudenthal, ‘R v lation et Raison, Torah et Mada, dans quelques  crits r cents’, in *idem et al.* (eds.) *Torah et science; perspectives historiques et th oriques –  tudes offertes   Chales Touati*, Louvain 2001, pp. 239–268. A very specific, helpful and contrasting perspective is to be found in Menachem Kellner, ‘Torah and Science in Modern Jewish Thought: Steven Schwarzschild vs. Yeshayahu Leibowitz’, *ibid.*, pp. 229–237.

⁸⁴ Menahem Fisch, *Rational Rabbis: Science and Talmudic Culture*, Bloomington 1997.

event. To Schleiden – who consulted eminent scholars of the Breslau seminar such as Heinrich Graetz and David Rosin for his research on this topic – this is a peculiarity that science and traditional Judaism have in common in contrast with the fact that Protestantism emphasises fixed beliefs as cornerstones of religion. One could add that – as the article on the Einstein-Bernstein connection shows – leading principles are not only an element of tradition but also play a key-role in German Reform Judaism.

2) Science is among other things a system of *learning*. This matches perfectly with Jewish tradition and its educational objectives which favoured such learning. In contrast to the educational system available to Jews at the end of the nineteenth century, the school education provided to non-Jews, especially Catholics, in Germany was in considerable disarray.

3) Science advances within a system of *favourable relationships* between individuals. Schleiden's example is the scientist using a microscope who depends on the quality of the work of those who produced this equipment, such as optical technicians. His analogy to Judaism is the way in which the Jewish merchant had to rely on his colleagues based at other places. Science and commerce can only flourish within a network of implicit trust, and the scientist as well as the merchant has to take into consideration unavoidable risks. To Schleiden, traditional Judaism is an exercise in managing such testimonial questions. But it has to be noted that in this regard his approach loses something of its strength if we look at the situation in nineteenth and twentieth century Germany. German Reform Judaism was and is oriented differently: it totally neglects testimonial relations and emphasises the epistemic and social autonomy of the individual.

Having been confronted with this array of topics from Schleiden's catalogue, one cannot deny that this is far from exhaustive. It can even lead into the wrong direction – as in the case of traditional testimonialism and its “reformed” suspension. But it does exemplify the interest in favourable conditions and its benefits. Some other non-volitional factors have already been mentioned above, as for example, the vicinity of some academic disciplines to certain traditional Jewish professions.

II. Research Practices, Achievements, Contexts

Empiricism and the Discreteness of Nature: Ferdinand Cohn, the Founder of Microbiology

Ute Deichmann

Jewish Microbiologists in the Nineteenth Century

Various branches of microbiology, in particular bacteriology, immunology and immunochemistry were among the most important fields of scientific medicine in the first half of the twentieth century. Their foundations were laid in the nineteenth century. Interestingly, Jewish scientists played a pre-eminent role in basic and applied microbiology as well as in immunology. Early on, they excelled in microscopic studies of micro-organisms for which Ferdinand Cohn (1828–1898) is the most outstanding example. Cohn's student Carl Weigert (1845–1904) and Weigert's cousin Paul Ehrlich (1854–1915) became prominent in the development of new staining methods for micro-organisms, with Ehrlich and Karl Landsteiner (1868–1943) also developing new experimental techniques and theoretical concepts in immunology.

The anatomist and pathologist Jakob Henle (1809–1885), professor at the universities of Zürich, Heidelberg and Göttingen, may count as the father of medical microbiology. Henle's parents were Jewish and converted to Protestantism. Henle, an experienced microscopist, conducted pioneering work on the microscopic structure of tissues, including the renal tubules that bear his name. Anticipating Pasteur, he was also one of the first scientists to propose the theory that micro-organisms are causal agents of infectious diseases and he coined the terms *contagium vivum* and *contagium animatum*. At the time he could not yet provide empirical evidence for his theory. It was his non-Jewish student Robert Koch (1843–1910) who in 1876 gave the first proof for the germ theory of disease by showing *Bacillus anthracis* to be the main cause of anthrax. In 1884 Koch formulated the basic criteria that must be met to establish a causal relationship between a pathogenic germ and a disease. Usually referred to as Koch's postulates, they have also frequently been called Henle-Koch postulates in order to give credit to Henle's contribution to the definition of a pathogenic germ. As will be shown below, Ferdinand Cohn, too, exerted a strong influence on Koch's microbiological work. A number of Koch's stu-

dents and many other bacteriologists were Jewish.¹ In 1850 Max von Pettenkofer (1818–1901) the (non-Jewish) eminent physiologist and first incumbent of a chair of hygiene in Germany at the University of Munich, developed an alternative concept to the one Cohn and Koch propagated, based on the environment, according to which local pollution was the main cause for epidemics: he claimed that cholera was not transmitted from one person to another and that drinking water did not play a role in cholera epidemics.² His concept remained very powerful and the majority of German physicians adhered to it until the 1890s.³ It lost credibility after Koch's theory proved to be successful during the cholera epidemic in Hamburg in 1892. But subsequently a modified version of Pettenkofer's theory gained ground, and after the German defeat in 1918 Jewish bacteriologists were discriminated against as "hunters of bacilli".⁴ During the Nazi era Pettenkofer's theory, supplemented by a consideration of some other factors, in particular racial predisposition became powerful under the name "Geomedizin".⁵

Apart from being outstanding in his work on the theory and practice of staining micro-organisms including bacteria – which was one of the results of his interest in organic chemistry and the recently discovered aniline dyes – Paul Ehrlich also was a prominent figure in early immunology and immunochemistry.⁶ His "side-chain" (later receptor) theory of immunity, according to which blood cells produce specific chemical groups, namely antibodies, with affinities to specific antigens, became the theoretical basis for studies about the antigen-antibody reaction. Ehrlich, who in 1908 shared the Nobel Prize for Medicine for his work in immunology, was not offered an academic position in Germany.

In 1896 he became director of a newly established Prussian institute for the control of therapeutic sera (*Institut für Serumforschung und Serumprüfung*) in Berlin.⁷ Some of Ehrlich's co-workers were Jewish, too, for example the

¹ With nine out of thirty-eight bacteriologists whose religious affiliations are known a quarter of all bacteriologists who are listed in the *Allgemeine Deutsche Biographie* (ADB) and the *Neue Deutsche Biographie* (NDB) are considered Jewish (information taken from: *Digitales Gesamtregister zur ADB und NDB*, edited by the Historische Kommission der Bayerischen Akademie der Wissenschaften and Bayerische Staatsbibliothek, München, as of October 2003); see also the contribution by Simone Wenkel in this volume.

² Thomas D. Brock, *Robert Koch: A Life in Medicine and Bacteriology*, Madison, WI 1988, p. 166.

³ Friedrich Hansen, 'Geschichte der DTG. Vom Kolonialismus zur Geomedizin', held at the Deutsche Gesellschaft für Tropenmedizin und internationale Gesundheit, Hamburg, 1 May 1999.

⁴ *Ibid.*

⁵ *Ibid.*

⁶ For Ehrlich's life and research see, for example, Ernest Baumler, *Paul Ehrlich: Scientist for Life*, New York 1984.

⁷ In 1897 he was appointed Public Health Officer in Frankfurt am Main. When, in

bacteriologists Ulrich Friedemann and Max Neisser and the chemist Heinrich Bechhold. The Viennese medical scientist Karl Landsteiner early on focussed in his research on immunology and, like Ehrlich, had a thorough knowledge of chemistry; but in contrast to Ehrlich he preferred physical chemical explanations over organic chemical ones for reactions of immunity. Landsteiner was born Jewish, too, but as a student he and his mother converted to Catholicism. Despite the fact that Landsteiner was one of the internationally most renowned immunochemists, he was never offered a professorship in Germany or Austria or obtained a comparable position at a *Kaiser Wilhelm-Institut* (KWI). In 1922 he accepted a call of the Rockefeller Institute in New York.⁸ In 1930 he received the Nobel Prize for Medicine for his discovery in 1901 of human blood groups.⁹

Why were there so many Jewish microbiologists of renown given the facts that Jewish participation in German academia had started to a noticeable extent only after 1871 and that Jews constituted barely one per cent of the German population? In the following no attempt will be made to analyse the general social causes for this phenomenon. Instead the biography and work of Ferdinand Cohn, one of the founders of microbiology, will be investigated. Among other things the question of whether his Jewish background might have had an impact on the choice of his research topic and his research practices will receive special attention.

Ferdinand Cohn

The botanist and microbiologist Ferdinand Julius Cohn, born in Breslau on 24 January 1828, came from a traditional Jewish family. He experienced what he called the “poetry of the old Jewish family life” such as the celebration of the Sabbath, the practice of new interpretations of the Torah and the commemoration of important events of Jewish history during his regular visits to his grandparents.¹⁰ He encountered the rules and obligations but

1899, the Royal Institute of Experimental Therapy was established in Frankfurt, Ehrlich became its director. In addition, he became director of the *Georg Speyer Haus*, devoted to chemotherapeutical research, founded in 1906 by Franziska Speyer, a Jewish woman from Frankfurt, and built next-door to Ehrlich’s institute. This appointment marked the beginning of a new phase of Ehrlich’s many and varied researches, in which he devoted himself to chemotherapy.

⁸ For Landsteiner’s life and research see, for example, Pauline M. H. Mazumdar, *Species and Specificity: An Interpretation of the History of Immunology*, Cambridge 1995.

⁹ Landsteiner would have preferred to have received the prize for his more recent work in immunochemistry.

¹⁰ Ferdinand Cohn, *Blätter der Erinnerung. Zusammengestellt von Pauline Cohn, mit Beiträgen von Prof. Felix Rosen*, 2nd edn., Breslau 1901, pp. 8–12.

also the joys inherent in this tradition. His father, a businessman, had attended a *yeshiva* but later decided to leave the Jewish ghetto. Ferdinand, an extraordinarily gifted child who began to read at the age of two, received a secular education and went to a *Gymnasium* in Breslau. His decision about which subject to study at university was largely determined by external factors. As he recalled: "The law and my faith prevent me from devoting myself to the study of law or to serve the state as a teacher or civil servant; my bad hearing [from which he suffered from early youth] does not allow me any hope of being able to work as a physician."¹¹ He chose to study sciences and mathematics, focussing on biological sciences but having a wide-ranging mind his studies also included the history of literature, modern European languages, and philosophy.

Several petitions to the Ministry – by the faculty, the dean, Cohn's father – did not succeed in granting Cohn and Jewish students at Breslau University in general the right to qualify for a Ph.D.¹² Therefore Cohn left Breslau in 1846 and continued his studies at the University of Berlin, where he received his Ph.D. in 1847. He had the support of the physiologist and anatomist Johannes Peter Müller (1801–1858) who also recommended him for *Habilitation* when Cohn returned to Breslau. There he obtained his *Habilitation* in botany in 1850 and in 1859 he became *professor extraordinarius*, a tenured position. He was the first director of the institute of plant physiology, founded in 1866, and in 1872 he obtained the position of full professor. He remained in Breslau until his retirement. Through his research on the development and cytology of micro-organisms, his institute became a centre of research in microbiology. Among his students was Carl Weigert, later professor of pathology, who developed techniques of microscopic staining, in which he used, unlike Cohn, not only natural dyes but also the new industrial aniline dyes. Weigert had a great influence on the career of his cousin Paul Ehrlich. Among the many distinctions Cohn received was his appointment, in 1893, as a fellow of the Royal Society of London and the award, in 1895, of the Linnean Society gold medal. He died in Breslau on 25 July 1898. A note in the Zionist journal *Die Welt* (Vol. 2/26, 1898), the only mention of Cohn ever in a Jewish journal or newspaper, simply stated the fact that he had died of a heart attack.

¹¹ *Ibid.*, p. 20.

¹² *Ibid.*, p. 41

Cohn's Research

Cohn received a traditional education in mid-nineteenth century biology with a focus on description and classification of animals and plants and their development. Though he produced well-received taxonomic studies of his own, he did not think too highly of a mere memorising of diagnostic properties of different species or other taxa.¹³ For him the microscope became the essential instrument enabling him to develop new fields of research and to tackle general biological questions. In the 1840s the microscopes at the University of Breslau and many other universities were still made partially from wood and very primitive. Inspired by his teacher Göppert, Cohn convinced his father to buy him a large modern metal microscope.¹⁴ With this instrument Cohn, who through enormous efforts had acquired a formidable microscope technique by himself, conducted all his microscopic research. One has to keep in mind that microscopy is more than a mere improvement of perception but requires detailed knowledge and experience concerning the functioning of the instrument itself, the handling of the items to be investigated, and the interpretation of the microscopic pictures.

Cohn's work was extensive and a detailed overview of his contribution to science may be found elsewhere.¹⁵ The focus of this article is on his main contributions in cytology, the taxonomy and development of algae and fungi, and bacteria. Here Cohn did not only produce new observational and experimental data, but on the basis of these data he also, often in a decisive way, helped resolve crucial questions in major scientific disputes of the time, in particular those concerning the generation of new cells and the constancy of microbial forms.

Cohn's microscopic studies of higher plants and algae showed that cells only multiply by fission. He thus refuted the assumption of some biologists, among them Matthias Jakob Schleiden, of a "free" generation of cells outside other cells.¹⁶ Schleiden and Theodor Schwann are regarded as founders of the cell theory, which was first formulated in 1839, but both were unable to provide clear evidence for a particular mechanism of the generation of new cells, assuming it occurred outside tissue. Cohn's observation of cell di-

¹³ Brigitte Hoppe, 'Die Biologie der Mikroorganismen von F. J. Cohn (1828–1898)', in *Sudhoffs Archiv* 67 (1983), pp. 158–189, here p. 167.

¹⁴ Felix Rosen in Cohn, *Blätter der Erinnerung*, p. 110.

¹⁵ Hoppe; see also assessments in Patrick Collard, *The Development of Microbiology*, Cambridge 1976, pp. 78 ff.; Paul Diepgen, *Geschichte der Medizin*, vol. II., part 2, Berlin 1955, pp. 118–124; William C. Summers, 'History of Microbiology', in Joshua Lederberg (ed.), *Encyclopedia of Microbiology*, 2nd edn., San Diego, CA 2000, vol. I, pp. 3–4.

¹⁶ Hoppe, p. 169. Cohn's studies, with which he demonstrated the propagation of cells by fission, took place in algae and infusoria between 1850 and 1853.

vision took place around the same time as Robert Remak, physiologist at the University of Berlin and probably the first (non-baptised) Jewish university teacher at a German university, came to the general conclusions that tissues do not generate outside cells and that cells only propagate by division, which starts from the nucleus.¹⁷ This important supplement to cell theory has usually been attributed to the renowned Berlin pathologist Rudolf Virchow, who in 1855 coined the expression *omnis cellula e cellula* (“all cells from pre-existing cells”) without giving credit to Remak despite the fact that he knew his work well.¹⁸ Another seminal contribution by Cohn to cytology was his far-reaching theory of the basic uniformity of the protoplasm of plant and animal cells and of the protoplasm (including the nucleus) as the basis of all activities of life, which he proposed in 1850.¹⁹

A detailed knowledge of the developmental stages of a unicellular organism is often of crucial importance for its classification and incorporation into the animal and plant taxonomic system. Cohn’s extended microscopic studies of micro-organisms contributed to a new understanding of the development of unicellular fungi and algae and to the recognition of sexuality in algae.²⁰ His work extended to applications as well. He provided evidence of fungi being the cause of many plant and animal diseases, and was one of the first persons to propose and conduct analyses of drinking water in order to search for micro-organisms as possible causes of epidemics.²¹

Cohn’s work had a particularly large and lasting impact in the field of microbiology that later became bacteriology. Because of their small size and capacity to transform into even smaller, inert spores, bacteria had been largely neglected by biologists. With his meticulous research on the morphology and life cycles of bacteria, summarised in his three-volume work *Untersuchungen über Bakterien*,²² Cohn laid the foundations of modern bacteriology.²³ He demonstrated the existence of inert durable forms of bacteria after drawing analogies to those micro-organisms, which due to their hard shell were resilient to unfavourable conditions. He was the first scientist to produce pure cultures of bacteria stained with natural dyes and argued for the establishment of a taxonomy which positioned bacteria within the

¹⁷ Heinz-Peter Schmiedebach, *Robert Remak (1815–1865). Ein jüdischer Arzt im Spannungsfeld von Wissenschaft und Politik*, Stuttgart 1995, pp. 183–185.

¹⁸ *Ibid.*

¹⁹ Hoppe, pp. 170–171.

²⁰ *Ibid.*, pp. 172–179.

²¹ For example he tried (unsuccessfully) to find micro-organisms as causal agents for cholera during the epidemic starting in Europe in 1852, (*ibid.* pp. 179–183). In 1883 Robert Koch succeeded to demonstrate the existence of bacteria as causal agents of this disease.

²² Bonn, 1872, 1875, 1876.

²³ See for example Summers, pp. 3 and 4.

known biological taxa (the kingdom of plants). Guided by his observations and his discovery of bacterial spores he held the view that each type of bacterium generates only from a bacterium of the same kind and is constant as are species of plants or animals, in other words that it has a definite form, development, and enzyme activity. Cohn thus contradicted the then widely accepted view that there was no constancy of forms in bacteria.

The renowned botanist Carl Wilhelm von Nägeli (1817–1891) was among those biologists who believed in the multiplicity of bacterial forms, known as polymorphism. He supported this view with his theory that bacteria and microscopic fungi can be produced spontaneously from animal or plant precursors. Nägeli's notion of a "seamlessly flowing nature"²⁴ and continuously blending differences between individuals²⁵ sharply contrasted with Cohn's conviction that clearly distinguishable bacterial species do exist and that they can be characterised empirically. Despite the influence of Nägeli and his school, Cohn's view, known as monomorphism, became the dominant view after Pasteur had conducted his famous experiments to disprove spontaneous generation of bacteria and after monomorphism was adopted and widely propagated by Robert Koch. Bacterial monomorphism was a pre-requisite for the development of bacteriology.

Cohn's Research Practice and the Impact of his Work

Cohn's work focussed on the cell and on micro-organisms and his methodology centred on the microscope. He also created or contributed to theories in these fields. They were strongly backed by observational or experimental evidence. Based on his acute and systematic observations and guided by careful reasoning he became convinced of the individuality of bacterial strains, when most other biologists still denied it. He then confirmed his assumption experimentally. Cohn expressed a predilection for reasoning and thought also in other contexts: trying to find out why he did not feel any affinity for music, he concluded that he could not perceive in music the "deep intellectual pleasure that only flows from thinking and that I experience with true poetry."²⁶ Generally, Cohn followed the methodological concept that the

²⁴ Mazumdar, p. 50.

²⁵ "Individuals are related to each other in the same way as successive states of the same individual. They are continuous with each other, every boundary is arbitrary, the whole movement is infinitely divisible. In the same way infinitely numerous individuals are possible and the differences between them blend continuously into each other (findet ein allmählicher Übergang der Unterschiede statt)." Nägeli 1844, cited after Mazumdar, p. 44.

²⁶ Cohn, *Blätter der Erinnerung*, p. 35. It should be added that many other eminent scientists think about music differently.

sciences had to pursue the inductive method in order to produce general theories, and that theories had to be based on facts.²⁷

A few errors in Cohn's work are reported, some of which Cohn himself immediately realised and corrected, but in general his work was reliable to the extent that his contemporaries believed him even when he contradicted authorities, such as Ehrenberg, Nägeli, and Schleiden.

Analysing the history of early immunology and immunochemistry Pauline Mazumdar, citing Kant, distinguishes between two basic groups of scientists. Those of the first group, the "unitarians", try to find the unity underlying the diversity of nature and therefore are more speculative, those of the second group emphasise nature's diversity and are more practical or empirical. Representatives of the latter are Linnaeus and all taxonomists working according to his principles.²⁸ In Mazumdar's view, Ferdinand Cohn was a traditional Linnaean, who developed a new classification of unicellular algae and bacteria which he divided into tribes, genera and species along Linnean lines.²⁹ It is obvious that Cohn distinguished himself from many "unitarians", in particular Nägeli, by his strictly empirical, non-speculative attitude and an extremely reliable research practice, in which he used the most modern techniques.³⁰ However, Cohn was not a traditional Linnean, something which his use of experimental techniques already shows. Above all, Cohn's contributions to cell theory, in particular his pioneering work on the unity of protoplasm of animal and plant cells and his strong support for Darwin's theory of gradual evolution show that he contributed to concepts of unity in nature and appreciated gradualism; for him there was no dichotomy between looking for unity and for differences. Differences in research practices, particularly regarding empiricism and speculation were at least in this case not determined by differences in philosophical outlook.

Cohn's methods and theories turned out to be very fertile and relevant. Through his publication on bacteria in 1872, the theory of bacterial monomorphism received general recognition, constituting a starting point for bacteriology. His work was also highly relevant for medical research. Since it showed that bacteria might indeed be specific infectious agents with charac-

²⁷ Ferdinand Cohn, *Die Entwicklung der Naturwissenschaft in den letzten fünfundzwanzig Jahren. Ein Vortrag*, 2nd edn., Breslau 1872, p. 33.

²⁸ Mazumdar, p. 4 ff. and *passim*.

²⁹ *Ibid.*, p. 7–8.

³⁰ To give an example of an investigation which sounds very modern: In a new species of algae, Cohn investigated the nature of its pigment, which according to Nägeli was a single "phycochrome". By means of a kind of paper chromatography (a method which was not yet widely practiced at the time), Cohn showed that the pigment consisted of three different pigments, and his analysis of pigments led him to discover new relationships between the various types of algae (*ibid.*, 51).

teristic properties and not just harmless parasites subject to constant change, it laid the foundation for medical bacteriology. This is best exemplified by the strong influence of Cohn's publications on Robert Koch, whom they inspired to start to work on the life cycle of the *anthrax* bacillus. Koch wrote to Cohn in 1876: "Motivated by your articles on bacteria in *Beiträge zur Biologie der Pflanzen* [a journal founded by Cohn] I started some time ago to conduct research on the anthrax contagium. After many unsuccessful trials I finally succeeded in completely analysing the developmental process of *Bacillus anthracis*."³¹

Cohn's work was also seminal for research in agriculture. Based on the observed facts of soil depletion after continuous cultivation and the restoration of soil fertility by the application of organic material and on the knowledge of the microbial role in fermentation and putrefaction, Cohn postulated in 1872 an important role of microbes in the biological cycle of the elements.³² Some years later several researchers confirmed this hypothesis.³³

In general, Cohn's work can be characterised as predominantly empirical and non-speculative. He became outstanding among his fellow biologists because of his superior handling of empirical research and his development of theories in new and scientifically relevant areas of biology.³⁴ Superior handling in this instance means possession of superior knowledge, observational and experimental skills, intellectual capacities such as abstraction and generalisation and the ability to make associations and to transfer knowledge from one field to another. He only published thoroughly researched results. He emphasised the importance of learning, of acquiring expert knowledge and technical skills, as is for example demonstrated by his plan to set up schools of microscopy.

His contemporaries appreciated his superior knowledge. Among them was Theodor Billroth who despite being an antisemite³⁵ asked Cohn to re-

³¹ R. Koch to F. Cohn, 22 April 1876, in Cohn, *Blätter der Erinnerung*, pp. 183–184. On the relationship between Cohn and Koch, see Brock, pp. 38–52 and *passim*.

³² Collard, *Microbiology*, p. 83.

³³ Most noticeably the Dutch bacteriologist Martinus Willem Beijerinck and the Russian bacteriologist Sergei N. Winogradski, *ibid.*, pp. 83–86.

³⁴ Elsewhere we have characterised Cohn as a "creative epigone", see Ulrich Charpa and Ute Deichmann, 'Jewish scientists as geniuses and epigones – scientific practices and attitudes towards them: Albert Einstein, Ferdinand Cohn, Richard Goldschmidt', in *Studia Rosenthaliana* (forthcoming).

³⁵ Cf. Ulrich Charpa, 'Judentum und wissenschaftliche Forschung – Einstellungskluster im späten 19. Jahrhundert und ihr Fortwirken', in *Simon Dubnow Institute Yearbook* 3 (2004), pp. 175–198, here pp. 187–190; Schleiden's treatise *Die Bedeutung der Juden für die Erhaltung und Wiederbelebung der Wissenschaften im Mittelalter*, Leipzig 1877, a work that was widely distributed and translated several times, is a rejoinder to the antisemitism of Billroth's *Über das Lernen der medicinischen Wissenschaften an den Universitäten der deutschen Nation*, Vienna 1876 (Ulrich Charpa, 'Matthias Jakob Schleiden (1804–1881): The

view his book on bacteria “kindly”, acknowledging Cohn’s superior command of botanical knowledge.³⁶ Cohn did review the book kindly even though Billroth obviously had not even read Cohn’s basic book on bacteria and Cohn had to reject some of the author’s central claims.³⁷

When Robert Koch as a then unknown country doctor had attained his first results on anthrax, it was Cohn whom he approached for his expert opinion. In the letter quoted above, he referred to Cohn as the “person most knowledgeable about bacteria”. The following example shows the unusual attention and acknowledgement Cohn was able to grant contributions made by others. Cohn invited Koch to come to Breslau to demonstrate his experiments and when he realised that in contrast to many amateurs who claimed to have made important discoveries, Koch’s research was reliable and path-breaking, he fully supported him. He called on his colleagues Julius Cohnheim, Ludwig Feuerbach, Ludwig Lichtheim, Moritz Traube, Wilhelm Waldeyer, and Carl Weigert to witness Koch’s experiments which lasted several days. He then helped Koch write up his first paper on the anthrax bacillus and published it to great acclaim in 1876 in *Beiträge zur Biologie der Pflanzen*.

When Koch had become a celebrity in medicine and a myth began to arise regarding the relationship between him and Cohn, Cohn made it clear that his own role had been to recognise and support Koch as the “unrivalled master of scientific success”.³⁸

Looking at the development of science in his book on this subject, Cohn makes a distinction between a few outstanding leaders and large numbers of more modest researchers without whom science would not proceed as well.³⁹ In his view no book in modern times had influenced modern science more profoundly than Charles Darwin’s *Origin of Species* (1859).⁴⁰ His acknowledgement of the greatness of Darwin’s book sheds light on his own notion of scientific leadership: Darwin was not the first to propose the idea of relationships in nature because of common ancestry but by a “careful collection of all supporting facts and an astute [*scharfsinnig*] criticism [he] elevated this idea to the higher level a theory” and provided a new understanding for the development of organisms.⁴¹ Cohn got to know Darwin personally when Darwin invited him during his journey to England in 1876. Cohn’s portrait

History of Jewish Interest in Science and the Methodology of Microscopic Botany’, in *Aleph: Historical Studies in Science and Judaism*, vol. 3, (2003), pp. 213–245).

³⁶ Rosen in Cohn, *Blätter der Erinnerung*, pp. 182–183.

³⁷ *Ibid.*

³⁸ Cohn in *Breslauer Zeitung*, 17 December 1890, cited after Cohn, *Blätter der Erinnerung*, p. 185.

³⁹ Cohn, *Die Entwicklung der Naturwissenschaft*, pp. 8–9.

⁴⁰ *Ibid.* 20.

⁴¹ *Ibid.* 22.

of Darwin shows his notion of scientific leadership; it seems that in a way he was also implicitly talking about himself:

Darwin was a man of great amiability filled with a genuine sense of truth who, with *scrupulous conscientiousness*, shrunk back from presenting hasty assumptions as proved facts, but who stated clearly and without hesitation what had proved true after thorough investigation. *The appreciation, which he granted the research of others*, even younger ones, was without envy and selfishness, even if they contradicted his favourite ideas. *He judged his own achievements with an almost moving modesty, as if he were unaware of their fundamental importance.* He warmly admired German science, for though his command of our language was not at all complete, he studied with perseverance all phenomena of the German scientific literature. *His publications show a thorough familiarity with this literature rarely to be found amongst our colleagues.*"⁴² (emphasis added)

One may ask: How is it that despite the huge importance and impact of Cohn's work he is less known than other outstanding microbiologists of his time, in particular Louis Pasteur and Koch, often referred to as geniuses? One reason is that Pasteur and Koch became best known for their direct contributions to medicine through establishing bacteria as causes of infectious diseases and creating vaccines (if only allegedly, Koch's tuberculin and Pasteur's vaccine against tuberculosis never were effective in immunisation, something that was not admitted at the time). Medical progress has always received more public attention than progress in basic biology. Moreover, Pasteur and Koch later became political figures by agreeing to serve as national heroes during the French German war. Another reason is that Cohn's personality and his scientific conduct did not fit the romantic notion of "genius" in the nineteenth century German tradition. He was extremely modest. Despite the fact that he contradicted several authorities of his time, he never polemicised against them. But his conclusive demonstration of the existence of bacterial species and his characterisation of many of them for which he used old, well-tried methods, as well as newly developed ones, led to truly revolutionary applications which later were made by others.

Was there an influence of religious tradition? Here we have to speculate, but some indications suggest that there was. Thus it is well possible that Cohn's scientific practice, the value he attributed to empiricism, to the knowledge of literature in the field, to the outstanding research by others, his readiness, if required by new evidence, to criticise and reject claims, and his predilection for reasoning can be related at least to some extent to his experience of "testimonial" Jewish traditional education in his youth. In addition, we may establish a parallel between the method of classification and the primarily legislative character of the Jewish religion and its classificational

⁴² Cohn's report of his journey to England, which appeared in *Breslauer Zeitung* in April 1882, after Darwin's death, quoted after Cohn, *Blätter der Erinnerung*, pp. 204–210, here p. 208, transl. by the author.

basis, in which clear decisions have to be taken such as, for example, whether or not a certain food is kosher.⁴³ As was shown before, Cohn strongly appreciated gradual changes and a unity underlying the plurality of life forms. He was also fully aware of the difficulties of dividing bacteria into species and the arguments against it.⁴⁴ But he was convinced that these difficulties could be overcome in the future and that it was important to continue to search for clear-cut differences, an approach that was, it has to be repeated, so much more fertile than an indulgence in a “seemingly flowing nature”.⁴⁵

It should be recalled that the percentage of Jewish scientists and medical practitioners among those who followed Cohn and became bacteriologists was remarkably large and that it was another Jewish scientist, Henle, who laid the foundation for medical microbiology by proposing a clear cut definition of a pathogenic germ.⁴⁶ As is known from the legal system, Cohn's example shows that there needs to be no contradiction between having knowledge of gradualism in nature and the search for class differences, necessary as a basis for future work in science. It is true that the concept of constancy of bacterial forms was used too dogmatically by others later on, and that this impeded research on bacterial sexuality.⁴⁷ However, this does not diminish the fertility of this concept for bacteriological research in the late nineteenth century.

⁴³ See the introduction to this volume.

⁴⁴ Mazumdar, p. 57.

⁴⁵ In this context Koch's opinion about Nägeli's book *Die niederen Pilze* of 1877 is revealing. He wrote to Cohn: “I have seldom come across any book which contained so much error and nonsense, and nothing at all which contributed to our knowledge.”; cited after Mazumdar, p. 66.

⁴⁶ We do not know, whether scientists such as Pettenkofer or Nägeli had many Jewish students, in any case they do not seem to have been scientists of renown. Landsteiner, despite the fact that he had been influenced by Nägeli's student Max Gruber, according to Mazumdar a “unitarian”, was an extremely empirically oriented scientist and he contributed decisively to concepts of specificity and differences in immunology, for example by his discovery of the human blood groups of the A, B, 0 system.

⁴⁷ Harriet Zuckerman and Joshua Lederberg, ‘Postmature Scientific Discovery’, *Nature*, 324 (1986), pp. 629–631.

German-Jewish Chemists and Raphael Meldola: The 1906 Jubilee Celebration for the Discovery of the First Aniline Dye*

Anthony S. Travis

Introduction

One hundred years ago, on 26 July 1906, chemists and industrialists from Europe and the United States gathered in London to mark the jubilee of the founding of the coal-tar colour, or aniline dye, industry. As befitted a celebration for a prestigious high-tech industry, little expense was spared. During the morning, guests assembled at the Royal Institution to hear speeches and messages of congratulation from around the world. It was a sparkling occasion, with some ladies appropriately dressed in mauve, the very first of the synthetic colorants. In the evening the gentlemen attended a grand banquet held at the Whitehall Rooms, Hotel Métropole, near Trafalgar Square. The sheer splendour of the mirrored banqueting room, with its ornate columns, palm trees, and soaring decorative ceiling, provided the perfect setting for the many civic leaders and foreign ambassadors, scientists, and industrialists. As the evening got under way, however, it became apparent through the speeches and toasts that though an English invention was being celebrated, the main credit for development of the industry lay with Germany. Of great significance here is the fact that among the German chemists present who had contributed to the growth of their nation's dye industry, several were Jewish. Moreover, it was the chairman, Professor Raphael Meldola, president of the British Chemical Society, and grandson of a chief sephardi rabbi of London, who through his earlier concern over loss by the English of their dye industry had emphasised the tremendous progress made

* I thank Hilary McEwan, Special Collection Archivist at the Library Archives and Special Collections, Imperial College London, and her colleagues for access to the Meldola Papers, Nicola Best and her colleagues at the Library and Information Centre, Royal Society of Chemistry, London, for access to items related to William Perkin, and the staff of the Special Collections, The Hartley Library, University of Southampton, for access to the papers of the Maccabaeans. Ute Deichmann and Hannah Gay are thanked for critical comments.

by the Germans. In this chapter, pride of place is given to the most important German-Jewish inventor, Heinrich Caro, and Meldola's role in bringing his achievements to the attention of the English-speaking world. Caro and Meldola were also competent historians of the industry, providing much added value to the stories of English decline and German ascendancy. While Jewishness might not be relevant to any interpretation of the over-representation by German-Jewish chemists and entrepreneurs in the dye-making industry, there is no denying their record of excellence in both science and industry. What was no doubt true was that for centuries close-knit Jewish communities, forced to retain their status as outsiders, had cherished craft skills as much as the sort of erudition that stimulated and integrated abstract thinking. And from around 1870 – with the establishment of relevant chemical theory – chemists were provided with the necessary insights to give meaning to chemical constitutions and structures, examples of which accompany this contribution.



Dinner to celebrate the jubilee of the discovery of the first aniline dye, mauve, held on 26 July 1906 at the Hotel Métropole, London. At the top table are William Henry Perkin (standing, with beard), Raphael Meldola (standing, next to Perkin), and Heinrich Caro.

By courtesy of the Edelstein Collection

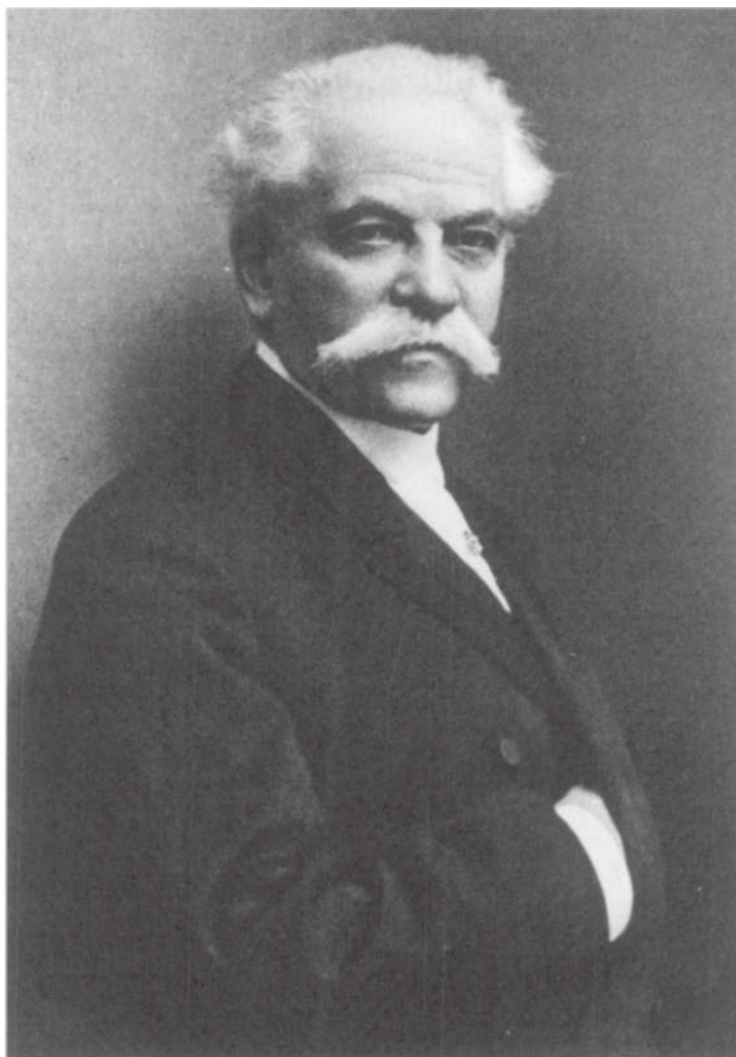
Heinrich Caro and other German-Jewish Chemists

The first synthetic, or aniline, dye was discovered in 1856 by the teenaged William Henry Perkin, assistant to the German chemist August Wilhelm Hofmann, director of the Royal College of Chemistry in London. The colorant, generally known as mauve, was followed from 1860 by aniline red, aniline blue, and aniline violet (Hofmann's violet). Perkin did not discover these other dyes, but he did invent a way of making alizarin, the important colorant in the root of the madder plant. However, his business was unable to grow, and he sold out at the end of 1873. By then Germany was the leading manufacturer of synthetic dyes.¹ Maybe it was the more entrepreneurial spirit, as well as the style of German business organisation, that facilitated the early growth of the German industry. If so, I suggest that the entrepreneurial spirit might well have been stimulated by the strong presence of German-Jewish inventors, many of whom were multilingual. The latter was important since the main market for their innovations was Great Britain. The United States also became a significant user of German-made synthetic dyes, as did Asian countries.

Though we have no way of establishing the percentage of German-Jewish chemists in or connected with the dye industry, there is no questioning that they were prominent, especially allowing for the fact that Jews represented less than one per cent of the German population. Moreover in other scientific and technical endeavours there were no comparable levels of achievement. What is certain is that the individual most responsible for the transfer of synthetic dye technology from England to Germany was the chemist Heinrich Caro (1834–1910). He was trained as a colourist in the calico (cotton) printing industry, where he learnt first-hand about the considerable technical challenges of dye application. That experience enabled him to facilitate the smooth transition among dye users from natural to artificial colorants. From 1868, Caro played the leading technical and scientific role in the growth of Badische Anilin- & Soda-Fabrik, better known as BASF, located at Ludwigshafen, on the River Rhine, almost opposite Mannheim. This followed his work on the synthesis and structure of alizarin, through academic-industrial research alliances, particularly collaboration with, in Berlin, Carl Graebe and Carl Liebermann (1869–1870), and, in Strasbourg, Adolf von Baeyer (1873–74).² Liebermann was of Jewish extraction, while the mother of Baeyer was Jewish.

¹ Anthony S. Travis, *The Rainbow Makers: The Origins of the Synthetic Dyestuffs Industry in Western Europe*, Bethlehem, P.A. 1993, pp. 163–203.

² Adolf von Baeyer and Heinrich Caro, Synthese von Anthrachinonabkömmlingen aus Benzolderivaten und Phtalsäure, in *Berichte der Deutschen Chemischen Gesellschaft* 7



Heinrich Caro (1834–1910)
By courtesy of the Edelstein Collection

Though Heinrich Caro was fully aware that his work was indispensable he had no way of knowing how it would contribute towards setting the agenda for chemistry for the next half century. His career is an exceptional example of how personalities, their backgrounds, and objective circumstances shape the course of history. Though of Jewish ancestry, Caro was thoroughly assimilated into German culture. It was only through his friends and colleagues of similar backgrounds that we find any suggestion of the connection with a sector of the Jewish community.³ Caro was born in Posen

(1874), pp. 968–976 and *ibid.* 8 (1875), p. 152–153; Adolf von Baeyer, *Adolf von Baeyer's Gesammelte Werke*, Braunschweig 1905, vol. I, pp. 613–620, 627 f.

³ Anthony S. Travis, 'From Color Makers to Chemists: A Jewish Profession Elevated', in *Simon Dubnow Institute Yearbook* 3 (2004), pp. 199–219.

(now Poznań in Poland), some two hundred kilometres east of Berlin, and under the control of Prussia, which meant that the German language was imposed on the population. Generations earlier, on his father's side, the family had included rabbinical leaders who once inhabited Adrianople, the Turkish city that gave its name to the cotton dye (Adrianople, or Turkey, red) obtained from the madder plant. Caro's more immediate predecessors had participated in the great migrations of Jewish traders and artisans across Europe and at some stage reached Portugal, then moved to Glogau in Silesia, and on to Posen.

Certainly Heinrich Caro's success cannot be understood without reference to his early career in the preparation and application of natural dyes during the 1850s, nor to the fact that these were trades in which Jews had specialised throughout Europe, North Africa, India, and Central Asia for several centuries. When he was still a child, Caro's family moved to Berlin, where he was educated in technical chemistry, prior to joining a firm of calico printers as an apprentice. His abilities were such that in 1857 he was sent to Manchester to investigate developments in machines and chemicals used in calico printing. Following completion of his apprenticeship Caro moved to Manchester, where late in 1859 he joined the firm of Roberts, Dale & Co., manufacturer of chemicals for the textile trades. Through Caro, connections were built up with German dye users, including the Jewish Meyer family, engaged in calico printing in Berlin, that included the later academic chemists Richard and Victor Meyer, the latter a leading chemist in the nineteenth century who in 1889 moved from Zurich Polytechnic to Heidelberg.⁴

Caro remained in Manchester until 1866, working and socialising with many expatriate Germans. They included Jews such as the alkali entrepreneur Alfred Mond, and fellow colourist August Leonhardt, also born in Posen. In common with Caro, these men had been drawn to Lancashire by its huge textile industry, as had Ivan Levinstein, who emigrated to England from Berlin in 1864, and founded what was to become one of the leading British dye-making firms. From the late 1880s he was an important friend and correspondent of Caro.

After Caro's return to Germany in 1866, he acted as consultant to BASF, prior to joining that firm late in 1868. Almost immediately, Caro was placed in charge of the development of the alizarin process through cooperation with the academic inventors Carl Graebe and Carl Liebermann. The connection with BASF had come about through Liebermann's father who was a good friend of Heinrich Caro, perhaps through mutual involvement in calico

⁴ Carsten Reinhardt and Anthony S. Travis, *Heinrich Caro and the Creation of Modern Chemical Industry*, Dordrecht 2000, pp. 214, 224, 228, 236, 327.

printing. On 29 May 1869, Graebe and Liebermann agreed to hand over patent rights for their alizarin process to BASF in exchange for a fourteen-year contract that would provide the inventors with three per cent of the turnover on alizarin sales. As part of the contractual arrangements, the two inventors agreed to assist the company during the technical development.⁵ This was successfully achieved, mainly by Caro. However, the important British patent of Caro, Graebe and Liebermann was rejected in favour of an almost identical patent filed by William Perkin just one day later in June 1869. Mainly through the efforts of Caro, whose English was excellent, a contract was drawn up between Perkin and BASF to divide up the alizarin market.⁶ Perkin would supply the British users, while BASF would control mainland Europe, the United States, and elsewhere.

Caro's interest in academic chemistry had enabled him to forge a strong link from the end of 1873 with Adolf Baeyer, shortly after he had moved to the new German university at Strasbourg. Their cooperation soon proved to be of crucial importance for the careers of both men, as well as for BASF. First was the successful elucidation of the structure of alizarin, in 1874. This stimulated Baeyer and Caro to tackle the structure and synthesis of indigo, the most important of all natural dyestuffs. Caro's access to Baeyer's research school in Munich after 1875 also brought about his collaboration with Emil and Otto Fischer on the constitution of aniline red. The network of contacts, both academic and industrial, was not restricted to Baeyer and his assistants. Caro's friendship with Victor Meyer led to a decade-long exchange of research results.

In Manchester during the 1860s, Caro had developed the first of what were later called azo dyes, and instructed dyers and printers in the use of the synthetic, or coal tar, colorants. His Manchester (later Bismarck or Martius) brown was made by a method that was fully understood only from the mid-1870s.

Here it is necessary to digress, in order to introduce some technical detail that will highlight what was achieved at the scientific level. By modern standards the discussion may seem arcane, but in the 1870s these were cutting edge advances. The formation of Bismarck brown involves the two-step process known to chemists as diazotisation (of an amino group, the atomic grouping of two hydrogens and one nitrogen) and coupling. In this case, the compound that is diazotised and the coupling component are one and the

⁵ Contract between BASF, Carl Graebe, and Carl Liebermann, Mannheim, 29 May 1869, BASF Archives, document-volume no. 1, fol. 38; transcribed in Elisabeth Vaupel, *Carl Graebe (1841–1927). Leben, Werk und Wirken im Spiegel seines brieflichen Nachlasses*, Munich 1987, vol. 1, pp. 642 ff.

⁶ Liebermann appears to have undertaken most of the negotiations with BASF on behalf of the two inventors; *ibid.*, pp. 747–753.

same, the aromatic amine *m*-phenylenediamine, that contains two amino groups. Thus one molecule of this *m*-phenylenediamine is tetrazotised, becoming in effect an intermediate form, and then coupled together with *m*-phenylenediamine. These names, the chemical structures that they represented, and the nature of the process, became available only after Friedrich August Kekulé's benzene ring theory of 1865 transformed the understanding of the nature of the aromatic products obtained from coal tar. The theory was adopted by chemists working on industrial problems as much as it was by their academic colleagues; it enabled them to draw the elusive formulae of many coal tar derivatives. The benzene theory was successfully applied to the study of alizarin during 1868–1874, by Graebe, Liebermann, Caro, and Baeyer, and to azo dyes during 1875–1876, in both cases mainly in Germany. Otto N. Witt, a German chemist at the firm of Williams, Thomas & Dower, at Brentford, west of London, and Caro, at BASF, independently found that dissimilar amines could be employed in the synthesis of azo dyes. Thus Witt found that diazotised aniline coupled with *m*-phenylenediamine afforded what Caro, who developed the manufacturing process for BASF, called chrysoidine. Witt's initial inspiration arose from his theory of colour and constitution (1875), the terminology of which is still in use, quite apart from the fact that it has contributed to the understanding of mechanisms of drug action.

Heinrich Caro and Raphael Meldola

In 1890, Heinrich Caro, by then acknowledged to be a scientific and technical genius, retired from BASF. His writing of what was to become the most comprehensive history of the synthetic dye industry during its first four decades was a self-imposed mission, presented to the *Deutsche Chemische Gesellschaft* in 1891. It was based mainly on Caro's own career and correspondence with pioneers in Germany and elsewhere. It was a technical history of tremendous scope.⁷

In contrast to Caro's approach, chemists in Britain, particularly Raphael Meldola, often used their histories of the synthetic dye industry as tools to lobby for improved scientific education and investment in industrial research. While that to some extent limited the capacity for historical judgement, it does provide a useful means for evaluating their attitudes and how they perceived the economic threat posed by German science-based technology. In the context of this article, then, a measure of the contribution of

⁷ Heinrich Caro, 'Ueber die Entwicklung der Theerfarben-Industrie', in *Berichte der Deutschen Chemischen Gesellschaft* 25 (1892), pp. 955–1105.

Germans to the chemical industry requires us to consider the principal differences with the stratagems of the British. That needs to be understood in order to fully appreciate the important German-Jewish contribution.

Meldola recognised that German dominance achieved by the 1880s was enabled by: a high reputation of German-made dyes among the important English and Scottish dye users; advances in synthetic and theoretical organic chemistry, particularly through Kekulé's theory; and a comprehensive patent law (1877) that protected inventions throughout Prussia and the principalities. (There was also the capture of non-European markets where natural dyes could be substituted by and supplemented with the synthetic products, including in China and Japan.)

Caro, as already indicated, was the principal contributor to all the technical endeavours. He not only played an important role in the protection of BASF patents, but also in the development of German patent law, particularly after direct azo dyes for cotton were introduced in 1884. These were made from the tetrazotised diamine known as benzidine, or its congeners. Careful control of reaction conditions enabled coupling with two different coupling components. The outcome was that the range of combinations through the coupling reaction was enormous, which created great difficulties with the awarding of patents. This was one reason why in 1886 the revision of the 1877 patent law in Germany was an issue of major importance among manufacturers of dyestuffs. The Imperial Commission that was charged with revising the law appointed Heinrich Caro as the expert in chemistry. Among his several suggestions was one that patentees should be more specific about the products claimed. Separately, in a case of litigation over the benzidine (benzopurpurine) dyes, he suggested that patents be awarded for novel technical effects, and not just the process or product. As a result, the Imperial Commission also proposed a more flexible approach to what constituted novelty, one that avoided a too-restrictive legal definition but that permitted technically acceptable variance and came within the domain of the "culturally fluid and mutable concept of invention." Revision of the German patent law to include these features, as well as both products and processes, took place in 1891.⁸

In 1880, Heinrich Caro developed a process for the synthesis of indigo based on the experiments of BASF consultant Adolf Baeyer, at the University of Munich. Though far from a commercial success, it had aroused considerable scientific interest, and printed samples were among the products displayed at the London 1885 International Inventions Exhibition, South Kensington, by BASF, the company with which "the name of Heinrich Caro will

⁸ Paul A. Zimmermann, *Patentwesen in der Chemie. Ursprünge, Anfänge, Entwicklung*, Ludwigshafen 1965, pp. 42 f.

always be connected.”⁹ The BASF products on display, that included all the major inventions of Caro, were awarded two gold medals. Samples were presented by Caro to his friend William Perkin. Other English chemists were so impressed that several requested samples from the Kensington showcase. They included Henry Edward Armstrong, at the recently opened Central Institution, South Kensington (later City and Guilds College, then Institute; it is now Imperial College of Science and Technology), and Raphael Meldola, at a junior institution, the Finsbury Technical College, the City and Guilds of London Institute (from 1885 known as the Central Technical College). It was from this time that Meldola began to use German achievements in order to chart the decline of the British dye industry, in which he had been intimately involved.

Raphael Meldola

Raphael Meldola (1849–1915), like Caro, was also of Jewish ancestry, but unlike Caro took great interest, and pride, in Jewish matters. He was the only son of Samuel Meldola, a printer, and named after his grandfather, rabbi (hakham) to the London Sephardi community. During 1866–1868, Meldola studied chemistry at the Royal School of Mines, successor to the Royal College of Chemistry. The reason for this is uncertain, though the fact that by the mid-1860s the synthetic dye industry had given a major stimulus to chemistry may well have been significant. On completion of his studies, he was appointed assistant to the chemist John Stenhouse, then assayer at the Royal Mint. This was followed by a post in the synthetic dye industry (1871–1873), with Williams, Thomas & Dower, the firm that later employed Otto Witt. In 1873, Meldola joined the Royal College of Science, where he undertook spectrum analysis. The prominent British chemist Edward Frankland recommended him for his ability to undertake original chemical work as assistant to the astronomer Joseph Norman Lockyer. This post lasted from 1874 to 1876, during which time Meldola was in charge of photographic equipment for the Royal Society’s expedition to the Nicobar Islands, east of India, to observe the total eclipse of the sun on 6 April 1875. The results were less than satisfactory due to poor weather conditions. In 1877, Meldola returned to the dye industry when he joined Brooke, Simpson & Spiller (BS&S), at the Atlas Works, Hackney Wick, East London.¹⁰

⁹ Watson Smith, ‘International Inventions Exhibition London: Report on the Exhibits Relating to the Chemical Industries’, in *Journal of the Society of Chemical Industry* 4 (1885) pp. 469–483, here p. 479.

¹⁰ James Marchant (ed.), *Raphael Meldola: Reminiscences of His Worth and Work by Those Who Knew Him, Together with a Chronological List of His Publications*, London 1916; Edward



Raphael Meldola (1849–1915)
By courtesy of the Edelstein Collection

Meldola spent eight years at BS&S. To emphasise his considerable achievements there, it is again necessary to sketch in several technical details that only later will assume significance. In 1877, Meldola discovered the first acid wool green dye; the sulphonated product, used for a year or two for the dyeing of wool, was named alkaline green by BS&S, though it was more generally known as Viridine. A specimen was displayed by BS&S at the 1879 Paris

B. Boulton, obituary notice, in *Proceedings of the Royal Society* 93A (1916–1917), pp. 32–37; William A. Tilden, obituary notice, in *Journal of the Chemical Society* 111 (1917), pp. 349–353; Kenneth R. Webb, 'Raphael Meldola, 1849–1915', in *Chemistry in Britain* 13 (1977); pp. 345–348.

international exhibition. In 1881, Meldola published the method of synthesis, based on the reaction of benzyl chloride with diphenylamine, in the *Berichte der Deutschen Chemischen Gesellschaft*.¹¹ In 1879 he discovered a dye soon known as Meldola's blue, a colorant similar to Caro's Methylene blue, though at the time not manufactured in England. Its use included as a substitute for indigo in calico printing. The BS&S management did not file patents for these discoveries. By the time that BS&S introduced its Meldoline blue the highly successful product was already manufactured in Germany by the Frankfurter Anilinfarben-Fabrik Gans & Co., of Frankfurt am Main. No doubt the poor response of the BS&S management, which filed only two patents based on the several discoveries made by Meldola, and offered him no royalty on sales of successful inventions, had encouraged him to sell his recipes to Germans. They included the processes, again seemingly esoteric and complex, that represented the state of the art around 1880 (See box, next page.)

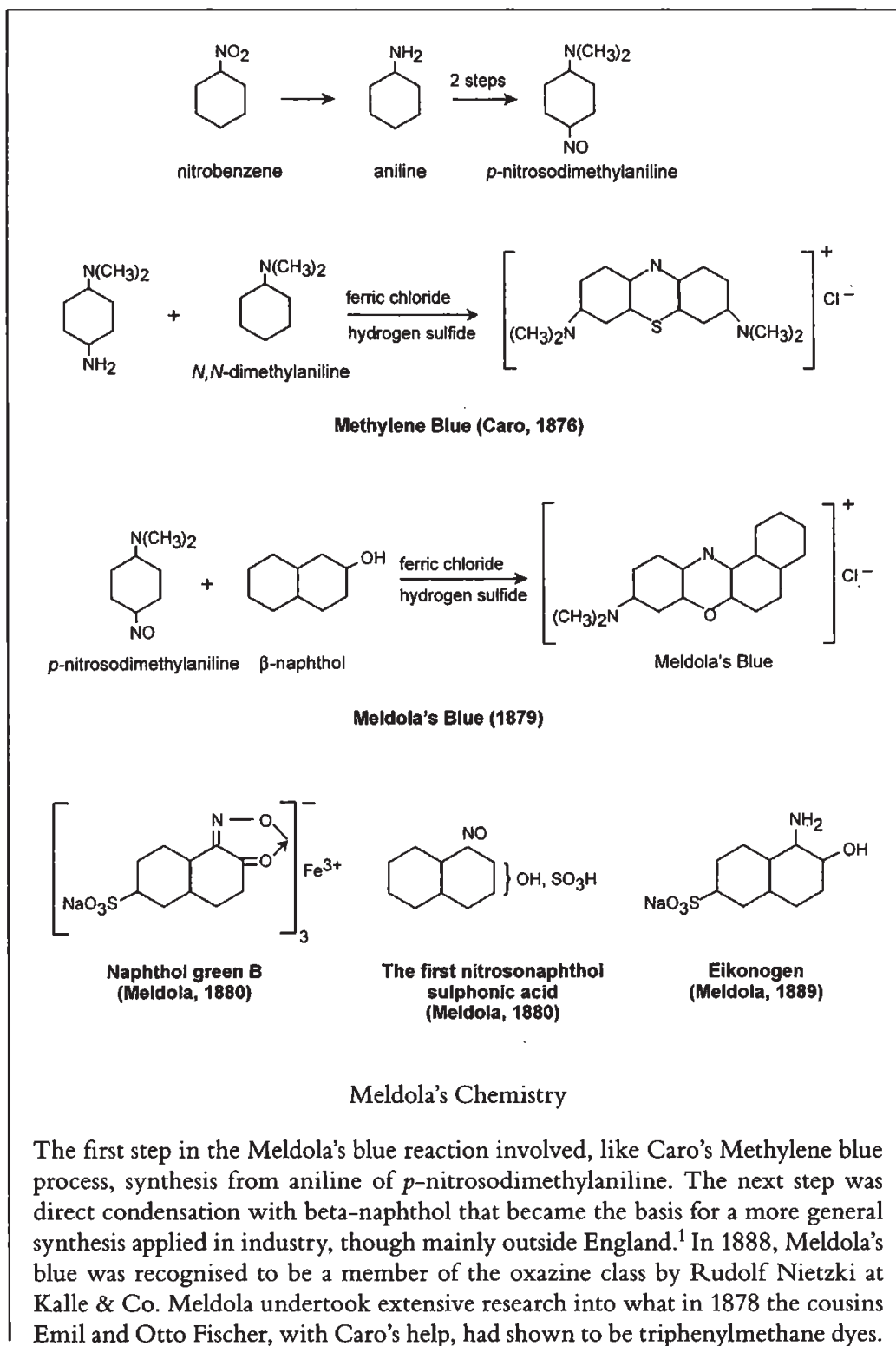
Meldola was highly dissatisfied with the lack of interest shown by the management of BS&S in protecting novel inventions, and left the firm in 1885 to become professor of chemistry at the Finsbury Technical College. His first publication from the college was an extensive summary of his research into halogen derivatives of naphthalene, based on his last researches at BS&S, and drawing in part on studies undertaken by Carl Liebermann.¹²

Meldola's connection with the Gans concern is of interest, since the latter firm was intimately connected with Jewish inventors and entrepreneurs. The Gans dye-making business arose from the 1868 partnership between August Leonhardt, who, like Caro, was a German-Jewish colourist turned chemical inventor, and Dr. Leo Gans. In 1870, they founded the Frankfurter Anilinfarben-Fabrik von Gans und Leonhardt, at Mainkur, near Frankfurt am Main. Leonhardt became associated with the Hoechst dyeworks, while Gans merged his business with those of Cassella and Weinberg. From 1883, Frankfurter Anilinfarben-Fabrik Gans & Co. was managed by Arthur Weinberg, who conducted a friendly business relationship with Meldola, and later, when the firm traded as Leopold Cassella, provided assistance to another notable German-Jewish scientist, Paul Ehrlich, for his biomedical studies.¹³

¹¹ Raphael Meldola, 'Ueber die Einwirkung des Benzylchlorids auf Diphenylamin', in *Berichte der Deutschen Chemischen Gesellschaft* 14 (1881), pp. 1385–1386; see also *idem*, 'Contributions to the Chemical History of the Aromatic Derivatives of Methane', in *Journal of the Chemical Society. Transactions* 40 (1882), pp. 187–201.

¹² *Idem*, 'On the Constitution of the Haloid Derivatives of Naphthalene', in *Journal of the Chemical Society. Transactions* 47 (1885), pp. 497–527.

¹³ Hans E. Rübeseamen, *Ein farbiges Jahrhundert-Cassella*, Munich 1970, pp. 85–88, 90–91.



¹ Raphael Meldola, 'Einwirkung von Nitrosodimethylanilin auf Phenole, welche nicht die Methylgruppe enthalten', in *Berichte der Deutschen Chemischen Gesellschaft* 12 (1879), pp. 2065–2066.

These colorants were aniline red (rosaniline is the free base) and its derivatives.² Meldola prepared beta-naphthylated rosaniline sulphonic acid, and as a result of this in 1883 the important cotton dye alkali blue XG (also known by various synonyms, such as brilliant sky blue). He devised methods for preparation of azo derivatives, and direct production of aminoazo compounds, and undertook research into a variety of azo and disazo compounds. In 1880, following investigations into the action of nitroso compounds on phenols that afforded products of use as technical colorants he discovered the first nitrosonaphthalenesulphonic acid.³ This became a source of naphthol green B manufactured by Gans & Co. from 1884. Meldola developed it into a photographic developer known as Eikonogen, the sodium salt of 1-amino-2-naphthol-6-sulphonic acid (sodium 1-amino-2-naphthol-6-sulfonic acid).⁴ His selective reduction of the nitro group with sodium sulfide in *p*-nitro-azo compounds was used in the manufacture of cotton disazo dyes, though not at Brooke, Simpson & Spiller.

Financial arrangements between chemists and manufacturers regarding novel inventions were common at the time, particularly since few secure academic posts were available. Chemists often changed jobs, according to what was available, or with the promise of better conditions. Meldola was no exception. His surviving correspondence demonstrates that he took a great interest in commercial matters as well as in consultancy work, and received payments for the latter. The circumstantial evidence strongly suggests that Meldola came to a financial arrangement with Weinberg over his inventions. So it was not just a matter of German firms freely copying British inventions, as has often been suggested, but of deliberate sale of rights to an invention, or provision of consultancy services, by a British inventor who had lost faith in his employer. Unusually for an industrial chemist, Meldola published the results of his endeavours at the Atlas Works, with the permission of the proprietors. While that may have conferred considerable prestige on both Meldola and BS&S, it did perhaps reveal the sort of technical information that German firms would have kept classified, or have made application for patents beforehand. The same thing happened with Arthur Green, successor to Meldola at the Atlas Works. Making this knowledge public before patents were filed (and certainly if patents were not filed) was certainly not helpful to the firm.

Whether Meldola chose the Gans concern because of the Jewish connection is not known, though Meldola certainly took great pride in the achieve-

² Carsten Reinhardt and Anthony S. Travis, *Heinrich Caro and the Creation of Modern Chemical Industry*, Dordrecht 2000, pp. 202–207.

³ Raphael Meldola, 'On a New Class of Colouring-Matters from the Phenols', in *Journal of the Chemical Society. Transactions* 39 (1881), pp. 37–40; *idem*, 'On Nitroso-β-naphtholsulphonic Acid', *ibid.*, pp. 40–48.

⁴ *Idem*, 'Note on Eikonogen, the New Photographic Developer', in *Journal of the Society of Chemical Industry* 8 (31 December 1889), pp. 958–959.

ments of fellow Jews, and perhaps preferred to deal with a successful German firm under Jewish ownership. Only one other dye firm seemed to fit this category, the Berliner Actien-Gesellschaft für Anilin-Fabrikation, or AGFA, controlled by members of the Mendelssohn Bartholdy, Oppenheim and Simson families. It is not without interest that from the mid-1880s at least Meldola was in correspondence with AGFA through its chemist Gustav Schultz, later author of the *Farbstofftabellen*.¹⁴ The strong preference for tribalism was well-known in industry, and particularly in the dye industry. Thus when CIBA of Basel was looking for a foreign partner in England, its preference was for a firm under 'Christian direction.'¹⁵ No doubt this was a reference to the notable presence of Jews in the dye industry, as both scientists and entrepreneurs. In the end CIBA had to make do with Clayton Aniline Company, Ltd, of Manchester, the business of Alfred Dreyfus, a Jewish chemist from Alsace who employed several Alsatian- and German-Jewish chemists. Dreyfus provides an excellent example of the role of personal relations in the application of useful knowledge, including a strong German-Jewish contribution. Charles Dreyfus was married to Hedwig Benfey, daughter of the German-Jewish banker Philipp Benfey, of Göttingen. A cousin of Charles, Sylvain Dreyfus, a chemist at Clayton, married a daughter of related German-Jewish banker Theodor Benfey, also of Göttingen. It was through these interminglings that the chemist Hans Benfey of Hanover joined Clayton.¹⁶ Viewed within the wider cultural context of the consolidation of clans in the textile industry through business and marriage such arrangements were certainly not untypical.¹⁷

Meldola, despite his own successes as an inventor and academic scientist, held no higher academic degree until 1910, when the University of Oxford conferred on him an honorary D.Sc. In 1912, he was appointed professor of organic chemistry at London's University College. He was one of the original fellows of the Institute of Chemistry of Great Britain and Ireland (1877), and its president during 1912–1915, and president of the Chemical Society

¹⁴ Gustav Schultz to Meldola, 14 December 1885, MLDA00022, 29 November 1885, MLDA00021, 2 March 1888, MLDA01814, Meldola papers, Imperial College Archives, London.

¹⁵ Harm G. Schröter and Anthony S. Travis, 'An Issue of Different Mentalities: National Approaches to the Development of the Chemical Industry in Britain and Germany before 1914', in Ernst Homburg, Anthony S. Travis and Harm G. Schröter (eds.), *The Chemical Industry in Europe, 1850–1914: Industrial Growth, Pollution, and Professionalization*, Dordrecht 1998, pp 95–118, here p. 107.

¹⁶ Information kindly supplied by Otto Theodor Benfey.

¹⁷ Perhaps the best example is that of Mulhouse, in Alsace, as described by Robert Fox in 'Science, Industry, and the Social Order in Mulhouse, 1789–1871', in *British Journal for the History of Science* 17 (1984), pp. 128–168.

during 1905–1907, of the Society of Dyers and Colourists during 1907–1910, and of the Society of Chemical Industry during 1908–1909.

There is another, and no less interesting, side to Meldola's academic life. From 1868 he published on natural history, mainly entomological works, particularly evolutionary subjects and mimicry. In 1872 he became a Fellow of the Entomological Society of London, was secretary of the society (1876–1880), and president during 1895–1896. His many colleagues included Arthur G. Butler, Edward Bagnall Poulton, the German naturalist Fritz Müller, and Charles Darwin, with whom he corresponded about mimicry. It was Darwin who encouraged Meldola to translate August Weismann's two volume *Studien zur Descendenztheorie* (1875, 1876) published in 1880 and 1882 as *Studies in the Theory of Descent*, and who first proposed Meldola for fellowship of the Royal Society, granted in 1886. Meldola later observed that he gained the fellowship not as a chemist but as a biologist, which certainly emphasises his broad interests and capabilities. He was also associated with other pioneers of evolution: Alfred Russel Wallace, Henry Walter Bates, and Roland Trimen. He participated in the activities of the Essex Field Club, to the east of London, which through his efforts became one of the leading natural history societies, and of which he was twice president. We may surmise that had more opportunities for making a living from biology existed then Meldola might well have made the switch from chemistry. In 1866, Meldola married Ella Frederica Davis, who joined his mother in the task of capturing moths, Meldola's main hobby, from which he had derived his interest in evolution. Well connected in English society, Meldola's range of Jewish and non-Jewish acquaintances encompassed the arts and sciences, and included Israel Zangwill, William Perkin, and fellow lepidopterist Lord Walter Rothschild. Meldola was an active member of the Maccabaeans, a British Jewish society of professional men founded in 1891 to engage in philanthropic and cultural activities.

On 16 December 1905, at Meldola's instigation, the Maccabaeans hosted a unique event, a "Science Dinner" to which several leading non-Jewish scientists were invited, at the Holborn Restaurant, London. The almost two hundred guests included the chemists William Perkin, Sir Henry Roscoe, Sir William Ramsay, Sir William Crookes, Professor Henry Edward Armstrong, representatives of other areas of science, the Chief Rabbi, and the Archdeacon of London.¹⁸ Toasts were drunk to "Science Institutions" and "Pure Science," and, among the various responses, Roscoe advised the audience that "Scientific men of the Jewish race had recently distinguished them-

¹⁸ Table plan and Dinner book, Maccabaeans, MS 126 AJ17/1/1 Box 1 Folder 1, Special Collections, The Hartley Library, University of Southampton.

selves in the world of Chemical Science.”¹⁹ He was, of course, referring to leading German-Jewish chemists.

The remarkable gathering received extensive media coverage. Its success no doubt enabled Meldola over the following weeks to garner strong support for the mauve jubilee celebrations.²⁰ In this endeavour, he was also corresponding with colleagues abroad, particularly Heinrich Caro, whom he had first contacted in 1885. The language of communication with Caro was English. However, Meldola had an excellent command of German, as evinced by his translation of Weismann’s book, and as required of organic chemists, particularly those working with the aromatic compounds upon which the dye industry was founded.

Meldola and Caro

If in 1885 Meldola had had any doubts about the decline of the English dye industry they were soon dispelled after observing the remarkable and colourful BASF display at the International Inventions Exhibition. This stimulated his contact with Heinrich Caro, by letter, requesting specimens for teaching purposes and for a lecture that he was preparing to give before the Society of Arts in London. Meldola advised Caro that in the lecture he intended to focus almost exclusively on Caro’s products, and on their role in bringing about a convergence between science and technology:

My object in writing to you is to beg a small favour for which I shall be very grateful if you will kindly accede to it. Some time ago my friend Dr. W. H. Perkin showed me a set of your products which you had presented to him.

May I ask you to do the same for me here? The specimens which I am asking for are required for two purposes, – in the first place as lecture specimens for showing my students – in the next place for a special lecture which I am going to give this session before the Society of Arts and in which I am going to treat *almost entirely of your discoveries* and of those of your firm. The object of this lecture will be to illustrate by your products what *science* has done for technology and *vice versa*; so that your firm may also see that it will be to their advantage for me to be able to show their own preparations. I am more particularly going to dwell upon the Rosaniline group with special reference to your beautiful synthesis of these colours by condensation from tetramethyldiamidobenzophenone. I should be very glad of a good specimen of the latter in order to show some of its reactions before the Society of Arts.²¹

¹⁹ *Observer*, 17 December 1905.

²⁰ The Maccabaeans sponsored the Meldola Medal of the Institute of Chemistry of Great Britain and Ireland (later Royal Institute of Chemistry), first awarded in 1921, and dedicated to the memory of Raphael Meldola (now the Royal Society of Chemistry’s Meldola Medal and Prize).

²¹ Meldola to Caro, 6 November 1885, quoted in Reinhardt and Travis, p. 308.

Caro recognised that Meldola's lecture was an opportunity for a British chemist to endorse the products of Ludwigshafen before an important public audience. On 21 November 1885, Caro informed Meldola:

My colleagues as well as myself shall feel very glad to place a collection of our products into your able hands and thus to contribute towards the aims of your noble Institute. Within the course of the next month we expect back the specimens exhibited at Kensington and then we shall forthwith divide them amongst the numerous chemists, who have done us the honour of applying to us for the same. In case you should have already appointed a day for the intended lecture at the Society of Arts, please have the kindness of informing me at what latest date the specimens shall be required by you. I trust my Dear Professor Meldola that you will never hesitate to confide your chemical wishes to me!²²

On 13 May 1886, Meldola gave his lecture before the Society of Arts. Using the example of the German dye industry, he warned of the failure to invest in scientific education and basic research: "I think it is desirable to make an attempt to show the inner mechanism by which chemical science has been and is being so successfully adjusted to commercial wants by our continental neighbours."²³

He then commenced a review of the influence of the German dye industry on industrial progress. That influence was hardly more tellingly invoked than by its impact on British chemists, particularly those with industrial experience, such as Meldola. They had not been slow in recognising the weaknesses of the British dye-making firms, whose decline had started in the mid-1860s, around the time when Caro and other Germans returned to their homeland. It was a few years later, in the aftermath of the Franco-Prussian war of 1870–1871, that German hegemony in dye manufacture became anchored in a mastery of aromatic organic chemistry to an extent that was not to be achieved elsewhere. The roles of many chemists in the industry were increasingly given over to research and development tasks. By the mid-1870s, Caro's research laboratory at BASF was almost entirely dedicated to invention. By 1886 it had evolved into the central research laboratory. Similar research laboratories were to become major features of all major German dye-making firms, and in fact of all science-based industries, through to the present time.

Meldola's choice of Caro's inventions as a focus of his lecture was certainly deliberate. He knew that British and German dyemakers operated in the same geographic markets, and customer loyalty was strong. The Interna-

²² Caro to Meldola, 21 November 1885, quoted in *idem.*, p. 310.

²³ Raphael Meldola, 'The Scientific Development of the Coal-tar Colour Industry', in 'Abstracts from English and Foreign Journals. V. Coal-tar Colours', in *Journal of the Society of Dyers and Colourists* 2 (1886), pp. 95–101, here p. 97; reprinted in Walter M. Gardner (ed.), *The British Coal-Tar Industry: Its Origin, Development and Decline*, London 1915.

tional Inventions Exhibition display put on by BASF encouraged him to make extensive enquiries among British dyers and printers about the sources of the dyes they used. He soon discovered that more than eighty per cent of synthetic dyes used in Britain, the largest dye-using nation in Europe, were made in Germany. What Meldola revealed in his lecture was not mere rhetoric; the threat was real. Meldola knew what he was talking about. The post at BS&S had been an excellent observation post from which to learn about the failings of the British synthetic dye industry and progress in Germany, enhanced no doubt by the interest shown by the Gans concern in his inventions. In 1885, when Meldola left the dye industry, German production of synthetic dyes was some six times that of the English firms.²⁴

Among the dye users that Meldola had approached for his survey were several that had been introduced to Heinrich Caro's products while he was working with Roberts, Dale & Co. in the 1860s. As a result, Lancashire and Scottish firms that employed colorants invented by Caro became major users of BASF artificial products.²⁵ The smooth transition to Caro's coal-tar dyes, whether made in Manchester in the 1860s, or at BASF from 1868, set a precedent that encouraged British consumers to adopt, sometimes almost exclusively, German-made products by the 1880s.

Meldola concluded that the Germans had managed to corner the market because "the strength of our competitors is in their laboratories, and not, as here, upon the [stock] exchanges."²⁶ It was a message that Meldola would repeat many times during the following two decades. And, drawing upon his interests in evolutionary biology, Meldola pushed home his point with a Darwinian vision, the "fundamental law" of the survival of the fittest.

Old products have been displaced by newer ones as fresh discoveries were made, or processes improved. ... The moral conveyed to the manufacturer is sufficiently obvious. If we are to recover our former supremacy in this country, we must begin by dispelling conservative ideas – we must realise the fact that no existing process is final, and that no product at present sent into the market is destined to survive for an unlimited period.²⁷

According to Meldola, who had been greatly discouraged by the attitude of the management at BS&S, scientific discovery based on aromatic – or coal-tar – products provided an opportunity never before available to chemical technology:

²⁴ *Ibid.*, pp. 95–101.

²⁵ Anthony S. Travis, 'Colour Makers and Consumers: Heinrich Caro's British Network', in *Journal of the Society of Dyers and Colourists* 108 (1992), pp. 311–316.

²⁶ Raphael Meldola, 'The Scientific Development of the Coal-tar Colour Industry', p. 100.

²⁷ *Ibid.*, p. 97.

It will, I think, be conceded that the manufacture of coal-tar products is par excellence the most scientific of the chemical industries. This high position may fairly be claimed for the industry when we consider the number and complexity of the products, the delicacy of many of the reactions employed, the special arrangements of plant required, and the intimate knowledge of the chemistry of the aromatic compounds which the colour chemist must at the present time possess.²⁸

A friendly correspondence developed between Meldola and Caro. On at least one occasion, in May 1886, Caro was invited to stay as a guest of the Meldola family while he was on business in London. Caro was dealing with an urgent patent matter, so it was unlikely that he could find time to attend Meldola's lecture that month. In June, Caro congratulated Meldola on a splendid lecture which "forcibly points to the necessity of a *thorough* training in chemistry. The beautiful results would never have been achieved by anyone, who did not command a similar knowledge of the entire range both of facts and methods accumulated by previous investigators."²⁹ This represented the acknowledgement of a style of rigorous scientific enquiry, based on a long cultural tradition and style.³⁰

Meldola's lecture was not just a warning to the English, but also a paean to the triumph of German chemical science and technology, which, even though he did not mention it, owed much to German-Jewish inventors, particularly Heinrich Caro. This raises the intriguing question of whether Meldola made anything of Caro's Jewish background. While there is no recorded evidence of this, it is interesting that Meldola did engage in correspondence with Witt concerning the Jewish backgrounds of several German-Jewish scientists, including colleagues of Caro, though not of Caro himself.³¹ It is highly likely, though, that Meldola was delighted to count a fellow Jew who had transformed chemical industry among his close friends. Caro was to become from the late 1880s a close friend of the German-Jewish émigré Ivan Levinstein who had built up one of the most successful dye-making businesses in England. We can interpret this friendship as further evidence of social grouping among individuals of similar backgrounds, in this case with a strong German-Jewish, albeit totally secular, element.

The dialogue between Meldola and Caro would continue until at least 1906, and with British society until 1914, through presidential and other lectures and publications in leading scientific and trade journals. Raphael Mel-

²⁸ *Ibid.*, p. 96.

²⁹ Caro to Meldola, 8 June 1886, quoted in Reinhardt and Travis, p. 258.

³⁰ This corresponds to the Jewish tradition of "testimonialism," for which see Ulrich Charpa and Ute Deichmann, 'Jewish scientists as geniuses and epigones – scientific practices and attitudes towards them: Albert Einstein, Ferdinand Cohn, Richard Goldschmidt', in *Studia Rosenthaliana*, forthcoming (2006).

³¹ Reinhardt and Travis, pp. 326 ff.

dola held up the synthetic dye industry as the supreme example of the successful application of science to technology. That success, however, had been at the expense of Britain. Meldola understood that there were distinct differences between the ways that industrial invention was achieved and managed in Germany and Britain, and by 1900 other British chemists were convinced, in part through Meldola's lobbying, that success in Germany lay in the modern, dedicated, industrial research laboratory, and in particular the central research laboratory, as prevalent in Germany but absent in Britain. The central research laboratory was an organisational innovation in its own right, introduced by Heinrich Caro at BASF, and administered by highly qualified chemists (after the 1880s invariably to Ph.D. level), sometimes including members of the board of directors. It was directly responsible to the central management of the firm. During the 1880s, the central research laboratory evolved into a complex structure, including a special sub-department for patent-related work.

Charting Industrial Decline

By the turn of the century there were signs in Britain that its economic strength was on the wane and that through neglect of the new chemical and electrical industries it had fallen far behind in industrial prowess. In the organic chemical industry, as Meldola and others had warned, there was even a sharp decline.³² Now there was a further difficulty: Synthetic indigo, manufactured by BASF and Hoechst from 1897, threatened the British-dominated trade in the natural product, which included the Indian growers. The triumph of synthetic indigo followed the earlier collaboration between Caro and Adolf Baeyer; the latter drew the correct chemical structure in 1883. In 1901, when Meldola addressed the Society of Arts with a paper describing this new German achievement, he pointed out the lack of scientific work that might have improved the yield from the Indian product. Elsewhere, British dye-makers were confronted with criticisms of their poor performances. They were not slow in declaring that a major cause was the duty on industrial alcohol, which placed an unfair burden on industry. Official bodies investigated the impacts of synthetic indigo, duty on alcohol, and patent law on the British dye industry. In the cases of indigo and alcohol, Heinrich Caro's opinions were deemed essential. The indigo business was of such tremendous importance for Britain's largest colony that the fate of the natural product was discussed extensively in parliament and in the press. However, this did nothing to reverse the decline.

³² Schröter and Travis, pp. 95–118.

One suggestion for decline put forward privately by Raphael Meldola on the occasion of Caro's seventieth birthday in 1904 was that it was linked to Caro's departure from Manchester. "*The worst thing that ever happened to the coal-tar colour industry of this country was the loss of Heinrich Caro! Now we have lost the industry altogether, and serve us right.*" (emphasis in original).³³

Though dye invention had been the central endeavour and achievement of Caro's life, and his record was unmatched, he offered, in response to Meldola, other reasons for the decline of the British dye industry: the retirement of the English pioneers, the return of Hofmann to Germany (in 1865), and the development of chemistry in Germany.³⁴

Caro's perspective, which has also been adopted by modern historians, did not alter the verdict of Meldola, who continued to encourage improvements in chemical education, research, and industry in Britain, especially in the dye industry.³⁵ Meldola's agenda was to bring about an improvement in the status of chemists, greater employment opportunities for his pupils – the lack of which was a principal cause of the failure of the Finsbury Technical College – and a role for chemists in company management. By 1905 the matter had become urgent. In that year, for his work on the structure and synthesis of indigo, and investigations into triphenylmethane compounds, related to aniline red, the then Adolf von Baeyer received the Nobel Prize in chemistry. The jubilee of the foundation of the dye industry provided an excellent opportunity to drive home the message that Victorian optimism in Britain was being shattered.

Fiftieth Anniversary of the Foundation of the Coal-tar Dye Industry, 1906

During early 1906, almost immediately following the success of the well-attended Maccabaeans "Science Dinner," Meldola, an enthusiast for gatherings of scientific men, international conferences, and commemorative events, as president of the Chemical Society became engaged in the planning of another grand celebration of science in London. This time it was to mark the jubilee of the coal-tar industry and mauve, also referred to as the Perkin Memorial.³⁶ The "Science Dinner" had in many respects been a trial run. The two main Perkin events were scheduled to take place on 26 July

³³ Meldola to Caro, 17 February 1904, quoted in Reinhardt and Travis, p. 346.

³⁴ Caro to Meldola, 2 March 1904, *ibid.*

³⁵ For a recent discussion of the decline in the British dye industry, see Peter J. T. Morris and Anthony S. Travis, 'The Chemical Society of London and the Dye Industry in the 1860s', in *Ambix* 39 (1992), pp. 117–126.

³⁶ Perkin to Caro, 31 May 1906, in Reinhardt and Travis, p. 339–342.

1906. Meldola, as chairman of the international celebration, sent out invitations to major figures throughout Europe and the United States.

Caro, who was in charge of arrangements for the German contingent, almost did not make it, because of a bout of rheumatism. By mid-July he felt well enough to attend, though he declined Meldola's request to give a speech. Caro's response, however, certainly conveys a spirit of warm and ongoing friendship with Meldola:

My dear Professor Meldola,

I received your kind letter of the 18th inst. to-day at noon and at once rushed to the telegraph-office to inform you that it was quite beyond any powers to comply with your highly flattering command to make a dinner speech on the Evening of the Jubilee in reply to your own toast of "the Coal Tar Industry." It is very unfortunate that your demand has arrived here on the eve of my departure from Mannheim and under circumstances, which absolutely prevent me from availing myself of the great honour, which you have so kindly allotted to me. In fact, I am over-worked and only slowly recovering from a recent attack of illness. The task of replying to a speech of Yours, without being fully acquainted with your train of thoughts and without being thoroughly prepared, is an exceedingly difficult one. It requires both leisure and a good mental condition, which at present I do not possess! I think Dr. Duisberg would be your man. Please, pardon your disobedient but faithful friend.³⁷

On 26 July several German-Jewish chemists, including the émigré Alfred Mond, as well as Herbert Levinstein, son of Ivan, participated in the formal proceedings, at the Royal Institution in London, chaired by Meldola, who, in common with many others, wore a mauve necktie. Representatives of science and industry from many countries were present, as were several ladies, including Mrs Ella Meldola, dressed in mauve. Carl Duisberg, head of the Bayer company, presented William Perkin with a special copy of Adolf von Baeyer's recent paper on synthetic dyestuffs presented at the *Verein deutscher Chemiker's* general meeting held on 7 June that year at Nuremberg. Bound in mauve-dyed leather, it gave Baeyer's version of the history of the industry. Caro, on behalf of the *Verein zur Wahrung der Interessen der chemischen Industrie Deutschlands*, congratulated Perkin, and scientific addresses were given by August Bernthsen of BASF, and Carl Liebermann, then at the Technische Hochschule, Berlin.

In the evening a "large and distinguished company" of around two hundred gentlemen attended a magnificent banquet held at the Hotel Métropole.³⁸ Caro was seated with the guests of honour, at the top table, close to Perkin and Meldola. Duisberg, who had agreed to deliver the main speech

³⁷ Caro to Meldola, 20 July 1906, MLDA02469, Imperial College Archives, London.

³⁸ Raphael Meldola, Arthur G. Green and John C. Cain (eds.), *Jubilee of the Discovery*

on behalf of German participants, represented the *Verein deutscher Chemiker*. Cassella, whose tremendous growth had made it an attractive partner for Hoechst – one year earlier they merged their interests – was represented by Dr. Felix Klingemann. The following day, some one hundred and fifty guests, prior to attending a garden party at Perkin's home, in Sudbury, north-west of London, visited the site of his long-derelict Greenford Green factory. It was a far cry from the tremendous dye factories along the Rhine of BASF at Ludwigshafen and of Bayer at Leverkusen, of Cassella and Hoechst near Frankfurt, and of AGFA, at Berlin and Wolfen. The successes of AGFA, BASF, and Cassella had relied considerably on German-Jewish chemists and entrepreneurs.

In 1908, the British Society of Dyers and Colourists at its annual meeting in Bradford inaugurated a Perkin Medal for outstanding contributions. The first recipients were Carl Graebe and Carl Liebermann. When Meldola, as president of the society, handed the medal to Liebermann he emphasised that even though their work on alizarin was made four decades earlier it was still continuing to make a significant impact on science-based industry.

Conclusion: The German-Jewish Contribution

Elsewhere I have delineated the history of German chemists in the synthetic dye industry, sometimes drawing attention to the roles played by those who were of Jewish extraction.³⁹ Foremost among them was Heinrich Caro.⁴⁰ Though he makes no mention of his Jewish roots, it is apparent that Caro was the exemplar of a remarkable enterprise culture that infected both Jews and non-Jews, but in which Jews appear to have played a very prominent part. There are many reasons for this, quite apart from the fact that prospects for Jews in the academic world were restricted, leading them to pursue careers in industry. Employment was facilitated by the existence of Jewish-owned, or backed, manufacturing firms, such as AGFA, BASF, and Cassella. But perhaps of far greater consequence, at least during the formative period of the industry, was the prior practical experience in the use of colorants, and an appreciation of the market forces, stimulated during the long periods of apprenticeship spent at dyers and calico printers. Caro, Leonhardt and Liebermann fall into this mould. During the same early period, which saw textile manufacture reach unprecedented heights, several important calico

of Mauve and of the Foundation of the Coal-tar Colour Industry by Sir W. H. Perkin, F.R.S., D.Sc., LL.D., Ph.D., Dr. Ing., London 1907, 37.

³⁹ See for example, my *The Rainbow Makers* and 'From Color Makers to Chemists'.

⁴⁰ See Reinhardt and Travis.

printing and dye trading firms in Germany were owned by Jewish entrepreneurs. So there would have been few if any prejudices against the employment of suitably qualified Jews. This would have been favoured by social grouping, often fostered or forced by outside influences as well as by tradition, even among the secular.

The willingness, as well as need, to travel was also important, and again an aspect of Jewish tradition among communities in Europe, as were language skills. We find young well-trained German Jews as guest-workers and émigrés in Manchester during the first six decades of the nineteenth century. They found opportunities in the world's largest textile manufacturing region, in chemicals and calico printing. This also generated networks of contacts that would be put to good use by those who returned to Germany, generally in the mid-1860s. Thus it was through Caro's efforts when working in Manchester during the 1860s that he gained a thorough understanding of the British market for dyes, which from the 1870s enabled him to convince British dye users to purchase the products of BASF. Not that he needed to do very much convincing, since he had already established a fine reputation among agents and users of synthetic dyes. While there is nothing distinctly Jewish about any of this, it does not stop us from acknowledging that the special situation of Jews in Germany made the accomplishment possible. The common trait among the generation of German-Jews discussed here was, basically, a similar background, which – combined with education, adaptability, and youthful exposure to and absorption in the principal pursuit of the second industrial revolution – enabled them to contribute to science and industry as never before.

One important way in which German science and industry was directly affected by them was in an altered relationship between science and the law through the realm of patents. Caro, while in England during the 1860s, learnt about the importance of patents, and also about the inadequacies of existing patent laws. This would also be put to good use in Germany in the 1870s and after. He also convinced the management of BASF of the need to treat industrial research as a major part of the firm's activity, particularly in support of patent protection. That seems to have escaped the attentions of Meldola's employers, who almost completely neglected the desirability of protecting science-based inventions. Little wonder that English science declined, or at least did not grow, hand in hand with the decline, or at best stagnation, in industry. This is why Meldola's accounts are so enlightening. By describing the British and German dye industries until the first decade of the twentieth century, mainly to promote improved science education, he subtly used the failures of the former to emphasise the successes of the latter. And, perhaps, it is hardly surprising that the German-Jewish émigré Ivan Levinstein was not only the most outspoken critic of the existing legal struc-

ture for protection of inventions in England, but also the individual most responsible for the new patent law of 1907, though it was too late, and too inadequate, to save the dye industry.

That there was a very strong Jewish connection with dyes and chemistry in Germany was perhaps an accident of timing based on existing occupation patterns, new opportunities, and restrictions on academic advancement for Jews in Germany. In the end, until the 1880s, Jews and non-Jews connected with industry, often through academic-industrial collaborations, pushed back the frontiers of organic chemistry, and gave chemistry a new direction, faster than was taking place in the universities. And when German chemical science and industry reached their peaks around the turn of the century, Jews were still among the most prominent contributors. Ironically it was only when cultural and racial differences were exaggerated or manipulated by the Nazis that the Jewish contribution was first singled out, in that case by the excision of Jewish contributors from history.

An Unusual Career between Cultural and Mathematical Modernism: Felix Hausdorff, 1868–1942

Moritz Epple

Introduction

Felix Hausdorff was born in Breslau on 8 November 1868. Together with his wife, Lotte Hausdorff, née Goldschmidt, and her sister, he committed suicide on 26 January 1942 in order to avoid being taken to a concentration camp.

Between these dates, Hausdorff pursued a most remarkable intellectual career in the fields of applied and pure mathematics, astronomy, literary authorship and criticism, and in philosophy. Between 1897 and 1912, he not only worked and published as a mathematician under his own name but he also published in fiction and philosophy under the pseudonym of *Paul Mongré*. Today he is mainly remembered for the mathematical achievements that followed this period of dual identity: as the author of a ground-breaking and paradigmatic textbook on abstract mathematical set theory, the *Grundzüge der Mengenlehre*, published in 1914, shortly before the outbreak of the First World War, and as one of the major original contributors to the growing field of modern set theory. However, since renewed attention is being paid to Hausdorff's work, presently culminating in a critical edition of his printed publications as well as of substantial parts of his rich unpublished *Nachlass*, historians of mathematics and philosophers are rediscovering in Hausdorff (and Mongré) an interesting major representative of cultural and mathematical modernism at the turn of the nineteenth century.¹

¹ An early indication of this renewed interest is Herbert Mehrrens, *Felix Hausdorff. Ein Mathematiker in seiner Zeit* (brochure), ed. by Fachschaftsrat Mathematik and Mathematisches Institut, Bonn University, Bonn 1980. Mehrrens also included a chapter on Hausdorff in his challenging monograph on mathematical modernism, *Moderne – Sprache – Mathematik*, Frankfurt am Main 1990. Since then, other publications have increased the interest in Hausdorff, see Eugen Eichhorn and Ernst-Jochen Thiele, *Vorlesungen zum Gedenken an Felix Hausdorff*, Berlin 1994; Egbert Brieskorn (ed.), *Felix Hausdorff zum Gedächtnis. Aspekte seines Werkes*, Wiesbaden 1996. Since 2001, one may consult Felix Hausdorff, *Gesammelte Werke*, ed. by Egbert Brieskorn *et al.*, Berlin 2001 ff. Of nine planned volumes, four have already appeared: II (2002), IV (2001), V (2005), VII (2004).

In the following, the main steps of Hausdorff's career will be sketched in order to place him in the larger context of modernism. Although the account will remain focused on just one individual, it will also resonate with several of the larger themes that have been discussed with respect to Jewish intellectual culture in Germany in the decades before and after 1900. These resonances are specific: Hausdorff belonged to the group of those German Jews for whom intellectual and scientific pursuits, offering a cosmopolitan perspective of intellectual achievement, ranged higher than both national and religious ties. Unlike some of his fellow scientists he did not choose to convert or follow a deliberate strategy of German patriotism towards the end of the German *Kaiserreich*. Moreover, his scientific career provides a characteristic example of a path leading through a variety of difficulties (some of which were related to his Jewish background) before reaching a period of striking success in a research field that was attractive to a significant number of other Jewish scientists as well. At the same time it should be emphasized that Hausdorff's intellectual outlook and career bear significant individual traits as well, prohibiting easy categorisations – his dual identity as a mathematician and a writer being just the most visible such trait.

This article begins with a brief sketch of Hausdorff's biography. Then the period of his university studies and early work will be discussed in order to show some aspects of the culture that shaped Hausdorff's intellectual outlook. This will be followed by a discussion of the transition from this early period to Hausdorff's main scientific occupation, set theory, and a few remarks on the intellectual style in which Hausdorff pursued the latter. In the last section, Hausdorff's intellectual biography will be reconsidered in the light of some arguments about Jewish intellectuals in Germany by George L. Mosse, Shulamit Volkov, Ulrich Charpa, and others.²

The availability of the full edition, prepared by an interdisciplinary group of editors of mathematicians, historians of science, philosophers, and representatives of German studies, will most certainly induce further changes of our views of Hausdorff. The edition will be cited below as follows: Hausdorff, *Werke* X, year, pp.

² This article draws heavily on the work of, and discussions with several other editors of Hausdorff's *Werke* (see note 1). In particular, I made use of the biographical studies of Egbert Brieskorn, initiator of the edition project, of Walter Purkert's archival research on all aspects of Hausdorff's life and work, and Werner Stegmaier's editorial contributions on Hausdorff's philosophical writings in Hausdorff, *Werke* VII, 2004. My own involvement with the edition began with a research stay in Bonn in 1999 and then again in 2000/2001. For a more philosophically oriented analysis of Hausdorff's views, treating topics similar to the present essay, the reader may consult my article 'Felix Hausdorff's Considered Empiricism' in José Ferreiros and Jeremy J. Gray (eds.), *The Architecture of Modern Mathematics: Essays in History and Philosophy*, Oxford 2006, pp. 263–289. By permission of Oxford University Press, the present article makes use of some of the biographical material included in this article.

Family Background and Biographical Sketch

The young Felix Hausdorff grew up in a family of a well-to-do Jewish textile merchant, Louis Hausdorff, and his wife, Hedwig Hausdorff, née Tietz.³ When Felix was three, the family moved to Leipzig. Louis Hausdorff, himself the son of a respected Talmud scholar and educated in a traditional fashion, became a respected member of Leipzig's Jewish community. In 1878, he was co-opted as a member of the community's *Ausschuss* (committee) as a representative of the "decidedly conservative direction" among the community's laymen. Felix's father even published in Jewish periodicals on Talmudic topics, both in Hebrew and in German. Whether or not the first years of Felix's education followed traditional lines is not known, but it is probable that the family was open to the liberal traditions of Leipzig's flourishing Jewish community as well. Abraham Meyer Goldschmidt, at the time Leipzig's rabbi and grandfather of Felix Hausdorff's later wife, was more influenced by Jewish Enlightenment traditions than by orthodoxy. The same goes for Meyer Goldschmidt's wife, Henriette Goldschmidt, who co-directed the *Allgemeiner Deutscher Frauenverein* with Luise Otto-Peters and others since its foundation in 1865. In any case, Felix received his secondary education in the renowned humanistic Nicolai-Gymnasium; it would have been there that he became acquainted with the basics of German *Bildung*, a resource on which he would heavily draw in later years. It is possible that Felix Hausdorff already distanced himself from the more traditional views of his father in these early years. Later, after he had taken up his studies at Leipzig University, the break had clearly been made.

This period of studies, which began in 1887 and ended in 1891 when Hausdorff obtained his doctorate in mathematics after having been supervised by the astronomer Heinrich Bruns, will be discussed later. In 1895, after his *Habilitation*, Hausdorff began lecturing on applied mathematics as a *Privatdozent* at Leipzig University and from 1898 at Leipzig's commercial college (*Handelshochschule*) as well. In 1896 his father died and in 1897 Hausdorff began to write under the name of Paul Mongré. A list of all known writings published under this pseudonym is given in the appendix. In 1910, after a remarkable reorientation of his research interests which will also be discussed later, Hausdorff was appointed to an extraordinary, paid professorship at Bonn University. Two years later, the last essay by Paul Mongré appeared. In 1913, Hausdorff accepted the offer of an ordinary professorship in Greifs-

³ The biographical information given in this section is mostly drawn from a lecture course given by Egbert Brieskorn at Bonn University in 2000 and 2001. A biographical sketch by the same author will be published in Hausdorff, *Werke* I (forthcoming). For further biographical information on Hausdorff see Eichhorn and Thiele.

wald, and in 1921 he moved back to Bonn. During his stay in Greifswald, Hausdorff's ground-breaking first mathematical monograph, the *Grundzüge der Mengenlehre*, was published.

Hausdorff seems to have welcomed the Weimar republic. Without being politically active, he became a member of the liberal, left wing *Deutsche Demokratische Partei*. His lecturing activities in this second Bonn period were as impressive as his research in set theory and various other fields of mathematical analysis. In 1935 he retired in the usual way, but after the November pogroms of 1938 his life was seriously endangered. In early 1939 he wrote a letter to Richard Courant, the influential German émigré mathematician in New York, and applied for a research fellowship in the United States. Other renowned émigré mathematicians, including Hermann Weyl and John von Neumann, wrote reports on Hausdorff, but the attempted emigration failed for reasons yet to be discovered.⁴

Mathematics, Kant, Nietzsche, and *Erkenntniskritik*

In the summer of 1887, Hausdorff entered Leipzig University, one of Germany's most lively universities of the period, second only to Berlin. Leipzig had a fairly high number of students in mathematics and the natural sciences, and it is well known that Leipzig was one of the few places in Germany where scientific empiricism was gaining more and more acceptance even among philosophers.⁵

Two years before Hausdorff entered the university, Felix Klein, who had built up a strong mathematics department in Leipzig, had left for Munich University but his successor, the Norwegian mathematician Sophus Lie, was equally well qualified and able even if a little narrower in his outlook. His speciality was the brand-new theory of continuous transformation groups which had important applications throughout the physical sciences. Hausdorff would develop a close relation with Lie's later assistant, Friedrich Engel, and in his own academic life would repeatedly lecture on Lie's theory.⁶ Other mathematicians in Leipzig who played a role in Hausdorff's

⁴ Cf. Reinhard Siegmund-Schultze, *Mathematiker auf der Flucht vor Hitler. Quellen und Studien zur Emigration einer Wissenschaft*, Wiesbaden 1998, p.121.

⁵ On Leipzig University, see Hartmut Titze (ed.), *Datenhandbuch zur deutschen Bildungsgeschichte*, vol. I, part 2, Göttingen 1995, chap. 19, pp. 403–427. A monograph containing interesting material on the empiricist leanings of Leipzig scientists is Michael Heidelberger, *Die innere Seite der Natur. Gustav Theodor Fechners wissenschaftlich-philosophische Weltauffassung*, Frankfurt am Main 1993.

⁶ See the Nachlass Felix Hausdorff, Universitätsbibliothek Bonn, Kapsel 05, Fasz. 20 (in the following quoted as NL Hausdorff 05/20) for a course delivered in 1905/1906, NL Hausdorff 09/32 for a course delivered in 1910/1911. From Hausdorff's papers, his

mathematical education included Gustav Adolph Mayer, Carl Neumann, and Friedrich Schur. In his undergraduate years Hausdorff may already have met Heinrich Liebmann among his younger fellow students. Liebmann was born in 1874 and was the son of the Jewish philosopher Otto Liebmann, teaching at Jena University, who had become renowned as one of the founders of Neo-Kantianism. In the late 1890s Hausdorff and Liebmann (who also spent several years at the universities of Jena and Göttingen) were both *Privatdozenten* in Leipzig and on good terms with each other. It was a common pattern among Leipzig mathematicians for mathematics to be perceived and pursued as a discipline related to the other sciences, especially to physics, rather than as an autonomous field of pure abstract thinking. This milieu suited the astronomer Heinrich Bruns very well. He had been the director of Leipzig's observatory since 1882, and was highly interested in mathematical methods, in particular, in the mathematical underpinnings of astronomical observation and the theory of probability.

During his mathematical studies, Hausdorff seems to have been torn between Lie's and Bruns's fields and personalities (with the former being quite difficult). Moreover, he was taught mathematical mechanics and analysis by Mayer. In the end Hausdorff wrote both his doctoral dissertation and his *Habilitation* thesis under the supervision of Heinrich Bruns, focusing on the mathematics of the optical properties of the atmosphere, a topic necessary for gathering astronomical data from optical astronomical observations on the surface of the earth. In retrospect, these topics appear rather limited and narrowly related to the state of astronomy in the 1890s. With the later, aviation-based information on the higher atmosphere and the advent of radio-astronomy, most of Hausdorff's (and Bruns') work became obsolete.

When he began lecturing as a *Privatdozent*, Hausdorff delivered courses not only on these topics but also on mechanics, geometry, and insurance mathematics. The latter task was given to him by the faculty. A letter of his mentor Heinrich Bruns to Felix Klein, who in 1897 asked Bruns about his opinions regarding Hausdorff's suitability for a position in mathematical astronomy at Göttingen University (which Hausdorff did not get), makes clear that this faculty decision was not related to Hausdorff's interests, but to his Jewish background: "... in addition, we have given him the theoretical lecture courses on insurance mathematics. For this ... task he will be able to rely on the specific dispositions of his race (not baptised)." It must be added, though, that this early encounter with statistics and the mathematics of

lecturing activities can be reconstructed more or less completely, see Hausdorff, *Werke* I (forthcoming).

chance would later help Hausdorff in developing a fairly modern, axiomatic approach to probability theory.⁷

Hausdorff's mathematical studies and early work in applied mathematics were at that time *not yet* sufficient to make him the successful and renowned mathematician and eminent set theorist he would become some fifteen years later. Therefore, we should now turn to his other academic activities which proved to be of great importance to his later work. It seems that in his formative years Hausdorff's intellect was more challenged by philosophy and literature than by mathematics. From the beginning of his studies, Hausdorff's interests went beyond mathematics. He attended lectures in physics, criminology, history (including a course on the history of socialism given by the Jewish historian Adolf Warschauer), and philosophy. During a stay in Berlin in 1888/1889, the Kantian Friedrich Paulsen made a strong impression on him.⁸ As his later work shows, Otto Liebmann, who had first published his influential collection *Die Analysis der Wirklichkeit* in 1876, also became important for his thinking. Both presented a type of Kantianism close to the empirical sciences and critical towards the neo-metaphysical tendencies fairly common in German philosophy of the time.⁹

Even more influential than these interdisciplinary studies, however, may have been Hausdorff's connection with an intellectual group that became a forum for modernist trends in science, literature, music and arts, namely the *Akademisch-Philosophischer Verein*. In this group, founded in 1866/1867 by some of the Leipzig empiricists (including Richard Avenarius, Gustav Theodor Fechner, Wilhelm Wundt, and others), topics such as Darwinism, psychology, Schopenhauer and Nietzsche, Wagner's music, Marxism, the emancipation of women, contemporary theatre and literary fiction were fiercely

⁷ See Hausdorff, *Werke V*, 2005, part III. Hausdorff had not yet taken the final steps toward a fully axiomatic treatment of probability theory as given by Andrei Nikolaevich Kolmogorov in the 1930s, see the editorial comments by Shristi D. Chatterji in Hausdorff, *Werke V*, 2006, pp. 723–742 and Thomas Hochkirchen, *Die Axiomatisierung der Wahrscheinlichkeitsrechnung und ihre Kontexte*, Göttingen 1999.

⁸ See Hausdorff's notes of a seminar with Friedrich Paulsen in Winter 1888/1889, NL Hausdorff 54/1153.

⁹ The affinities of German-Jewish philosophers with Kant and Kantianism have been noted by many authors. For the period under discussion here Hermann Cohen's role in neo-Kantianism is often cited, cf. Peter Gay, 'Begegnung mit der Moderne. Deutsche Juden in der deutschen Kultur', in Werner E. Mosse and Arnold Paucker (eds.), *Juden im Wilhelminischen Deutschland*, Tübingen 1976 (Schriftenreihe wissenschaftlicher Abhandlungen des Leo Baeck Instituts 33), pp. 241–311, here pp. 258–263; in more detail, Ulrich Sieg, *Aufstieg und Niedergang des Marburger Neukantianismus. Die Geschichte einer philosophischen Schulgemeinschaft*, Würzburg 1994. For Hausdorff, who was highly critical of some of Cohen's less enlightened remarks about mathematics, Liebmann, who was more knowledgeable about recent mathematical (and generally, scientific) developments, was clearly the more important author.

discussed at regular evening meetings. In Hausdorff's time, several leading members of the *Verein* advocated a Bohemian way of life and it seems that Hausdorff was drawn to this as well. The *Verein* had several Jewish members, and in the early 1880s it campaigned in Leipzig against the wave of antisemitism that had come from Berlin. However, in the mid 1890s, antisemitic tendencies gained a foothold even within the *Verein*, if only for a brief period.¹⁰

It is highly probable that Hausdorff's cultural orientation, or, as we might say, that of his alter ego, Paul Mongré, was shaped in these circles. Here Hausdorff encountered Nietzschean thought as well as symbolistic literature, and here he found like-minded young Jewish and non-Jewish intellectuals who aspired to a non-traditional, modernist culture. The best example of this is an author whom Hausdorff met at the *Akademisch-Philosophischer Verein*, namely Otto Erich Hartleben (1864–1905). Hartleben was a radical Bohemian writer, satirist and eroticist critic of society and morals. After a first German translation of Albert Giraud's symbolist poems had appeared in 1886 under the title *Pierrot Lunaire*, both Hartleben and Hausdorff produced further, free renderings of Giraud's poems with Hausdorff's versions being farther from the original than Hartleben's whose efforts proved to be more successful: Arnold Schönberg would choose them as the textual basis of his own *Pierrot Lunaire* (op. 21). Hartleben dedicated his poems to several individuals of the Leipzig group, including to Hausdorff and the Nietzsche-inspired lawyer Kurt Hezel, as well as to the language critic Fritz Mauthner who later also played a significant role in Hausdorff's life.

This culture was apparently far removed from astronomy and applied mathematics, the domain of Hausdorff's early academic career. When, in 1897, two years after his *Habilitation*, Hausdorff published his first writings as a member of this circle, he chose to do it under a pseudonym, *Paul To-My-Liking*, as we might translate his self-chosen French name which most probably was programmatic in itself.¹¹ Hausdorff's collection of aphorisms was closely modelled on Nietzsche's and printed by the philosopher's publishing house C. G. Naumann. Its full title, *Sant' Ilario – Gedanken aus der Landschaft Zarathustras*, indicates that the author even followed the habits of his role-model: the aphorisms were (partly) written during a stay on the Mediterranean coast in Italy undertaken to effect an improvement in Hausdorff's health. Earlier on he had visited Sils-Maria where Nietzsche had stayed, as well as the Nietzsche Archive in Weimar run by Elisabeth Foerster-Nietzsche; moreover, he had been an intimate friend of the writer

¹⁰ The information in this and the following paragraph derives from Egbert Brieskorn's lecture course (note 3).

¹¹ See Werner Stegmaier's editorial remarks in Hausdorff, *Werke* VII, 2004, pp. 21–26.

Kurt Lauterbach (d. 1895), who had edited Max Stirner's *Der Einzige und sein Eigentum*, and had translated several of Nietzsche's works.¹² Hausdorff thus was one of those young Jewish intellectuals who found Nietzsche's free-thinking style attractive before antisemitic readings of Nietzsche had become common.¹³

Nevertheless, Mongré kept a critical distance from Nietzsche; in some respects this was crucial. Under the headings *Spätlings-Weisheit; Einer und Nullen; Vom Normalmenschen; Pour Colombine; Müsiggang und Wetterglück; Denken-Reden-Bilden; Splitter und Stacheln; Von den Märchenerzählern; Zur Kritik des Erkennens* Mongré collected 411 aphorisms, some of them short, some several pages long. At the end a number of poems rounded off the collection. The aphorisms presented their author as a sceptic of any kind of traditional morality, as a critic of limitations resulting from religious or national traditions, and as a passionate proponent of cultivated, aestheticised individualism.¹⁴ He admired writers such as Goethe and Gottfried Keller and musicians like Richard Wagner. For Mongré, the acquisition of *Bildung* amounted more or less to the ability of being productive in literature, music or the arts, not to the possession of traditional knowledge or to the fulfilment of traditional values.¹⁵

In the collection Hausdorff's Jewish background is not emphasised very strongly. However, the topic of religion does play a significant role, and in these passages, his attitude towards the Jewish religion can be gathered as well. With respect to religion, Mongré considered himself a "Spätling", a late-comer. According to Hausdorff both Jewish and Christian faith had had their time in history when they had transformed the world. For Christianity, this was the time of Jesus of Nazareth and of the Roman Empire which adapted Christian beliefs and practices. The Jewish religion was of even older origin. For Mongré, the life of these ancient systems of values seemed exhausted:

Whatever life there had been in them has been gnawed off and consumed lavishly enough by earlier times. We don't have any choice but to find for ourselves our own nourishment, to plough our own furrow, to know our own truths, to believe in our own gods, to cultivate our own passions; we are no longer at liberty to draw on our inheritance in epigonous infertility ...¹⁶

¹² More details on Hausdorff's involvement with Nietzsche and Nietzscheanism can be found in Stegmaier's introduction to Hausdorff, *Werke VII*, 2004.

¹³ See Steven G. Aschheim, *The Nietzsche Legacy in Germany, 189 – 1990*, Berkeley, CA 1990; Jacob Golomb (ed.), *Nietzsche and Jewish Culture*, London 1997; Werner Stegmaier and Daniel Krochmalnik (eds.), *Jüdischer Nietzscheanismus*, Berlin 1997.

¹⁴ Cf. *Sant' Ilario*, aphorism 22 in Hausdorff, *Werke VII*, 2004, pp. 121 f.

¹⁵ Cf. the section 'Denken, Reden, Bilden', aphorisms 279–351, *ibid.*, pp. 277–340.

¹⁶ *Sant' Ilario*, aphorism 21, *ibid.*, pp. 117–118.

Accordingly, Hausdorff ironised both Christian and Jewish religious traditions, the former by relating them to philosophical systems (including Kant's practical philosophy), the latter to moral casuistics.

To the scepticism of a distinguished Roman, asking 'what is truth' one would have to add the scepticism of a religious Jew, perhaps condensed in the question 'what are the precepts?' This Jesus, who was born from truth and had come to fulfil the precepts, had to be admired as a miracle of intellectual and ethical naivety, both by the adepts of a rough and ready philosophy and ... by the guardians of a highly refined [system of] moral casuistics, who had surrounded humankind with a thicket of laws that was nigh impossible to disentangle.¹⁷

Mongré's aphorisms tended to question Christian religious ideas and their often destructive role in history much more openly than Jewish ones. But both systems of beliefs were, for him, probably not much better than imaginations such as the one he describes as follows: "Someone claimed that our universe arose from the excrements of an immense turtle. Those who protested or did not take notice he called achelonists, turtle gainsayers."¹⁸

The last section of the collection, entitled *Zur Kritik des Erkennens*, contains the germ of Hausdorff's epistemological views, as well as a first sketch of his views of science. Here he claimed that empirical science should be considered on an equal basis with aesthetic production and emotional life. However, according to Hausdorff/Mongré, just as moral dogmas would have to be considered misguided in the context of real life, any kind of naïve or metaphysical *realism* would have to be regarded in the same way in science. In science as well as in art, literature or moral life, Mongré's motto was individualism. Radicalising Kant's philosophy and taking up similar motifs in both Liebmann's and Nietzsche's works¹⁹, Hausdorff claimed that every individual's consciousness produces a well-ordered "cosmos" from transcendental "chaos", and epistemological idealism, he wrote, teaches

that the teleological, causal, richly organised course of empirical reality says nothing at all about the transcendental one; that a completely arbitrary *Geschehen* [happening] 'in itself' suffices to guarantee for us, as a subjective effect, a determined *Geschehen*; that even the most perfect cosmos only comes about by the wildest chaos having passed through the sieve [of consciousness].²⁰

¹⁷ *Ibid.*, aphorism 18, p. 113.

¹⁸ *Ibid.*, aphorism 352, p. 345.

¹⁹ These references became even stronger in Mongré's second essay, to be discussed below. They concern Otto Liebmann, *Analysis der Wirklichkeit*, Strasburg 1876, and various passages in Nietzsche, cf. Stegmaier's introduction in Hausdorff, *Werke* VII, 2004, pp. 49–61.

²⁰ *Sant' Ilario*, aphorism 408 in Hausdorff, *Werke* VII, 2004, pp. 449–451.

Science thus was another human construction, a way in which individuals organised their world. “God”, Mongré wrote “views the world ... through the veil of time as a meaningless, hopeless, play of chance of eternal recurrence, and without salvation.”²¹ For human beings, on the other hand, experiencing the world in time and framing scientific beliefs to account for this experience, this chaotic play appeared as a lawful, ordered world. In these bold claims, mathematics began to play a role as well: it could help to recognise and to analyse meaningless metaphysical assumptions in science. The “last purpose of mathematics”, Mongré wrote, might be a “self-critique of science”.²²

From *Erkenntniskritik* back to Mathematics

These ideas, which also show that Hausdorff/Mongré increasingly distanced himself from Nietzsche, form the general thrust of Mongré’s second book, *Das Chaos in kosmischer Auslese – Ein erkenntniskritischer Versuch*, a short but dense and rather difficult monograph on epistemological matters. It was published in 1898, just one year after *Sant’ Ilario*. Its stated aim was to establish a genuinely philosophical position by a kind of metaphorical use of mathematics. Hausdorff’s/Mongré’s ideological position was double-edged, combining a fervent attack on metaphysical realism (that is, on the belief that it was possible to ascertain by philosophical means the structure of reality, independent of all human experience) with a critically refined version of scientific empiricism. Depending on which side he wanted to emphasise, Mongré called his views either “transcendent nihilism” or “considered empiricism”.

Without going into too much detail²³, let me outline Mongré’s argument with respect to the crucial concept of *time*, an essential notion in most if not all scientific theories, and equally in various systems of philosophy, morality, and religious ideas. Traditional epistemology has it, Mongré began his argument, that empirical ideas about the concept of time held by individuals are contrasted with a conception of absolute time. This not only applies in metaphysics, but in traditionally interpreted physics as well. Now suppose that the *relation* between these two ‘times’ is modelled mathematically as a *mapping* from one time continuum (the absolute) to the other, the empirical one. Mongré termed this mapping a “motion of the point of presence” of an individual consciousness through empirical time. Naïve realism would then

²¹ *Ibid.*, aphorism 403, p. 437.

²² *Ibid.*, aphorism 401, p. 436.

²³ A more detailed discussion of Hausdorff’s ‘considered empiricism’ is given in Epple, ‘Felix Hausdorff’s Considered Empiricism’.

amount to the claim that this mapping is trivial, that is, that the two time continua have the same structure: to each moment of experienced time there would correspond a moment of absolute time, and vice versa, and they would be passed in the same order. But what would be the case, Mongré asked, if a *different* relation would apply between absolute and empirical time? If, for instance, absolute time were to ‘run backwards’ with respect to our empirical conception of time? Or if absolute time would repeat a certain interval of empirical time over and over again (here he referred to Nietzsche’s idea of eternal recurrence)? *For us*, Mongré argues, *nothing at all would change*, as all our ideas about time are part of our empirical consciousness. Hence we cannot know anything about time ‘as such’, beyond our empirical impressions and scientific conventions. *Transcendentally*, it does not make sense to speak of a structure of time at all.²⁴

Consequently, and this was one of Mongré’s Nietzschean points, all metaphysical and ethical views which rely on a notion of absolute temporal order – including religious views built on an idea of salvation or any other substantial religious process in time, but also utilitarian or socialist philosophies hoping for a better future – were reduced to nothing. At the same time, Mongré pointed out that this transcendent nihilism about time was different from Nietzsche’s doctrine of eternal recurrence, a doctrine which Mongré took to be about a concept of the structure of empirical, not absolute time.²⁵

To the argument regarding the concept of time Mongré added a similar one about *space*, and in fact about all other scientific notions which draw on these two, such as (absolute, rather than perceived) *motion*, *causality*, and so on. One might argue that this was not much more than a somewhat more radical rephrasing of what Kant had called transcendental idealism, and Mongré would have agreed. He claimed that he had given a different, and stronger *argument* in favour of this view, by offering the kind of reduction *ad absurdum* indicated above. Moreover, he elaborated this argument by proceeding in steps towards stranger and stranger notions in which absolute and empirical time, absolute and empirical space might be related. This exploration went far beyond a rigid philosophical argument; Mongré, the writer, also used it to imagine a multiplicity of different worlds in rather poetic terms.

It was here, in Mongré’s imagination of ways in which an absolute and an experienced world might be related, and not in his academic work, that Hausdorff began to rely on the very new mathematical notions that Georg

²⁴ The whole argument is given right at the outset of *Das Chaos in kosmischer Auslese*, after some initial clarifications of the aim of the book, see Hausdorff, *Werke* VII, 2004, pp. 605–611.

²⁵ These reflections can be found *ibid.*, chap. 3.

Cantor and others had begun to develop in the field of set theory. Indeed one can show from the way the mathematical notion of the infinite is used in critical arguments about Nietzsche's purported "proof" of his theory of eternal recurrence that Hausdorff learned the basic notions of set theory right between publishing the *Sant' Ilario* and the *Chaos in kosmischer Auslese*.²⁶ These very mathematical notions, so Hausdorff/Mongré realised, would also change the possibilities and meaning of scientific empiricism. What set theory, and contemporary higher geometry following the theories developed by Georg Friedrich Bernhard Riemann and others, showed was that basic empirical notions such as time, space, motion, and so on allowed, briefly put, *different mathematisations*. Modern mathematics, Hausdorff realised, offered more than one possibility of speaking of *continuity* in time and space, for example. In fact, not even mathematics had as yet explored all these possibilities, as Hausdorff pointed out with respect to the notion of continuity in space:

It is a question indicated by G. Cantor's researches ... whether in place of the usual point continuum [n-dimensional Euclidean space] an everywhere dense point set or a semi-continuum (for instance, a continuum from which certain continuous or everywhere dense point sets have been removed) would be of the same service. But continuity, in the physical as well as in the mathematical domain, is a difficult problem about which discussion has not even seriously started.²⁷

There was not only no viable path from the empirical world to an assumed absolute reality, but also no straightforward path from empirical measurements to scientific conceptions. If individuals ordered their experiences into an ordered cosmos, and if this ordering could happen in different mathematical frameworks, then the task of science no longer was to unveil ultimate truths about time, space, motion, and so on, but the construction of an effective, fertile, and perhaps even beautiful system of beliefs for living in the empirical world. Hence, the empirical attitude of science had to be complemented by a critical insight into the spectrum of different possible mathematisations of scientific notions and the corresponding conventional, or constructive elements in science.

This, I think, was the final result of Hausdorff's engagement with Nietzschean thought and critical epistemology. Rather than "transcendent nihilism", it was "considered empiricism" which Hausdorff (now writing under his ordinary name) adopted and elaborated after the turn of the cen-

²⁶ See Walter Purkert's comments in the introduction of Hausdorff, *Werke* II, 2002, pp. 2–7. The question of whether or not Nietzsche hoped for "scientific proof" of his doctrine of eternal recurrence is debatable. Hausdorff, on inspecting Nietzsche's relevant papers, obviously thought so, and protested.

²⁷ Hausdorff, *Werke* VII, 2004, p. 716.

ture. In 1903, when he chose “*Das Raumproblem*” as the topic of his inaugural lecture as an (unpaid) extraordinary professor at Leipzig University, he elaborated this position in very clear terms regarding the scientific notion of space, and he extended his arguments to the notion of time during a lecture course in Leipzig in the winter term of 1903/1904.²⁸

The intellectual possibilities of set theory, the basic mathematical tool of these epistemological arguments, began to fascinate Hausdorff. In 1901, still being a *Privatdozent* in Leipzig, he gave a first lecture course on the subject, indeed one of the first lecture courses on set theory ever given (Cantor himself had never lectured on his theory). From that time onward, it moved more and more into the foreground of Hausdorff’s mathematical research. In his literary production, Mongré began to try out new forms. In 1900 he published a collection of poems, followed in 1904 by a play, a “*Groteske*”, attacking the emptiness of male duelling rituals which had quite some success in German-speaking cities (roughly a hundred performances in Berlin alone). The play was reprinted in 1910 and 1912. Moreover, Mongré became an active contributor of essays to the *Neue Deutsche Rundschau*. Some of the topics he dealt with in this publication may be gathered from the essay titles listed in the appendix. Compared to his earlier Nietzschean aphorisms, these essays document a more rationalistic approach, opposed to mystical and anti-scientific tendencies in cultural modernism. In their own way, however, they remained no less modernistic themselves. But it was more and more the modernism of the sciences, and of mathematics, to which Hausdorff now turned.

Looking back on Paul Mongré’s literary production, his genuinely philosophical arguments (which have been summarised rather superficially here) are most significant in the present context. However, they were hardly noticed by many readers before the First World War, and even thereafter, only few philosophers realised that Hausdorff had been thinking along lines which came to be more important in the 1920s and 1930s. Perhaps the most influential such philosopher was Moritz Schlick, co-founder of the Vienna Circle, who, after an exchange of letters in 1919, acknowledged Hausdorff’s priority in his own critical philosophy of space and time.²⁹

²⁸ Felix Hausdorff, ‘Das Raumproblem’, in *Ostwalds Annalen der Naturphilosophie* no. 3 (1903), pp. 1–23; the article will be reprinted in Hausdorff, *Werke* VI (forthcoming). The notes of the lecture course can be found in NL Hausdorff 24/71 and will be reprinted in the same volume. For a discussion of ‘Das Raumproblem’, see Epple, ‘Felix Hausdorff’s Considered Empiricism’, pp. 279–284.

²⁹ See Moritz Schlick, *Raum und Zeit in der gegenwärtigen Physik*, 3rd edn., Berlin 1920, p. 24, note 1; see also Epple, ‘Felix Hausdorff’s Considered Empiricism’, pp. 284–289.

Hausdorff's Mathematical Work

Hausdorff, the mathematician, took up Cantor's theory where the latter had left it. In the early 1900s he delved into the famous open problems of set theory, in particular, the so-called continuum problem. Briefly put and somewhat simplified, this problem asks for an answer to the question "how many real numbers do exist?" Using the set-theoretic tools introduced by Cantor, one could go beyond the simple answer "infinitely many": There were, in fact, infinitely many different types of infinity that could be investigated mathematically. At the time, the answer to the above question was expected to be one of the infinite (cardinal) numbers that Cantor had introduced. Cantor himself had believed that the cardinality of the set of real numbers was the *smallest* cardinal number larger than the cardinality \aleph_0 of the natural numbers. It took until the 1960s before the mathematician Paul Cohen realised that an answer does not exist in a straightforward sense: The question is *independent* of the usual axioms of set theory, in other words: we can conceive *different* mathematical theories (or rather, set theories), each of which allows us to develop the usual theory of real numbers, but in each of which the cardinality of the set of real numbers is different.

Obviously, Hausdorff was working in a difficult field. Despite the fact that he did not solve the above problem, he had significant success. His earliest contributions brought new insights into the structure of ordered sets, and in 1904 he was involved in clarifying a disturbing error in a mistaken solution of another of Cantor's famous open problems.³⁰ With his monograph *Grundzüge der Mengenlehre*, written in a thoroughly axiomatic style³¹, Hausdorff restructured the whole of higher set theory, dividing it into two major subspecialties, the theory of ordered sets, and the theory of 'topological spaces', as Hausdorff proposed to call sets with an additional structure that allowed the definition of spatial terms such as neighbourhoods, continuity, and so on.³² In purely mathematical terms, Hausdorff's studies of ordered sets emerged from his initial attempts to solve the continuum problem.

³⁰ Erhard Scholz, 'Logische Ordnungen im Chaos: Hausdorffs frühe Beiträge zur Mengenlehre', in Brieskorn (ed.), *Felix Hausdorff zum Gedächtnis*, pp. 107–134.

³¹ Without, however, being based on a fully axiomatic *definition* of sets; Hausdorff's reasons were that such a definition was not yet available. Hausdorff rightly regarded Ernst Zermelo's earlier attempt to provide an axiomatic foundation of set theory insufficient. The situation was improved when Abraham Fraenkel and Thoralf Skolem clarified certain formal aspects of Ernst Zermelo's approach in the 1920s.

³² Similar definitions had been proposed earlier, notably by Friedrich Riesz in 1907. As it turned out, however, Hausdorff's framework was more fruitful than these earlier attempts. For a discussion of the emergence of the concept of topological spaces, see Walter Purkert *et al.*, 'Zum Begriff des topologischen Raumes', in Hausdorff, *Werke II*, 2002, pp. 675–744).

The theory of topological spaces, on the other hand, was related to the modern foundations of higher analysis, that is, measure and integration theory and the emerging branch of functional analysis. It is possible, however, that the division of Hausdorff's monograph once again reflected his philosophical preoccupations: While ordered sets were the necessary tool for mathematising time, topological spaces provided a rich and subtle framework for mathematising concepts of space far beyond ordinary spatial intuition. Even if the latter theory was not Hausdorff's creation alone, his presentation became the starting point for most of the later research in what mathematicians today call general topology.³³

After the First World War, Hausdorff's monograph was quickly absorbed and widely discussed by those in the field of mathematics who were interested in the new and growing fields of set theory and topology. In 1927 Hausdorff's monograph was republished, in fact rewritten, in order to include new material that had emerged in the meantime. The focus of this second *Mengenlehre* was descriptive set theory, that is, the theory of point sets in abstract spaces. This specialty was more broadly developed in the 1920s and 1930s, and was particularly strongly pursued by the Polish community of mathematicians for whom both of Hausdorff's books served as a decisive starting point.³⁴ Several of these mathematicians were Jewish as well.

Another field in which Hausdorff had a significant impact was analysis, or more precisely, measure theory and the theory of integration. In 1919 Hausdorff introduced a new mathematical notion that once again documents his ability to go beyond traditional conceptions. In his article *Dimension und äußeres Maß*, he gave a rigorous definition of a notion of the dimension of certain point sets which could take infinitely many real values *between* the integer numbers 1, 2, 3, ... Certain strange point sets in Euclidean spaces could thus be of the dimension 2.5, or 3.14, and so on. Of course these sets formed very different types of point continua than usual lines, surfaces or spaces. This paper, whose conceptions were soon generalised to more abstract settings, seems to be the most frequently cited of Hausdorff's papers up to the present day.

Throughout his mathematical career after the most decisive years in his life just before 1900, Hausdorff adhered to a modern, axiomatic style of mathematics.³⁵ Once more it was his interest in an epistemological analysis of the possibilities for framing mathematical notions of time and space that

³³ See Purkert's editorial introduction *ibid.*, pp. 55–76.

³⁴ A forum for this research was the journal *Fundamenta mathematicae*, founded in 1920.

³⁵ For a general discussions of modernism in mathematics, see Mehrstens, *Moderne – Sprache – Mathematik*; Moritz Epple, *Die Entstehung der Knotentheorie: Kontexte und Konstruktionen einer modernen mathematischen Theorie*, Wiesbaden 1999, esp. chap. 7; a substan-

had already prepared him for the methodological advantages of the axiomatic method when David Hilbert published his famous book *Grundlagen der Geometrie* in 1899. Hausdorff's papers around 1900 document an intense interest in Hilbert's approach, and he even entered into a correspondence with its author about certain details. Moreover, most if not all of his lecture courses after 1900 bear the stamp of axiomatic mathematics. One of the first such courses is the one on *Zeit und Raum* delivered in the winter term of 1903/1904. At the same time, Hausdorff kept a critical attitude towards fields of mathematics which were not yet based on set-theoretic or sound axiomatic foundations. Only if he himself or others succeeded in restructuring these fields according to axiomatic standards, did Hausdorff develop an interest in them.³⁶ For Hausdorff, the formal style of modern axiomatics also guaranteed an essential feature of mathematics as he wished to pursue it: its complete intellectual autonomy.³⁷

To conclude these comments on Hausdorff, the mathematician, I would like to cite a striking example published in 1914 which shows that his mathematical work was guided by a modernist quest for a critical assessment of seemingly intuitive but in fact epistemically limited traditional ideas.³⁸ By means of a construction which is based on an infinite iteration of certain steps, but fairly simple by modern mathematical standards, Hausdorff showed how one could decompose the surface of a sphere in three-dimensional Euclidean space into four disjoint parts, say A , B , C , and Q , in such a way that

- (1) Q is a set of countably many points (and hence had vanishing 'content');
- (2) the three other parts A , B , C are mutually congruent, that is, each could be rotated around the centre of the sphere in such a way that it covered either of the other two;
- (3) the set A is congruent to the *union* of B and C as well.

As a consequence of (1) and (2), A , B , and C each cover *one third* of the total surface of the sphere. But as a consequence of (3), A also covers *one half* of the sphere's surface! This is a truly paradoxical result. Intuition seems to require that Hausdorff's construction is simply impossible. Hausdorff, on the other

tial new monograph on modernism in mathematics written by Jeremy J. Gray is eagerly awaited.

³⁶ See note 31. A field which Hausdorff was sceptical about was, for many years, combinatorial topology.

³⁷ This was most clearly expressed by Hausdorff in an unpublished manuscript 'Der Formalismus', written around 1903 and possibly intended to form part of a monograph on time and space, NL Hausdorff 49/1067, pp. 1–12.

³⁸ The example was first published in Felix Hausdorff, 'Bemerkung über den Inhalt von Punktmengen' in *Mathematische Annalen* 75 (1914), pp. 428–433 and then again in the appendix of Hausdorff's *Grundzüge der Mengenlehre* in Hausdorff, *Werke* II, 2002, pp. 569–573.

hand, proved that the construction *was* possible on the basis of the accepted mathematical axioms. What was happening here? The first thing to notice is that the three subsets of the sphere which Hausdorff constructed are absolutely not intuitive, they are wild, infinite sets of points scattered all over the sphere. The second, and more consequential reaction to the paradox was to accept that the notion of the *size* or *content* of a point set was meaningless in some of these wilder cases; there exist *non-measurable* subsets of continuous spaces such as the surface of a sphere in three-dimensional Euclidean space. This insight lies at the basis of all modern theories of measure and integration. Hausdorff's paradox was later reformulated in a more streamlined and somewhat more extended fashion which today is usually known as the Banach-Tarski paradox.

Placing Hausdorff in the Context of Jewish Intellectuals beyond Judaism: Some Open Questions

My elaborations above are hardly adequate to capture the subtle, rich, and challenging style of Hausdorff the mathematician and Mongré the writer, and neither do they suffice when discussing the question of whether or not, or in which ways, Hausdorff /Mongré was influenced by the fact that he was Jewish. Certainly the notion of “influence”, suggesting that his Jewish family background was one of the factors “determining” his life, is misleading here. Hausdorff led a complex life, and was acting in complex situations structured by different and unequal elements. Even when the Nazis threatened his life and that of his family he chose to act in a way which defeats simple explanations.

A more fruitful question than that of Jewish “influences” might be: “In what sense and in which ways did Hausdorff’s career resonate with general trends in Jewish intellectual life in Wilhelmine Germany and the Weimar Republic?” Two such trends were already mentioned at the beginning: First, Hausdorff provides a characteristic example of a very successful German-Jewish scientist, working in a highly specialised branch of modern science and entering the German university system, and second, he seems to belong among those Jews who perceived in German *Bildung*, and science in particular, a possibility of transcending the religious and cultural differences that still existed between Jewish and non-Jewish German citizens after their parents had achieved legal emancipation just a few decades earlier. In other words, Hausdorff might be viewed as an unexpected example of what George L. Mosse called *German Jews beyond Judaism*.

To consider such “resonances” of course invites no less methodological criticism than a search for “influences”. We are again trapped, it seems, between claiming a causal relationship between a general trend and an individual career (which would need detailed documentation, at least) on the one hand, and drawing illegitimate conclusions about the validity of general theses based on a singular case, on the other. Indeed my intention is more limited than both of these options. The following brief comparisons of Hausdorff’s career with certain general ideas discussed in the relevant historiographical literature are not aimed at a better “explanation” of his life, nor are they meant to be direct arguments for or against a given thesis. What they might provide, at best, are indications of how – in the light of Hausdorff’s biography – a rethinking of these well-known arguments might lead to interesting modifications or qualifications of some issues of the debate about Jewish intellectuals in German-speaking culture.

My point of departure will be Shulamit Volkov’s discussion of *Social causes of Jewish success in science*.³⁹ In this article, which in the meantime generated a variety of critical reactions and whose conclusions have been modified by the author herself, Volkov considered a sample of physicists, chemists and medical researchers mentioned in the *Dictionary of Scientific Biography*, thirty-nine men and one woman. All were born between 1820 and 1880; Hausdorff would be among the younger in this group. Even if mathematicians were not included in the sample,⁴⁰ it may make sense to contrast Volkov’s conclusions about five theses purporting to explain Jewish success in German-speaking science with our knowledge about Hausdorff.

Thesis 1: Intellectual achievements of Jews were related to a respect for learning, acquired in the tradition of religious and Talmudic studies. With respect to this thesis, Volkov points to the fact that with one exception, all members of her sample came from secularised families in which traditional Jewish education and religious studies did *not* play a significant role. Here Hausdorff would belong to the *exceptional group* although we do not know how important Talmudic studies were in his parental home. I know of no positive evidence that such studies helped him in his mental and intellectual development. However, it is clear that a tension existed between young Felix and his father’s outlook on religious matters. For Felix, the religious occupations of his father must have seemed obsolete – so much so that he moved

³⁹ First published in German in 1987; I am using the re-edited version in Shulamit Volkov, *Antisemitismus als kultureller Code*, Munich 2000, pp. 146–165. An English version of the article appeared as ‘Jewish Scientists in Imperial Germany, Part I’, in *Aleph* 1 (2001), pp. 215–249.

⁴⁰ A general, or prosopographic study of German-speaking Jewish mathematicians is still missing, despite the fact that disproportionate scientific success definitely was a relevant feature of the mathematical community.

even beyond the liberal factions of Leipzig's Jewish community. It is perhaps not inappropriate to assume that this move represented an intellectual challenge to the young Felix Hausdorff in his student years.

2. Thorstein Veblen's thesis: The position of Jewish scientists as members of a social minority beyond both traditional religious orientations and the value systems of the social majority helped them to develop a sceptical attitude towards society and intellectual matters. Volkov questions this thesis by pointing out that most scientists in her sample viewed themselves as well-integrated members of their national scientific community rather than as outsiders.⁴¹ Moreover, she argues that in the natural sciences it is doubtful whether a general critical attitude alone (without strong roots in an established scientific tradition) would have helped to produce innovative research and scientific success.

Again, Hausdorff's case is interesting. On the basis of the above, there can be no doubt that his attitude towards a large part of both Jewish tradition and German scientific and cultural tradition was indeed sceptical, and that this scepticism did help him in his innovative mathematical research. Thus we might have a case in favour of Veblen's thesis. Nevertheless, it is unclear whether Veblen's sociological argument (coming from a social minority helps to be successful in science) would not equally work without reference to Hausdorff's Jewish background – he also was a member of an intellectual bohème in his student days which set him apart from mainstream academic traditions; his reactions to symbolism and Nietzsche, for instance, might equally account for his critical outlook on culture, philosophy, and mathematics, rather than his being Jewish.

Moreover, Hausdorff's case underlines an argument proposed by Ulrich Charpa in the discussion of Veblen's thesis.⁴² In order to achieve successful intellectual emancipation (leading to autonomy and fruitful scepticism), Charpa points out, more is required than just a negation of the culture from which one distances oneself: one has to contribute competences and knowledge; intellectual skills acquired before (or during) the process of emancipation. If we take Mongré's early writings as documenting the initial results of his personal emancipation from tradition, we can clearly perceive some of these skills. A mastery of the German language far beyond ordinary use, an acquaintance with a large range of *Bildungswissen*, and last but not least the strong self-confidence and daring attitude of an aspiring scientist are obvious. Many of these skills related to both German-speaking and international

⁴¹ Cf. Volkov, *Antisemitismus als kultureller Code*, p. 151; the point was reinforced by *idem*, 'Jewish Scientists in Imperial Germany, Part II', in *Aleph* 1 (2001), pp. 250–281.

⁴² Ulrich Charpa, 'Judentum und wissenschaftliche Forschung – Einstellungscluster im späten 19. Jahrhundert und ihr Fortwirken' in *Simon Dubnow Institute Yearbook* 3 (2004), pp. 175–198, here 177.

culture. Whether or not the vigour with which young Hausdorff embraced this culture stemmed from his earlier Jewish education must again remain undecided.

An interesting twist on the double marginalisation thesis has been made with respect to Jewish intellectuals interested in Nietzscheanism in the late nineteenth century. In a state both beyond Judaism and the Christian majority, Jacob Golomb has argued, Nietzschean motifs of the free reinvention of culture on the basis of an authentic life may have appeared very attractive.⁴³ Again, Hausdorff's case fits nicely, but leaves open the more interesting question why he became an independent writer in this milieu rather than just a passive follower of Nietzsche like so many others.

Thesis 3: Drawing on older results of Christian von Ferber, Volkov points out that most of the scientists in the group studied by her came from economically successful, upper middle class families, while very few Jewish scientists came from the lower classes.⁴⁴ This is significantly different from the social stratification of scientists in Germany as a whole and might account for strong Jewish representation in science. As is probably well known, Volkov connects this with the dynamics of Jewish assimilation in late nineteenth century Germany. While, according to Volkov, the generation of the fathers of the scientists in the sample economic success was considered as "an acceptable replacement for complete integration", some of the younger Jews from these families viewed science and its universalistic values as the most promising path toward a community beyond "religious or racial differences".⁴⁵ This pattern (which seems quite compatible with some of Mosse's theses) seems to fit Hausdorff's case very well.

Thesis 4: Constantly fighting against antisemitic pressures motivated individuals to pursue scientific excellence. Hausdorff did indeed experience antisemitic pressures, both in the Akademisch-Philosophischer Verein and in his mathematical career. But while we cannot exclude the possibility that this motivated him to work harder on his projects, there is no positive evidence that it did. As discussed earlier, his quest for knowledge seems at least to have had other sources as well, and – to repeat Charpa's point – the struggle against antisemitism cannot account for the specific skills that Hausdorff possessed.

Thesis 5: When considering the career patterns of the forty scientists whose lives she investigated, Volkov pointed out that many obtained their permanent professorships rather later than their fellow German scientists, that is after a long period of working as Privatdozenten. She contends that

⁴³ Cf. Jacob Golomb, 'Nietzsche und die Grenzjuden', in Stegmaier and Krochmalnik (eds.), pp. 228–246.

⁴⁴ Volkov, *Antisemitismus als kultureller Code*, pp. 152–153

⁴⁵ *Ibid.*, p. 155.

this particular period in a scientific career made room for specialisations in innovative scientific fields, a specialization that was hard to achieve for most ordinary professors in late nineteenth-century German universities. As the development of science around and after 1900 did in fact rely on progressive specialisation, this particular experience of Jewish scholars helped some to get to the cutting edge of research more quickly than their German colleagues.

This argument (which sometimes, and superficially, is taken to be not much more than a variant of the marginalisation thesis⁴⁶) does indeed apply not only to Hausdorff's case, but also to that of several other Jewish mathematicians of the period. It seems evident that Hausdorff's success did rely on a rather unusual, indeed almost singular specialisation in set theory which he acquired during his period as a Privatdozent. It must also be recalled that his success came rather late. His initial university appointments in mathematics did not result in major success. This only came about after he had engaged with the difficult open problems in set theory for some years. Again, one should not overrate this factor. Others, less social and more intellectual in character, must clearly be kept in mind. Set theory became of interest to Hausdorff in the context of his earlier philosophical criticism, in his discussions of time and space, and not because he had nothing else to do as a Privatdozent.

In this way we are once again referred back to the context of modernism as a crucial element in Hausdorff's scientific career.⁴⁷ For Hausdorff success came only after he managed to combine his mathematical skills with his modernist cultural orientation. Neither young Hausdorff, the applied mathematician, nor Paul Mongré, the Nietzschean writer, made a breakthrough; but the Hausdorff of the early twentieth century, who digested, analysed and transformed contemporary mathematics and set theory, as he had digested, analysed and attempted to transform literature and philosophy in the 1890s, certainly did. In a sense, therefore, it was Hausdorff's specific way of living

⁴⁶ This, in my opinion, would be mistaken. What this career pattern – if it actually obtains – might explain is how in a population of *equally gifted* young researchers a subgroup, namely those working in particularly promising areas of research, can achieve higher success than the population as a whole. Such effects undoubtedly exist in the history of science; not all *gifted* young scientists turn into *successful* scientists. A similar pattern might result if a subgroup for some reason happens to work in the immediate vicinity of the very best researchers of the former generation (in mathematics, one might for instance speak of a “Hilbert effect” around and after 1900). Whether or not Volkov's pattern comes to have significant effects, and at what times it may be effective, will vary and is a matter of empirical investigation. For mathematics, at least, it provides an interesting hypothesis to work with.

⁴⁷ The question whether or not this modernism should be viewed as a specifically Jewish modernism or just as one strand of cultural modernism per se must remain open to discussion here; I might return to the issue on another occasion.

and acting as a German Jew beyond Judaism which is deeply interwoven with his scientific success which led to him being so successful in the various fields in which he attempted to make his mark. Unlike other German-Jewish scientists, but not so different from some of the intellectuals described by Mosse, Hausdorff consciously avoided patriotic activities or leanings in the Wilhelmine period and embraced the liberal democracy of the Weimar era. Equally consciously, he avoided religious tradition. For him, both culture at large and science or mathematics in particular represented universal enterprises, not to be compromised by national or religious traditionalisms, in fact, not to be compromised by traditionalism at all. As a renowned university professor as well as a writer being completely at home in and influencing many areas of German culture, he certainly belonged to the German-Jewish Bildungsbürgertum – at least in the Weimar period.

The fact that Hausdorff began his intellectual career as one of the Jewish proponents of a Nietzschean avantgarde does qualify, but, in my view, not invalidate this view.⁴⁸ For him, being a Nietzschean and admiring Goethe and Keller went hand in hand with each other, and claiming aesthetic self-cultivation as Paul Mongré did not preclude his alter ego Felix Hausdorff advocating scientific investigation. In Hausdorff/Mongré's activities, Nietzsche himself was seen as radicalising the Enlightenment, as re-orienting, rather than as discarding true *Bildung*. And of course, Nietzsche's own ideas had to give way if they came into conflict with the professional core of Hausdorff's main occupation, mathematics.

Hausdorff's lasting success in science, however, remained confined to the rather narrow world of mathematicians. In the interwar period he was still much better known as a Jewish Nietzschean. In 1936 the *Handbuch des jüdischen Wissens*, published by the Philo-Verlag in Berlin, did not list Hausdorff among the 46 Jewish mathematicians mentioned in a not too well-researched article. In contrast, Paul Mongré could be found in two places: among the over hundred Jewish philosophers, where he is listed together with Max Brahn, Aron Gurevitch, Paul Rée and Raoul Richter under the subheading "Nietzscheans", and in a long article on "Schrifttum" ("Writings"), where he is listed as an author of philosophy, lyrics, and drama. This last article even reveals that Mongré was Hausdorff's pen-name. Mathematics was not mentioned among his occupations. The persecution of Jews and the collapse of liberal intellectual life in Nazi Germany not only induced Hausdorff to end his life, it also deleted most memories of Paul Mongré, the

⁴⁸ The point has been raised against Mosse's claims about certain Jewish intellectuals of the Weimar period by Steven E. Aschheim, 'Jenseits von Bildung und Liberalismus. Die radikale jüdische Erneuerungsbewegung in der Weimarer Republik', in Johannes Fried und Johannes Süßmann (eds.), *Revolutionen des Wissens*, Munich 2001, pp. 136–155.

modernist writer, at least in Germany. It could not, however, prevent the stream of research that further developed the work of Hausdorff, the mathematician. Today we are in a position to appreciate both – including the relationship between the two.

Appendix: Felix Hausdorff's Publications under the Name of Paul Mongré

- 1897 *Sant' Ilario – Gedanken aus der Landschaft Zarathustras*, Leipzig
- 1897 *Selbstanzeige* of the above.
- 1898 *Das Chaos in kosmischer Auslese – Ein erkenntniskritischer Versuch*.
Leipzig
'Massenglück und Einzelglück', in *Neue Deutsche Rundschau* [= *NDR*] no. 9, pp. 64–75.
'Das unreinliche Jahrhundert', in *NDR* no. 9, pp. 443–452.
'Stirner', in *Die Zeit* no. 213 (29 October 1898), pp. 69–72.
- 1899 'Tod und Wiederkunft', in *NDR* no. 10, pp. 1277–1289.
Selbstanzeige of *Das Chaos in kosmischer Auslese*.
- 1900 *Ekstasen*, Leipzig
'Nietzsches Wiederkunft des Gleichen', in *Die Zeit* no. 292 (5 May 1900), pp. 72 f.
'Nietzsches Lehre von der Wiederkunft des Gleichen',
in *Die Zeit*, no. 297 (9 June 1900), pp. 150–152.
- 1902 'Der Schleier der Maja', in *NDR*, no. 13, pp. 985–996.
'Der Wille zur Macht', in *NDR, ibid.*, pp. 1334–1338.
'Max Klingers Beethoven', in *Zeitschrift für bildende Kunst* no. 13,
pp. 183–189.
'Offener Brief gegen G. Landauers Artikel "Die Welt als Zeit"',
in *Die Zukunft* no. 10, pp. 441–445.
- 1903 'Sprachkritik', in *NDR* no. 14, pp. 1233–1258.
- 1904 'Gottes Schatten', in *Die neue Rundschau* [= *NDR*]
no. 15, pp. 122–124.
'Der Arzt seiner Ehre. Grotteske', in *NDR* no. 15, pp. 989–1013
(Reprints Leipzig 1910, Berlin 1912).
- 1909 'Strindbergs Blaubuch' in *NDR*, no. 20, pp. 891–896.
- 1910 'Der Komet' in *NDR*, no. 21, pp. 708–712.
'Andacht zum Leben', in *NDR* no. 21, pp. 1737–1741.
- 1912 'Biologisches', in *Licht und Schatten* no. 3, Heft 35 (unpaginated).

“I Detest his Way of Working.”¹
Leonor Michaelis (1875–1949),
Emil Abderhalden (1877–1950), and Jewish
and non-Jewish Biochemists in Germany

Ute Deichmann

Introduction

Biochemistry had been a fast growing science from the early twentieth century with Germany as the international leader until the 1930s. Jews, representing around thirty per cent of the German biochemists in 1930, were disproportionately represented in this discipline. Moreover, Jewish refugee biochemists from Nazi Germany in the United States and England were highly successful scientifically², to an extent comparable only to the refugee theoretical physicists.

The quotation in the title, made by the well-known biochemist Leonor Michaelis about his colleague Emil Abderhalden in 1921, indicates that there were not only different individual topics of biochemical research, but also different types of approaches, apparently incompatible with each other. I have looked into the research of these two biochemists and the community of (medical) biochemists³ in early twentieth century Germany, and distinguished two groups according to their prevailing research practices. The first group can be characterised by strong scientific leanings, applying quantita-

I thank Jonathan Harwood and Anthony S. Travis for valuable suggestions and criticism.

¹ “*Seine Arbeitsweise ist mir widerlich.*” (Michaelis, 4 March 1921, to Jacques Loeb, Loeb papers, Library of Congress, Manuscript Division, file Michaelis).

² Ute Deichmann, *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker in der NS-Zeit*, Weinheim – New York 2001, chaps. 3 and 4, see also references. Jewish biochemists in Germany were, as a group, more successful than Jewish scientists in other fields with a high Jewish participation, for example physical chemistry, see Ute Deichmann, ‘Erfolg und Fachdisziplin. Juden in Chemie und Biomedizin in Deutschland bis 1933’, in *Simon Dubnow Institute Yearbook 3* (2004), pp. 269–292.

³ They are medical scientists whose research and sometimes teaching was in biochemistry. They worked at university departments of physiological chemistry or other departments in theoretical medicine and several Kaiser Wilhelm Institutes. In Germany, biochemistry was established as a discipline in the natural sciences only in 1953.

tive methodology and a preference for concepts of organic and physical chemistry. It is here represented by Michaelis and consists, interestingly enough, almost exclusively of Jews. As for the second group, the characteristics are emphasis on non-quantitative methods, a predilection for concepts of colloid chemistry and a strong emphasis on medical applications. This group is represented here by Abderhalden, and includes the majority of medical biochemists, non-Jewish as well as Jewish.

Differences in research practices have usually been dealt with as differences in research styles. An example is Jonathan Harwood's comprehensive study on differences of national styles in the genetics communities of the USA and Germany, and in Germany itself from the 1920s to the 1940s.⁴ More recently, Harwood has analysed national differences in the scientific styles of German refugees from various disciplines in the United States and their American colleagues.⁵ Differences concern, for example, specialisation – German refugees were much less specialised in their research than American scientists – and attitudes towards theory. In several disciplines, for example engineering, American professors only rarely made use of scientific theory or mathematics in contrast to German refugees.⁶ Harwood did not enquire whether the fact that most German refugees were Jewish was responsible at least in part for the characteristics typical of a German style of science. He also did not deal with the question of different levels of success regarding particular styles.

This article addresses both topics in regard to biochemistry. It raises the question of whether being Jewish might have had an influence on the way biochemical research was conducted in Germany – and after 1933 in countries of refuge. It also tries to assess levels of success of different approaches. Any resemblance with Nazi claims of the existence of “Aryan” and “Jewish” science, for example of a “Jewish physics” (see the contribution by Aharon Loewenstein in this volume) is only superficial. As Jonathan Harwood has pointed out in regard to recent studies of “national styles” of science, the question of whether the personal or social identity of researchers influenced their scientific research practices has nothing to do with a “timeless manifestation of race”, but with “socially and historically specific phenomena whose origins should be explicable in just the same way as any historical event or movement.”⁷

⁴ Jonathan Harwood, *Styles of Scientific Thought: The German Genetics Community 1900–1933*, Chicago 1993.

⁵ *Idem*, ‘National Styles in Academic Culture: Science in Germany and the United States between the World Wars’ in Christophe Charle, Jürgen Schriewer and Peter Wagner (eds.), *Transnational Intellectual Networks: Forms of Academic Knowledge and the Search for Cultural Identities*, Frankfurt am Main 2004, pp. 53–79.

⁶ *Ibid.*, p. 64.

⁷ *Ibid.*

Analysing sociological and personal factors as possible explanations for the phenomenon of two different types of biochemical research practices in Germany will help us answer the question of whether the Jewishness of researchers influenced the choice of topics and practices of research. This will enable us also to examine whether the scientific characteristics of German refugees, as proposed by Harwood, were German or, rather, more specifically, German-Jewish ones, as far as biochemists are concerned.

A comparison of the research practices of Leonor Michaelis and Emil Abderhalden serves as starting point for the analysis. Despite large differences in their career patterns, their scientific biographies show many similarities. The results of this comparison lead us to the assumption that, in contrast to the widespread usage of the concept of a scientific style, differences in research practices or styles are not neutral to scientific *advancement* and – at least in some cases – reflect different *qualities* of research.

1. A Brief Sketch of the Lives and Researches of Leonor Michaelis and Emil Abderhalden

Leonor Michaelis (1875–1949) was born in Berlin, where his father Moritz Michaelis was a merchant. Though Michaelis was Jewish, we do not know whether Jewish traditions were still practised in his family or whether he experienced them outside the family. Like many of his contemporary scientists – Jewish and non-Jewish alike – Michaelis did not talk or write about his religious upbringing. But unlike many of his colleagues, he did not even mention other aspects of his personal biography in his reminiscences, writing exclusively about his research.⁸ The only comment he gave on his family was that he was born into an “environment which was far removed from science”.⁹

Michaelis had been a member of the orthodox Jewish community in Berlin, Adass Jisroel, which he left on 16 November 1915.¹⁰ The announcement of the marriage of one of his daughters shows, however, that his children were obviously not brought up in an entirely secular environment: a short note in the *Herald Tribune* about the marriage of Eva Michaelis to Gustav Jacoby, “son of Amanda and the late Siegfried Jacoby” in New York City

⁸ ‘Leonor Michaelis, 16 January 1875–8 October 1949: An Autobiography with Additions by D.A. Macinnes and S. Granick’, National Academy of Sciences, Biographical Memoirs XXXI, New York 1958, pp. 282–321.

⁹ *Ibid.*, p. 282.

¹⁰ Centrum Judaicum Berlin, Archive.

reads: "The ceremony was performed at Sherry's by Rabbi Dr. W.F. Rosenblum. The bride was given in marriage by her father ..."¹¹

Michaelis attended a *humanistisches Gymnasium* in Berlin, and studied medicine in Berlin and Freiburg. An unpaid extraordinary professor, he worked as a bacteriologist in a rather small research laboratory of a Berlin hospital. In 1922 he left Germany to become visiting professor at Nagoya University in Japan. In 1926 he became lecturer at Johns Hopkins University, Baltimore, and in 1929 member of the Rockefeller Institute in New York.

Emil Abderhalden (1877–1950), born in Ober-Uzwil near St. Gallen, Switzerland, was a Protestant; his father was a teacher. Abderhalden studied in Basel and after graduating as a doctor of medicine he moved to Berlin in 1902. In 1908 he became professor of physiology at the *Tierärztliche Hochschule* in Berlin, and in 1911 of physiology and physiological chemistry at the University of Halle. In 1931 he was appointed president of the oldest German Academy of Science, the *Leopoldina*. In 1946 he returned to Switzerland where he became a professor in Zurich.

Despite the differences in their careers, there are many parallels in Michaelis' and Abderhalden's scientific biographies. Michaelis and Abderhalden were almost the same age. Both of them studied medicine and later specialised in theoretical (non-clinical) medicine, focusing on biochemistry. Both of them were educated by prominent scientists: as a student, Michaelis worked in the laboratory of Oskar Hertwig, a famous embryologist, and as a post-doctoral student he became a private assistant (for a year) of Paul Ehrlich, a founder of immunology and serology and a medicine Nobel laureate in 1908. Abderhalden was, from 1902–1908, a private assistant of Emil Fischer, arguably the most renowned organic chemist of his time and a chemistry Nobel laureate of 1902. Michaelis and Abderhalden made or claimed to have made important discoveries, which brought them international fame. Conducting research in both basic and applied scientific medicine, their most important basic research was in protein biochemistry, in particular enzymology.

Michaelis began his protein research, in which he mainly used physical and chemical methods, when he was already an independent researcher. He became best known for having developed a quantitative basis for the concept of the isoelectric point and explored the dependence of enzymatic action on the hydrogen concentration of the environment. Based on a series of measurements, which he conducted with the Canadian researcher Maud Menten in 1913, he mathematically derived the affinity constant of the enzyme substrate bond, which became known as Michaelis constant (sometimes Michaelis-

¹¹ *Herald Tribune*, 22 November 1930.

lis-Menten constant).¹² This work was – and still is – of great importance for basic enzymology as well as for medical applications and became a foundation of industrial biotechnology. The Michaelis-Menten equation and diagram are still included in every textbook of biochemistry.

Abderhalden started protein research in collaboration with Emil Fischer. Fischer's work between 1899 and 1908 on the development of methods to separate and identify amino acids, the building blocks of proteins, and on the synthesis of peptides (small proteins), in which he suggested that proteins consist of chains of amino acids linked by the peptide-bond, laid the foundations for all later studies of proteins. When Fischer turned his interest to other fields – he did not consider the continuation of peptide synthesis fruitful with the then available methodology – Abderhalden continued protein research by himself. He first started with the synthesis of various different small peptides. Then, following a vague earlier assumption of Fischer, Abderhalden developed a new theory of protein structure (diketopiperazin theory) in 1924, which he maintained for many years and defended as late as 1942, though diketopiperazin rings were soon shown to be artefacts of the peptide preparation and most likely not parts of the proteins.¹³

Abderhalden's most important discovery, in his own view, was the so-called *Abwehrfermente* (defence enzymes). According to Abderhalden, animals and humans produce specific enzymes that split proteins (proteases), the defence enzymes, when they are challenged with foreign proteins in their blood. From 1909, when he claimed to have discovered them, until his death he devoted most of his work to various medical applications of these enzymes.¹⁴ The first such application was his development of a pregnancy test, which was based on his assumption that pregnant women produce specific proteases against proteins of the placenta in their serum. This test received widespread international attention of gynaecologists and biochemists and its apparent validity was accepted by the majority of German professors of gynaecology.¹⁵ Later, Abderhalden developed modified versions of the

¹² Leonor Michaelis and Maud Menten, 'Die Kinetik der Invertinwirkung', in *Biochemische Zeitschrift* 49 (1913), pp. 333–369.

¹³ Deichmann, *Flüchten*, p. 257–8.

¹⁴ Research on defence enzymes has been extensively analysed in Ute Deichmann and Benno Müller-Hill, 'The Fraud of Abderhalden's Enzymes', in *Nature* 393 (1998), pp. 109–111; Deichmann, *Flüchten*, chap. 7.1; Michael Kaasch, 'Sensation, Irrtum, Betrug. Emil Abderhalden und die Geschichte der Abwehrfermente', in *Historica Leopoldina* 36 (2000), pp. 145–210; Ulrich Charpa and Ute Deichmann, 'Vertrauensvorschuß und wissenschaftliches Fehlhandeln. Eine reliabilistische Modellierung der Fälle Abderhalden, Goldschmidt, Moewus und Waldschmidt-Leitz', in *Berichte zur Wissenschaftsgeschichte* 27 (2004), pp. 187–204.

¹⁵ Between 1912 and 1913 more than 25 papers from various gynaecological laboratories were published which dealt with Abderhalden's pregnancy test, most of them confirming its validity. In 1914 a medical journal asked the directors of German university

test for the diagnosis of carcinomas, infectious diseases like syphilis, and psychiatric diseases such as schizophrenia.

Despite the wide recognition which Abderhalden received, his claim for the existence of specific defence enzymes was refuted by several researchers early on, first, in 1914, by Michaelis.¹⁶ While working in the chemical laboratory of a Berlin hospital, he had been asked by the clinicians to examine the appearance of defence enzymes in the case of various diseases; Michaelis decided to first establish the method's validity with Abderhalden's pregnancy test.) His results were soon confirmed by researchers in the United States, among them Donald D. van Slyke at the Rockefeller Institute for Medical Research in New York.¹⁷ Defence enzymes largely disappeared from research agendas outside Germany. Abderhalden, however, never accepted the refutations and was able to continue and, during the Nazi era, increase this work until 1945. It is now generally accepted that defence enzymes do not exist and that Abderhalden's research in this area has to be regarded as a severe case of scientific misconduct or fraud.¹⁸ This article is, however, not concerned with this issue.

2. Differences in the Research Practices of Michaelis and Abderhalden

Since defence enzymes were a field in which both scientists conducted research with contradicting results I use it as a starting point for the comparison of their research. Michaelis' 1914 paper of refutation indicates his type of experimentation and shows his style of writing. The following quotations from this paper demonstrate the emphasis he laid on the exactness and reliability of experimentation and the use of appropriate methods:

In every detail we kept pedantically to the very clearly described instructions of Abderhalden. ... When we nevertheless came across disagreements, we discussed them in person with Mr. Abderhalden in Halle. When we again ... met with difficulties, one

women's hospitals to describe their experience of this test. Fifteen replied: all had had more or less positive results; none a negative result that contradicted the test. In the fourth edition of his book *Abwehrfermente* (Berlin 1914) Abderhalden quotes 451 papers, many of them in non-German journals, which describe various uses of his test.

¹⁶ Leonor Michaelis and L. v. Lagermarck, 'Die Abderhaldensche Schwangerschaftsdiagnose', in *Deutsche Medizinische Wochenschrift* no. 7 (1914), pp. 316–319.

¹⁷ Deichmann and Müller-Hill, 'The Fraud'.

¹⁸ *Ibid.*; Charpa and Deichmann, 'Vertrauensvorschuß'. For a philosophical justification of the non-relativistic appraisal of Abderhalden's defence enzyme work as fraud see Ulrich Charpa, 'Selbsttäuschung und Forschertugend', in Jürgen Mittelstraß (ed.), *Zukunft des Wissens*, (XVIII. Deutscher Kongreß für Philosophie), Konstanz 1999, pp. 843–850.

of us (v. L.) spent a week in Mr Abderhalden’s laboratory in Halle, with his kind permission, where he and his assistants again demonstrated everything that was necessary. ... In spite of all this, we cannot confirm that a serum from pregnant women behaves different in any recognisable, regular, practically usable way from sera of non-pregnant women or men.

Concerning one of Abderhalden’s colour methods – biuret:

It is simply incomprehensible to us, how [Abderhalden] could possibly have received apparently very unambiguous results with such an imprecise method.

Concerning Abderhalden’s blaming the imperfection of some technical devices – tubes for dialysis (*Dialysierhülsen*) – on wrong results:

... the psychological influence of the investigator who regards the uselessness of the tubes to be a comfortable explanation of the wrong result.

After testing the tubes with a more appropriate method:

The tubes are absolutely impermeable for protein, and if there may perhaps be occasionally bad and permeable ones, the Abderhalden method of testing is not appropriate to reveal this in the right way.¹⁹

These quotations, in particular the last one, make clear that, when stating his strong dislike of Abderhalden’s “type of working”,²⁰ Michaelis was not just concerned with two different but in principal equally good styles of work, but with different qualities of work. The sharpness with which he rejected Abderhalden’s claims points to strong differences in scientific practice between the two scientists. A review of their work in protein biochemistry discloses these differences: while both of them were scientists whose work was primarily empirical, they differed nevertheless in the reliability and quantitative nature of their experiments, their theoretical interpretation, a predilection of chemical concepts on the one side and colloid chemical on the other, the breadth of their scientific knowledge, their readiness to optimise research practices, and preferences for basic research on the one hand, and applied on the other.

2.1 Differences in empirical and theoretical research

While Michaelis and Abderhalden did not differ substantially in the importance they attributed to empirical or theoretical research, their actual research practices in both areas were very different. Exact experimentation and the development of new quantitative methods were at the core of

¹⁹ Michaelis and v. Lagermarck, ‘Die Abderhaldensche’ (transl. by Ute Deichmann).

²⁰ Michaelis, 4 March 1921, to Jacques Loeb, Loeb papers, Library of Congress, Manuscript Division, file Michaelis.

Michaelis' work. In the interpretation and generalisation of his findings, he usually remained close to his experiments. A striking example is the above-mentioned groundbreaking 1913 paper on the affinity constant of an enzyme to its substrate, in which he refrained from any generalisation.²¹ This can be explained by his modesty, but we may also assume that he considered it obvious that the clear-cut results he found concerning one enzyme should be tested and confirmed when considering other enzymes as well, and this indeed is what happened.

According to Michaelis' own assessment of the nine problems, which he had investigated while he was still in Germany, three dealt with the *development of methods*: in one case he *developed a theory*, in two others he *investigated a theory*.²² In Germany as well as the United States he was appreciated as an extremely talented experimenter and methodologist. The example of defence enzymes shows for instance that he was able to make use of more precise techniques to show traces of proteins than was Abderhalden. Despite the fact that Michaelis' refutation of Abderhalden's claim about defence enzymes contradicted the "very numerous confirmations that Abderhalden's methodology had received in various areas of medical diagnostics", the editors of *Deutsche Medizinische Wochenschrift* published it because the "clinical and in particular the physical and chemical work by L. Michaelis" justified that also this paper should have been fully considered.²³

Nevertheless, Michaelis created new theories not only by sound experimentation but sometimes by daring intuition. His colleague E.S. Guzman Barron, a biochemist from the University of Chicago, gave two prominent examples: "When the protein nature of enzymes was as yet unknown, Michaelis guided by his genius foresaw it; with daring and his elegant simplicity he put forth the theory of enzyme-substrate complex formation."²⁴ The second example relates to the concept of intermediary free radicals in chemical reactions, another fundamental theory:

²¹ The paper ends with a summary of the empirical results and their mathematical formulation, which reads: "From all these assumptions we can derive a differential equation for the process of the breakdown of *saccharose*, the integral of which corresponds well with the observations." Michaelis and Menten, 'Die Kinetik', p. 369 (transl. by Ute Deichmann). I thank my colleague Siegfried Roth and students of our course on the history of biochemistry at the University of Cologne (2005–2006) for discussing with me this peculiarity of the paper.

²² Michaelis, 'An Autobiography'.

²³ Note added to Michaelis' and v. Lagermarck's 'Die Abderhaldensche'. The fact that the editors considered it necessary to add this note also points to the strong hierarchy in the medical establishment.

²⁴ E. S. Guzman Barron, 'Leonor Michaelis, 1875–1949, Memorial Lecture', in Guzmán Barron (ed.), *Modern Trends in Physiology and Biochemistry: Woods Hole Lectures Dedicated to the Memory of Leonor Michaelis*, New York 1952, pp. xvii–xxii, p. xx.

Here, as in the field of enzymes, his genius brought forth theories of fundamental importance for the understanding of the kinetics of biological oxidations. The simultaneous discovery with Elema, from Holland, of the two-step reduction of pycocyanine in acid solutions was the starting point of Michaelis' principle of monovalent oxidation-reductions and the intermediary formation of free radicals during the oxidation process of systems, which perform the reaction by transfer of two electrons. The presence of such free radicals, existing in equilibrium with their 'parent substances' even in aqueous solutions, was a daring concept which appeared absurd to conservative chemists. Like his theory of enzyme-substrate formation, it was more the foresight of a genius than the result of a methodical and secure approach.²⁵

Michaelis' theories had a mathematical structure. As these quotations show, they aimed at a better understanding, which included its increasing simplicity, of his empirical data and they became empirically confirmed. His response to criticism is revealing. Best known is his response to the complete rejection, at first, of his just mentioned theory of two-step oxidations. His first paper had been rejected by both the *Journal of Biological Chemistry* and the *Journal of the American Chemical Society*. Guzman Barron recalled:

So indignant was one referee of the latter journal that in horror he wrote, 'In short, a principle of modern scientific philosophy is violated.' The paper was published in *Biochemische Zeitschrift*. Michaelis felt deeply this criticism. To answer the charges of lack of conclusive evidence and of too much reliance on potentiometric data he diligently started the study of quantum mechanics and of magneto-chemistry, attacking them with the same enthusiasm as when 30 years previously he had prepared himself in organic chemistry and mathematics. He simplified the method of the magnetic balance for the measurement of the paramagnetism of these intermediate compounds and left no room for doubt about the existence of free radicals. Thus the name of Michaelis has been incorporated in every textbook of organic chemistry.²⁶

Abderhalden, too, presented himself as a sound empiricist, explicitly emphasising the importance of experimental evidence for new ideas and hypotheses. In contrast to Michaelis he generalised his findings quickly and speculated about broad applications. When he produced theories, such as the diketopiperazin theory of protein structure or of the existence of specific defence enzymes, he claimed that they had an empirical basis. Therefore he put a lot of effort into convincing colleagues that any negative results of the defence enzyme reaction, that is results which contradicted his theory, were due to their experimental shortcomings and not due to the fact that his theory might be flawed.

His editing of a hundred volumes of *Handbuch der biologischen Arbeitsmethoden* shows that methods were important to him. However, and in sharp contrast, in his research Abderhalden often used imprecise methods and did not work

²⁵ *Ibid.*, pp. xx-xxi.

²⁶ *Ibid.*

quantitatively. His work seems to have been generally sloppy; in some cases he did not use controls.²⁷ Even his students later admitted that the methods Abderhalden used for protein analysis were far too imprecise to give the clear-cut quantitative results he claimed to have achieved.²⁸ According to biochemist and historian of science Joseph Fruton, a good part of Abderhalden's work both as a member of Emil Fischer's group and as an independent investigator proved to be irreproducible.²⁹ For example, Emil Fischer's method to synthesise peptides became outdated by the time Fischer ceased to use it in 1910 and only survived in Abderhalden's laboratory, where many peptides were produced "albeit of uncertain identity or purity".³⁰ Fischer, who initially thought highly of Abderhalden's chemical talents, later had to withdraw the claim of a special new protein amino acid, which was based on Abderhalden's experiment.³¹

Columbia University microbiologist Bernard F. Erlanger remembered, too, that he hardly ever succeeded in reproducing an experiment of Abderhalden, when, as a graduate student, Erlanger worked on methods of peptide synthesis.³² As already mentioned, the experiments which led to Abderhalden's alleged most important theory, the existence of specific defence enzymes, were totally unreliable, and the untenability of this theory was criticised by several colleagues, quite apart from Michaelis. Abderhalden did not accept criticism. He conceded that there were some laboratories where his test did not work properly, but claimed that this was due to the fact that the method was difficult and not properly used. He worked hard on its improvement with the result that the method became technically more and more complicated but not more reliable. Today no major discovery is related to Abderhalden's work.

2.2 Differences in the breadth of scientific knowledge, the variety of research topics and methods

Michaelis began his career as a researcher with a paper in embryology, followed by his Ph.D. thesis in this field. Embryology was also the topic of his first book in 1900, *Kompendium der Entwicklungsgeschichte des Menschen mit*

²⁷ Deichmann, *Flüchten*, chaps. 6.1.3 and 7.1. An example is Frederick Sanger, who in a review article showed that Abderhalden had not carried out an obvious control experiment when he claimed to have found diketoperazin rings in silk fibroin. See Sanger, 'The Arrangement of Amino Acids in Proteins', in *Advances in Protein Chemistry* 7 (1952), pp. 1–67.

²⁸ Kaasch, 'Sensation', pp. 204–207.

²⁹ Joseph Fruton, *Contrast in Scientific Style: Research Groups in the Chemical and Biochemical Sciences*, Philadelphia 1990, p. 193.

³⁰ *Ibid.*, p. 187. Fischer's method was the halogenacyl method.

³¹ *Ibid.*, pp. 187–193.

³² Erlanger, letter to the editor, in *Nature* 393 (1998), p. 301.

Berücksichtigung der Wirbeltiere, which was published in ten editions; two more were to follow after it was reworked by Richard Weissenberg. When Michaelis quit biology, turning his focus of interest to biochemistry, he always kept the biologist's point of view in mind. As was indicated above, Michaelis made lasting contributions to a number of different fields of biochemistry and even physical chemistry, most importantly the physical chemistry of proteins and enzymes and the oxidation–reduction processes.³³ In this article I focus on the change of Michaelis' methodical approaches.

In his contribution to the *Festschrift* for the 60th anniversary of Paul Ehrlich, Michaelis characterised Ehrlich's methodical specialty as “the taking-up of the progress of chemical research for biology”.³⁴ This attitude became central to Michaelis' research, too. True to the tradition of Emil Fischer and Paul Ehrlich, Michaelis sought solutions to problems at the interface of biology and chemistry by first applying chemical concepts and methods. Thus he was of the opinion that specific affinities, for example of antibodies, can be explained by organic chemistry alone, because it “offered innumerable examples of direct chemical reactions in which no electrical phenomena are involved at all”.³⁵ He rejected the far-reaching claims by some colloid chemists and physical chemists according to whom electrical properties were sufficient to account for biological specificity.

Michaelis recognised, however, the importance of physical chemical concepts for biochemistry early on and at first also considered colloid chemistry – at the time a largely descriptive science, which had originated from inorganic chemistry – as potentially useful. According to the colloidal concept, proteins (and other biologically relevant large molecules such as nucleic acids) were not macromolecules, but colloidal aggregates of small molecules without a uniform molecular weight.³⁶ There were even vitalistic connota-

³³ For an overview, see Michaelis, ‘An Autobiography’.

³⁴ Leonor Michaelis, ‘Das Sauerstoffbedürfnis des Organismus’, in Paul Ehrlich. *Eine Darstellung seines wissenschaftlichen Wirkens*, Jena 1914, pp. 24–39.

³⁵ Leonor Michaelis, ‘Physikalische Theorie der Kolloide’, in Alexander von Korányi and Paul Friedrich Richter (eds.) *Physikalische Chemie und Medizin. Ein Handbuch*, Leipzig 1908, pp. 452 f., cited in Pauline M. H. Mazumdar, *Species and Specificity. An Interpretation of the History of Immunology*, Cambridge 1995, p. 236. When appealing to pure chemical forces, Michaelis related to Emil Fischer's “lock and key” concept for fermentations and Ehrlich's “side-chain” (later receptor) theory.

³⁶ The exact composition of such an aggregate was considered irrelevant for its biological action. What mattered was its size as an outcome of its degree of dispersity. These speculative claims did not fulfil. The colloidal phenomena for example of proteins became phenomena of macromolecules, obeying chemical and physical laws. For the influence of colloid chemistry on biochemistry see, for example, Marcel Florkin, *A History of Biochemistry*, Amsterdam 1972, pp. 175 ff, 287 ff.; Joseph Fruton, *Macromolecules and Life*, New York 1972, pp. 140 ff. For the history of colloid chemistry in Germany see Ute Deichmann, *Flüchten*, pp. 372–394. The initiator and first president of the German Col-

tions to colloids. Some scientists considered proteins in the protoplasm, which allegedly did not follow the laws of physics and chemistry such as the laws of the definite proportions and the mass action law, to be the bearers of life processes which cannot be fully understood by physics and chemistry.

Michaelis soon became aware of the limitations and flaws of the colloid concept and he was one of the first to recognise the importance of the physico-chemical theory of the influence of the ionic environment, a core concept of early physical chemistry. Thus, following the Danish biochemist Sören Sørensen who in 1909 had established the importance of the hydrogen ion concentration, Michaelis studied its effect extensively and expanded its theoretical background. Through the work of Sørensen and Michaelis, this concept became the foundation of an exact physical chemistry of proteins and enzymes. Michaelis used it as a starting point to establish quantitatively the affinity constant of enzymes and their substrates, a work which succeeded in pushing enzymology out of its often derided niche and turning it into a field of research in the exact sciences. His theory of enzyme-substrate complex formation became one of the solid foundations of enzymology. However, his work was not taken up at universities in Germany at the time. The colloidal concept of proteins (and other macromolecules) came increasingly under attack and finally disappeared from the biological and biochemical sciences.³⁷ The beginning of its end was marked by Jacques Loeb's book *Proteins and the Theory of Colloidal Behaviour* in 1922.³⁸

Michaelis' wide methodological range, including not only chemistry and physics but also mathematics, in which he was very skilled, was rare among medical scientists in Germany. His scientific correspondence from 1936 until 1945 with Linus Pauling demonstrates impressively Michaelis' knowledge of the hard sciences and mathematics as well as his focus on experimentation, which was highly appreciated by Pauling.³⁹

loid society, founded in 1922, was Wolfgang Ostwald, who after 1933 became a strong supporter of the Nazis, and a rabid antisemite.

³⁷ Joseph Fruton pointed to the fact that though the claims of colloid chemistry disappeared they contributed to an awareness of the importance of physical chemical methods in biochemistry and of concepts such as adsorption. See Joseph Fruton, *Proteins, Enzymes, Genes: The Interplay of Chemistry and Biology*, New Haven, CT–London 1999, pp. 158–9.

³⁸ Jacques Loeb, *Proteins and the Theory of Colloidal Behaviour*, New York 1922, a summary appeared in German: 'Die Erklärung für das kolloidale Verhalten der Eiweißkörper', in *Die Naturwissenschaften* 11 (1923), pp. 213–221. Loeb showed that proteins do react like chemical molecules and that the so-called colloidal phenomena of proteins could be explained by already existing chemical theories alone, once the concept of hydrogen ion concentration was taken into account, a fact which most colloid chemists disregarded.

³⁹ Linus Pauling Papers, Section Correspondences, Oregon State University, Corvallis, Oregon, 246.9 L. Michaelis.

It is worth adding that his abilities included a phenomenal command of languages, not only modern European ones. As a pupil he excelled in classics (and even considered studying the classics), and during his stay in Japan he was able to learn Japanese in a short time. Among his other cultural predilections was music; he was an able pianist who sometimes performed in public.

Abderhalden had worked on various fields of physiology, for example nutrition, before he turned to protein biochemistry, working mainly on two topics, the synthesis of small peptides and the study of defence enzymes. A physiologist with some training in organic chemical methods, Abderhalden later became a spokesman for colloid chemistry, which he like many of his colleagues considered much more fundamental than chemistry for providing explanations for biochemical and physiological phenomena.⁴⁰ In contrast to Michaelis and other medical scientists, among them Karl Landsteiner⁴¹ and Jacques Loeb, Abderhalden did not take a critical stand later on and never used the concept of hydrogen ion concentration. Generally, he seemed to have preferred to stay with a method once he had found it useful; he was reluctant to optimise or abandon it even when severe problems occurred. Thus in his defence enzyme work, Abderhalden basically stuck to his poor methods (in particular dialysis and biuret or ninhydrin staining) and only changed some minor steps of the procedures. Horst Hanson, one of his most faithful students, later admitted that Abderhalden “neglected ... the further experimental research of the basis of the [defence enzyme] reaction and the construction of an unambiguous exact quantitative method of measurement”.⁴²

2.3 Orientation towards basic versus applied research

Michaelis, who had strong scientific leanings even as a pupil, published scientific papers when he was still a student. Most of his work was in basic research though it had a strong potential of becoming fruitful in medical applications. Examples of this are his numerous articles in the *Biochemische*

⁴⁰ Abderhalden assumed that a wide range of biological and physiological phenomena, such as muscle contraction, reaction of the egg to fertilisation, and enzymatic action, could not be explained by their chemical properties and reactions but only by their colloidal properties, which could allegedly only be examined by colloid science, which investigates surface properties and the degree of dispersity of particles, their molecular constitution being regarded as irrelevant. See Emil Abderhalden, ‘Über die Beziehung der Kolloidchemie zur Physiologie’, in *Kolloid-Zeitschrift* 31 (1922), pp. 276–279.

⁴¹ For Landsteiner see Mazumdar, *Species*, and *idem*, ‘The Antigen-Antibody Reaction and the Physics and Chemistry of Life’, in *Bulletin History of Medicine* 48 (1974), pp. 1–21. Landsteiner, one of the founders of immunochemistry was an extremely thorough experimenter who also engaged in theoretical reflections on the antigen-antibody reaction. After a short “colloid revelation” in 1903 he left the “classical colloid camp” (Mazumdar, ‘Antigen’, p. 17) in order to study the chemistry of this reaction.

⁴² Quoted in Kaasch, ‘Sensation’, p. 151.

Zeitschrift around 1910, dealing with the clarification of concepts, such as the hydrogen ion concentration in biochemistry or the enzyme, and the introduction (or optimising) of physico-chemical methods into biochemical research, which had strong bearings on medical biochemistry. Generally, his basic research led to a variety of applications, prominent among them the permanent wave, but he was never primarily interested in the applied side of his research.

Abderhalden, in contrast, was strongly interested in the practical use and potential applications of his research, for example, in the field of nutrition. Early on he pointed to the potentially crucial importance of “defence enzymes” for a wide spectrum of medical applications, such as the diagnosis of cancer and schizophrenia. When he spoke on this subject in a public lecture at the Charité hospital in Berlin in 1913, he received tremendous acclaim also outside academia for his “sensational lecture” and for having revolutionised medical diagnosis.⁴³ Many of Abderhalden’s articles after 1910, for example those published in *Fermentforschung*, a journal founded by him, were devoted to applications of his defence enzyme research.

2.4 Scientific success, research practices and general attitudes

The examples of Michaelis and Abderhalden not only show that the use of appropriate research practices is a prerequisite for scientific success, but also suggest that success may strongly influence the preference of particular research practices and general attitudes. One might say that with hindsight it is easy to state that Michaelis was a successful scientist with major and lasting achievements in various areas of research, whereas most of Abderhalden’s alleged great achievements turned out to be failures. But at the time, too, it was clear to many researchers in the field that Michaelis’ work was highly reliable, relevant, efficient, and paved the way for other research practices as well as for practical applications, whereas Abderhalden’s work was neither considered reliable nor efficient, and the fertility and relevance which colleagues praised so highly, was always only hypothetical.⁴⁴

Michaelis was successful in almost everything he tackled in his research. According to his friends and co-workers “Michaelis could have made substantial contributions to nearly any human endeavour that he chose to enter. And in doing so he brushed away obstacles that would have completely discouraged a man of ordinary capabilities.”⁴⁵ His great competence in many areas of science including mathematics helped him to conduct his empirical

⁴³ *Ibid.*, p. 150.

⁴⁴ Concerning the criteria of successful research, see Charpa and Deichmann, ‘Vertrauensvorschuß’.

⁴⁵ Additions by Macinnes and Granick to Michaelis, ‘An Autobiography’.

research in such a manner that he was able to create new explanatory ideas that integrated various scientific fields. An obituary in *Nature* characterised him as “one of the most prolific and original scientific minds of the twentieth centuries. ... He learned with ease, his memory was tenacious, he could quickly grasp the essence of a problem, he was a persistent and meticulous worker.”⁴⁶

At the same time colleagues perceived him as “extremely modest and unassuming”, as someone who “has gone to no ends of pains and trouble to assist the younger men ... with their work.”⁴⁷ His success might have contributed to his modesty (which, however, did not prevent him from occasional impatience and undiplomatic behaviour) and the generosity and kindness in particular to students and also to colleagues, for which he became known in the United States.⁴⁸ He generously acknowledged colleagues for their contributions to his work. Thus he depicted his path-breaking results in enzyme kinetics only as an “enlarged modification of the results of Henri’s derivation” which had become possible because of newly acquired knowledge.⁴⁹ In his autobiography he listed a number of co-workers “whose share in the works published jointly must be estimated at not less than 50 per cent, or even more”.⁵⁰

Abderhalden knew about his limitations. Shortly after he arrived in Berlin in 1902 – his aim having been to study organic chemistry with Emil Fischer in order to be able to experimentally tackle certain physiological problems – he wrote to his former teacher Gustav von Bunge in Basel about his concerns regarding his career. His attempt at finding a position in Switzerland had failed. As a Swiss citizen Abderhalden considered a career as a clinician to be impossible in Germany and he had been given strong advice not to embark on a career in theoretical medicine, for example biochemistry.⁵¹ When he decided to stay in Berlin and not to return to Switzerland to work in clinical medicine, he felt “obliged to succeed”⁵² and worked tremendously hard with only dubious success. We may assume that this was

⁴⁶ Obituary by Sam Granick, in *Nature* 165 (1950), p. 299.

⁴⁷ Physician-in-chief of the Johns Hopkins Hospital, Longcope, 26 January 1929, to Simon Flexner, Rockefeller Institute, Rockefeller Archive Center, collection Rockefeller University, Record Group 450 M 582.

⁴⁸ In the memorial minute by Dr. Gasser at the meeting of the board of Scientific Directors of the Rockefeller Institute, 21 January 1950, Michaelis was characterised as a scientist who was “at heart a teacher” whose “gifts were devoted to the highest type of teaching to the most receptive of students”. (From the minute, sent by the secretary of the board of directors to Mrs. Michaelis, 30 January 1950).

⁴⁹ Michaelis and Menten, ‘Die Kinetik’, p. 364. Michaelis was referring to the French biochemist Victor Henri.

⁵⁰ Michaelis, ‘An Autobiography’.

⁵¹ Kaasch, ‘Sensation’, p. 147.

⁵² *Ibid.*

one of the reasons why Abderhalden engaged so strongly in applied work, which was highly esteemed by his peers at the time. In addition, he started other activities aimed at benefitting the general population. Thus he founded the journal *Ethik* and became an activist in the eugenics movement in Germany. The biochemist Eberhard Hofmann characterised Abderhalden as an “epigone”, who had an idea once in his life, around 1912, and who stuck to it ever since; who did not realise and tackle the problems “lying abundantly on the street”: “He did not have enough imagination and scientific ideas, and he lacked originality.”⁵³ Abderhalden considered it important and difficult to find something new.⁵⁴ He knew that he was regarded only as an epigone who followed the ideas of others, in particular Emil Fischer. Editing more than one hundred volumes of the *Handbuch der biologischen Arbeitsmethoden*⁵⁵ is usually not considered a creative undertaking.

So it may be understandable that he wanted to produce something new and great and of enormous practical relevance, something which he alone had discovered, and that he was not prepared to abandon his idea once its failure became obvious. This was possible because he received support from his peers in Germany and because Michaelis’ scientific research practices were not widespread in the community of German medical scientists. In this context we should allow for the fact that Michaelis’ occasional sharp comments may have been a reaction also to the mediocrity of some of the medical scientists with successful academic careers in Germany, who, after all, had denied him an academic position.

3. Michaelis and Abderhalden – Representatives of their Jewish and non-Jewish Peers?

3.1 Social and political aspects

Michaelis was one of many Jewish biochemists who did not receive an academic position at a German university. Some of them were lucky to be promoted in other institutions. Thus his mentor Paul Ehrlich became head of a public and then a private research institute; Carl Neuberg, Otto Warburg, Otto Meyerhof, and the protein chemist Max Bergmann were appointed to leading positions at Kaiser Wilhelm Institutes. Some had already left Germany before 1933. Apart from Michaelis, Jacques Loeb, Karl Landsteiner

⁵³ Eberhard Hofmann in the discussion over Kaasch’s talk, ‘Sensation’, printed there p. 207.

⁵⁴ *Ibid.* Abderhalden wrote this in a letter in 1935.

⁵⁵ *Handbuch der biologischen Arbeitsmethoden. Unter Mitwirkung von 500 bedeutenden Fachmännern herausgegeben*, ed. by Emil Abderhalden, 106 vols., Berlin 1920–1939.

(from Austria), and Fritz Lipmann, all left their home country, the latter two becoming Nobel laureates in 1930 and 1953, respectively.

Unlike the case with physiology, where the separation of physiology from anatomy at German universities took place in a very short time – fifteen chairs were established between 1839 and 1864,⁵⁶ the establishment of independent departments of physiological chemistry (biochemistry) was a very slow process. Despite the fact that the first chair in biochemistry was founded as early as 1845, there were only six full professorships in 1932 with one incumbent, Gustav Embden in Frankfurt, being Jewish. The fact that many (medical) biochemists were Jewish was most probably one of the reasons for the slow institutionalisation of biochemistry at universities.⁵⁷ Non-Jews considered the large number of scientifically influential Jews an impediment to joining together. Thus in 1942 Franz Knoop, professor of physiological chemistry in Tübingen and one of the most distinguished German professors of biochemistry at the time, wrote about the missing leadership among biochemists in the past: “Since in Germany many Jews worked in our discipline, this, too, was a reason for not working more closely together. Neuberg, Embden, Meyerhof, Friedmann, Spiro, Fürth, and others played too big a role; it could only result in disunity.”⁵⁸

The number of newly founded institutes (departments) of biochemistry at German universities increased drastically after Jewish scientists were expelled in 1933, and the German Society for Physiological Chemistry was founded (naturally without Jewish participation) in 1942.⁵⁹ While Emil Fischer was successful in providing a position for his Jewish student Max Bergmann as director of a Kaiser Wilhelm Institute (KWI), Paul Ehrlich and Jewish university professors could not help their students obtain university positions. Thus Ehrlich convinced Michaelis to embark on a career in clinical medicine unless he had enough private money. Rudolf Höber, professor of physiology in Kiel, was unable to promote his assistant Otto Meyerhof (who shared the 1922 Nobel Prize for Medicine despite many efforts, and Otto Warburg told Hans Krebs (who shared the Nobel Prize in 1953 with Fritz Lipmann) to return to clinical medicine after he had spent four years in research with him.

⁵⁶ Joseph Ben-David, *Scientific Growth*, Berkeley, CA 1991, p. 111.

⁵⁷ Various other reasons for the delayed development of medical biochemistry, for example the fear of competition from influential representatives of physiology, have been discussed elsewhere (see for example Deichmann, *Flüchten*, chap. 6.1.1. and references).

⁵⁸ F. Knoop to E. Abderhalden, 28 July 1942, Archive of the Leopoldina Academy, EA 238; see Deichmann, *Flüchten*, pp. 246–247.

⁵⁹ From 1933 to 1944 fourteen institutes of physiological chemistry were founded, which constituted a threefold increase (Deichmann, *Flüchten*, p. 247).

3.2 Research

This section, too, leaves aside the aspect of fraud. Abderhalden's research practice – a strong emphasis on application in various medical and biological areas, predominantly non-quantitative work, non rigorous experimentation, a predilection for concepts of colloid chemistry – was typical of many physiologists and physiological chemists at the time. The sloppiness of their experimentation and their tendency to grand speculative theories was frequently criticised by chemists, for example Emil Fischer who contrasted these practices to the precise experimentation found in organic chemistry: "Regrettably, biological chemistry is that part of our science in which imprecise and incomplete experiments are often heavily padded with the dazzling ornamentation of so-called ingenious reflections to produce pretentious treatises."⁶⁰ Abderhalden's first teacher Gustav von Bunge, a professor of physiology at Basel University, was renowned because of his social activities, in particular his fight against alcoholism, and not because of any scientific achievements. He inspired Abderhalden to publish the *Bibliographie über die gesamte wissenschaftliche Literatur über den Alkohol und den Alkoholismus*.⁶¹ Abderhalden's methodical concepts, for example, concerning pregnancy, cancer or psychiatric diseases fitted prevailing contemporary concepts well. Michaelis wrote in 1921:

In Germany one can succeed only when one presents so-called 'practical' advance, may they be as bad as they may be. Someone who wants to work on pure science and pursues a goal is regarded a one-sided crank, and so he finally stops working. People such as your M. H. Fischer [an American colloid scientist of German origin who promised spectacular medical applications but whose work was highly questionable] are in high esteem here, too. I consider Abderhalden one of them, even though he cannot be denied great organisational talent. But I detest his way of working (*Arbeitsweise*). My position in Germany has suffered because of my opinion against his pregnancy test. Even though there are already many who see through him, nobody dares to say anything against him.⁶²

⁶⁰ Letter from Fischer to Theodor W. Engelmann, 24 February 1904, cited in Fruton, *Contrasts*, p. 193. Interestingly Fischer here still praised Abderhalden as an exception, an assessment that, as Fruton commented, soon proved incorrect. What Fischer failed to see however was that sound biochemical research, for example, on pathways of intermediary metabolism and the nature of enzyme action required not only experimental methods of organic chemistry but also of physical chemistry and biology (*ibid.*, p. 194).

⁶¹ Emil Abderhalden, *Bibliographie über die gesamte wissenschaftliche Literatur über den Alkohol und den Alkoholismus*, Berlin 1904.

⁶² Michaelis, 4 March 1921, to Loeb, Loeb papers, Library of Congress, Manuscript Division, file Michaelis, transl. by the author.

Can we classify Abderhalden's practices as non-Jewish? This is clearly not the case. It is true that he received high acclaim for his work from his non-Jewish peers in medical biochemistry and was appointed president of the prestigious *Deutsche Akademie der Naturforscher Leopoldina*. But, first, the majority of the large number of highly successful non-Jewish (and Jewish) chemists in Germany were famous for their empirical and exact research practices, and, second, there was a large group of Jewish medical scientists whose research practices showed similarities to Abderhalden's.

Abderhalden had Jewish students and assistants, among them Andor Fodor and Ernst Wertheimer, both of whom emigrated to Mandate Palestine – Fodor, who was already a Zionist in the 1920s, Wertheimer after his dismissal in 1933. Fodor attempted to establish chemistry and biochemistry in pre-State Israel on the basis of colloid chemistry.⁶³ The result of committing a science so strongly to this controversial concept was a poor research record. This was remedied only later by another group of scientists from Germany, the chemists Ladislaus Farkas and Ernst David Bergmann, who both fled Hitler.

Generally, a large number of Jews became colloid scientists.⁶⁴ Some stuck to the colloid concept in biochemistry and protein research even after its flaws had become evident. It should be emphasised again that some physical-chemical methods used in colloid chemistry were fertile also in biochemistry, but the dogmatic claim that life processes could not be analysed and explained by existing chemical theories and methods, only by colloidal ones, proved detrimental. One of the Jewish colloid chemists was the protein chemist Wolfgang Pauli of the University of Vienna. For a long time he refused to take the hydrogen ion concentration into account and strongly criticised Michaelis for proposing this new approach (around 1910). According to Pauline Mazumdar, Pauli “presented colloid chemistry as the new expla-

⁶³ Ute Deichmann and Anthony Travis, ‘A German Influence on Science in Mandate Palestine and Israel: Chemistry and Biochemistry’, in *Israel Studies* 9.2 (2004), pp. 34–70.

⁶⁴ Apart from medical scientists a number of Jewish physico-chemists and organic chemists at least for some time used colloid chemistry as a basis for an examination of biological and biochemical phenomena. Three of the thirteen main lectures at the founding conference of the Society for Colloid Chemistry in 1922 were held by Jews, around a third of the forty academic founding members from Germany were Jewish. In 1923, eight of the twenty publications from Fritz Haber's KWI for Physical Chemistry were devoted to topics in colloid chemistry. At the 1926 meeting of the *Gesellschaft deutscher Naturforscher und Ärzte*, many Jewish scientists (also some non-Jews) argued against Hermann Staudinger's macromolecular concept and in favour of a colloid chemical explanation of the phenomena concerning high molecular weight molecules. Among them were the organic chemists Hans Pringsheim, Max Bergmann, Kurt H. Meyer and Richard Willstätter, the latter three, however, changed their opinion soon after (Deichmann, *Flüchten*, chap. 6.1.2).

nation of almost everything in medicine and biology. Ehrlich's structural chemistry was outdated; all that was new and brilliant in modern pathology was a result of the application of the methods of colloid chemistry."⁶⁵ This was similar to Abderhalden's stance. Michaelis was very critical of Pauli's style of research: "I have always disliked the works of Pauli, with his up to seven decimal numbers exact measurements and with a complete lack of theoretical and intellectual rigorousness [*Durcharbeitung*]."⁶⁶

Many Jewish scientists and medical practitioners took up Abderhalden's theory of defence enzymes. According to a cautious estimation at least thirty authors or co-authors of 289 papers dealing with defence enzyme research (around ten per cent of all authors) between 1912 and 1914, which Abderhalden listed in the 1914 edition of his textbook *Abwehrfermente* (Defence Enzymes), were Jews.⁶⁷ A selective reading of some of these illustrates that (apart from Michaelis' refutation) some were moderately critical of the claim of specific defence enzymes, but others, based on experimentation of their own, highly supportive. Their research practices thus seem to have been closer to Abderhalden's than to Michaelis'.

When we turn to Michaelis we find that his research practice – scientific, quantitative and exact, interpreting empirical findings close to experiments, employing a wide range of biological and chemical methodologies, basic as well as applied, and a predilection for chemical, not colloidal concepts – was typical of a very successful group of German medical scientists. They initiated or became leading figures in new and intellectually challenging fields of research at the interface of medicine, biology and chemistry. It is most interesting that this group consisted almost entirely of Jewish scientists.

Members of this group were among others: Paul Ehrlich and Karl Landsteiner (chemical immunology), Jacques Loeb, Max Bergmann, Leonor Michaelis, Otto Warburg (protein chemistry and enzymology), Otto Meyerhof, Fritz Lipmann, and Hans Krebs (bioenergetics and intermediate sugar metabolism), Franz Knoop, Rudolf Schönheimer, Konrad Bloch (after emi-

⁶⁵ Mazumdar, *Species*, p. 227. This is from her comments on Wolfgang Pauli's 'Festival Lecture' to the *K.K. Gesellschaft der Ärzte in Wien* in 1905.

⁶⁶ Michaelis, 8 January 1921, to Loeb, J. Loeb collection, file Michaelis.

⁶⁷ Emil Abderhalden, *Abwehrfermente*, 4th edn., Berlin 1914, pp. 379–400. In many cases this had to be guessed from the names and thus cannot be stated with certainty. The names are: A. Bornstein, H. Deutsch (two entries), Emil Epstein, Ernst Fränkel (three entries), Felix Rosenthal (two entries), Ernst Freund, Richard Freund, Carl Fried, M.E. Goudsmit (two entries), Hans Guggenheimer, Jacob Gutman (two entries), J. Halpern, Paul Hirsch, Hirschfeld, Otto W. Lederer, Johanna Levy, L. Loeb, Otto Lowy, Leonor Michaelis, M. Rubinstein, Henry Schwarz (three entries), E. Friedberger. Unclear cases and thus not included were Fritz Heimann (five entries), Richard Hertz, W. Jonas, V. Kafka (four entries), Lichtenstein (two entries), A. Mayer (three entries), August Mayer, Wilhelm Mayer (five entries), Eugen Weiß, Georg Wolfsohn and Bloch-Normser.

grating to the USA), and Feodor Lynen (intermediate lipid metabolism). Knoop and Lynen were not Jewish.

This group has to be distinguished from the group of German *chemists* who, elucidating the chemical structure of biologically important macromolecules from around 1900 to the 1930s, became highly successful in natural products chemistry. Among them were Adolf von Baeyer and Emil Fischer, the initiators of this field of research; Richard Willstätter and Hans Fischer (chemistry of natural dyestuffs on the basis of porphyrin), Heinrich Wieland, Adolf Windaus and Adolf Butenandt (steroid chemistry), Richard Kuhn (chemistry of vitamins). While von Baeyer and Willstätter were Jewish (Baeyer’s mother was Jewish), Jews were in the minority, but nevertheless made up around twenty per cent of this group. However, the extraordinary success in “dynamic biochemistry” in the first half of the twentieth century in Germany can be specifically related to a group of Jewish medical scientists and thus is a most striking phenomenon. The next question is: How can the prevalent role Jews played in this kind of biochemistry be explained?

4. Reasons for the Success of Jewish Scientists in “Dynamic Biochemistry”

The success of German Jewish biochemists and the background to their success has been extensively analysed elsewhere (this includes a critical evaluation of the applicability of the well-known sociological concepts of “creative scepticism” and “creative niche”, see also the introduction to this volume).⁶⁸ Here I give an overview on those factors which may explain to some extent the emergence of a particular scientific style in biochemistry dominated by Jewish medical scientists.

(i) *A high concentration of individual scientific competences*

Jewish religious tradition has attributed a high value to the study of medicine and the medical professions, and a Jewish influence on the theory and practice of medicine has been described for various countries and cultures from mediaeval times onwards.⁶⁹ Jewish communities in Germany encouraged

⁶⁸ Ute Deichmann, ‘Erfolg und Fachdisziplin. Juden in Chemie und Biomedizin in Deutschland bis 1933’, in *Simon Dubnow Institute Yearbook 3* (2004), pp. 269–292.

⁶⁹ See for example Harry Friedenwald, *The Jews and Medicine*, Baltimore 1944. For the relationship between Jews, Judaism and medicine in Germany, see Werner Kümmel, ‘Jüdische Ärzte in Deutschland zwischen Emanzipation und “Ausschaltung”’, in Gert Preiser (ed.), *Richard Koch und die ärztliche Diagnose*, Hildesheim 1988, pp. 15–47; John M. Efron, *Medicine and the German Jews: A History*, New Haven, CT–London 2001. Ac-

the study of medicine at secular universities long before the legal emancipation in the late nineteenth century. Jews were allowed to study medicine at some German universities despite the general discrimination against Jewish students and physicians. Rudolf Virchow, a well-known German pathologist, spoke with high admiration of the “vigour and the knowledge” by which Jewish physicians had committed themselves for the conservation and the progress of medicine since medieval times.⁷⁰

Social factors contributed to the disproportionate representation of Jews in medicine. The profession of physician was a free profession which did not require civil service status but promised social security. For non-Jewish academics the study of medicine became attractive only later. Until the nineteenth century, faculties of law and theology were of higher reputation than faculties of medicine.⁷¹ As a consequence of the high esteem of the study of medicine in Jewish tradition, many talented and broadly scientifically interested young people studied medicine; they often decided to get an additional education in chemistry or biochemistry. Prominent examples are (in chronological order) Paul Ehrlich, Jacques Loeb, Karl Landsteiner, Carl Neuberg, Otto Warburg, Rudolf Schönheimer, and Fritz Lipmann.

The need for a proper biochemical education for medical students was first recognised in Germany by a Jewish medical scientist, Peter Rona. At the Pathological Institute of the Charité he established informal, mainly methodological courses to train medical graduates in biochemistry. Among the participants were many Jewish students such as Ernst Chain, Felix Haurowitz, Hans Krebs, Fritz Lipmann, Karl Meyer, David Nachmansohn, and few non-Jewish ones, for example Robert Ammon.

(ii) The influence of role models

The rise of dynamic biochemistry took place at a time when chemistry and medical sciences in Germany were internationally renowned and in many fields even led the way. Paul Ehrlich who first introduced organic chemistry into medical science became a role model for many Jewish medical scientists; as indicated above, he had for example a great influence on Michaelis. A highly influential figure in biochemistry was Otto Warburg. He was a student of Emil Fischer, arguably the most renowned organic chemist of the early twentieth century, and adopted Fischer's strong empiricist outlook of

According to Efron, there are only a few activities that can be related so directly with a group of people as medicine is with the Jews (*ibid.*, p. 3).

⁷⁰ Lecture about Morgagni at the International Congress of Medicine in Rome, 1894, cited in Friedenwald, *The Jews and Medicine*, p. 5. Virchow explains these Jewish talents by heredity.

⁷¹ Efron, *Medicine*, p. 59–60.

research, at the heart of which was exact experimentation. Warburg placed great emphasis on the development of exact physical methods in biochemistry. Among the Jewish biochemists whom he strongly influenced were Otto Meyerhof, Hans Krebs, and Fritz Lipmann. According to Lipmann, Warburg’s insistence on letting experiments speak and keeping interpretation to a minimum dominated his (Lipmann’s) generation of biochemists.

(iii) National and international networking between Jewish scientists

Networking was not specific to Jewish scientists. In Germany, it was crucial in order to obtain a post. Hans Krebs observed: “Indeed, getting a junior position very much depended on knowing people, on having a personal connection, on having an effective supporter. This was because it was not customary in Germany to advertise academic positions – in contrast to the British rule.”⁷² Thus Krebs received his first paid post as research assistant to Otto Warburg due to his friendship with the medical scientist Bruno Mendel, Mendel’s friendship with Einstein, and Einstein’s friendship with Warburg. Mendel also approached a benefactor who provided funds.⁷³

As an immigrant in the US since 1891 Jacques Loeb kept strong ties to Europe, especially Germany. Loeb, like Michaelis originally an embryologist, rejected vitalistic and metaphysical explanations for biological phenomena and became a pioneer in looking for physical and chemical explanations of biological phenomena. He had a strong impact on the research practices of some Jewish biochemists in Germany, in particular Michaelis, Meyerhof, and Peter Rona.⁷⁴ Loeb offered to help Meyerhof find a position in the United States. Meyerhof preferred, however, to stay in Germany. When he was awarded the Nobel Prize in 1923 (for 1922) and received an invitation from Yale University, the Kaiser Wilhelm Society offered him a position. It was through Loeb that Michaelis received a position at Johns Hopkins University in the United States.

⁷² Hans Krebs, *Reminiscences and Reflections*, Oxford 1981, pp. 25 f.

⁷³ This began in 1925 and lasted four years (*ibid.*, p. 25).

⁷⁴ Loeb’s influence in Germany becomes evident from his correspondence with many biochemists and physical chemists (Loeb papers, Library of Congress, Manuscript Division). He tried to convince them for example of the importance of the physical and chemical concepts and the flaws of the colloid approach as far as proteins are concerned. A German version of Loeb’s crucial work on the chemical explanation of the colloidal behaviour of proteins (‘Die Erklärung’) appeared despite the opposition of German colloid chemists, in particular Wolfgang Ostwald, because Fritz Haber had sent it to Arnold Berliner, the (Jewish) editor of *Die Naturwissenschaften* (Loeb, 26 May 1923, to Haber, Loeb papers, file Fritz Haber).

(iv) Favourable institutional conditions

Whereas biochemistry was marginalised at universities, in 1913 the Kaiser Wilhelm Society founded several institutes for research in basic as well as applied biochemistry. Interestingly, most of these institutes or departments were headed by Jewish scientists.⁷⁵ These scientists could not offer positions to young colleagues, but they provided research opportunities for postdoctoral fellows and were thus able to pass on their knowledge and style of research. These institutes became international centres of biochemistry. The cosmopolitan attitude of many Jewish scientists contributed to the establishment of international scientific relations even after the First World War, when the Allies had imposed a boycott on German scientists. An example is the close cooperation between Meyerhof and André Lwoff at the Institut Pasteur in Paris. Generally, young scientists from other European countries and the United States considered it desirable to work for some time at these German centres of biochemistry.

In this context it has to be asked, whether the differences of research practices between the two groups of biochemists which are examined here, also reflect their different institutional affiliations. According to Robert Kohler, who has looked at how medical chemistry developed in the scientific discipline of biochemistry in the United States, particular scientific styles flourish only where intellectual priorities are congruent with institutional structures and goals.⁷⁶ While this is true for the high level of biochemical research at Kaiser Wilhelm Institutes, this conclusion does not provide an explanation for the origin of the differences in question. Only few of the scientifically oriented Jewish biochemists received a position at a Kaiser Wilhelm Institute and all of them had already developed contents and methods of their work when they were still at a university institute. Prominent examples are the research projects on the biochemistry of intermediary metabolism, which was about to become the most flourishing field of basic biochemistry. Among them are Hans Krebs' elucidation of the urea cycle which was begun and completed while he was an assistant at the University of Freiburg, Otto Meyerhof's work on muscle biochemistry, which was begun at the University of Kiel and continued at the KWIs for Biology and Medical Research,

⁷⁵ Carl Neuberg, director of the Kaiser Wilhelm Institute (KWI) for Biochemistry (as successor to August von Wassermann), was a pioneer in the biochemistry of intermediary metabolism, Max Bergmann, director of the KWI for Leather Research, conducted protein chemistry, Otto Warburg, director of the KWI for Cell Physiology, was an international leader in the area of biochemistry and biophysics of enzymes, and Otto Meyerhof, head of the department of Physiology at the KWI for Medical Research, was an international leader in the biochemistry of sugar metabolism in cells.

⁷⁶ Robert Kohler, *From Medical Chemistry to Biochemistry: The Making of a Biomedical Discipline*, Cambridge 1982, p. 324, and *passim*.

and Rudolf Schönheimer's research on arteriosclerosis, which he began and re-oriented to the question of intermediary metabolism of cholesterol while he was at the University of Freiburg. Krebs and Schönheimer were expelled from Germany in 1933.

According to the preceding, it does not seem likely that they would have received one of the few professorships of biochemistry had they not been dismissed, despite their already great international scientific renown. Emigration in particular to the United States but also England in these cases provided research opportunities, which most of them would not have found in Germany. In contrast to many other disciplines, émigrés of biochemistry succeeded in transforming American biochemistry from a purely practically oriented field to a scientific discipline with a new theoretical and methodological framework and new possibilities of application, as was stated by Harvard Medical School biochemist Eugene Kennedy:

Prior to the Second World War, biochemistry in the United States had a strong flavor of clinical chemistry. ... American students had to go abroad to Germany or to England for training in what came to be called dynamic aspects of biochemistry. After the war, the flow of students was largely reversed. This transformation was in considerable part the result of new insights and new approaches brought to America by immigrant scientists.⁷⁷

5. Conclusion

Summarising the results, we might feel tempted to speak of a “Jewish biochemistry” in early twentieth century Germany. But this obscures the historical situation. We can distinguish a research practice which was typical of the group of mainly Jewish biochemists and, among other things, can be related to the fact that the study of medicine had a high reputation among Jews for centuries with the result that the most talented young people chose to study this subject. Through this practice – scientific, quantitative and exact, employing a wide range of biological and chemical methodologies, basic as well as applied, and a predilection for chemical instead of colloid chemical concepts – members of this group initiated or became leading figures in new and intellectually challenging fields of research in the interface of medicine, biology and chemistry, in particular immunology, enzymology and intermediate metabolism. The extraordinary success of German science in “dynamic biochemistry” in the first third of the twentieth century was related to these Jewish medical scientists. But there were a number of Jewish biochemists who did not belong to this group and rather shared characteristics

⁷⁷ Eugene P. Kennedy, ‘Hitler's Gift and the Era of Biosynthesis’, in *Journal of Biological Chemistry* 276 (2001), pp. 42619–42631, here p. 42619.

with the majority of non-Jewish German medical biochemists at the time, namely a strong emphasis on medical application, a comparably poor methodology, non rigorous experimentation, and a predilection for concepts of colloid chemistry.

The other question raised at the beginning can be answered more definitely. That is, for a “German style of science”, which Jonathan Harwood found with refugees in the United States, did it matter that most German refugees were Jewish? The results of this paper suggest that it did at least in biochemistry. The dominant research style of the refugees in biochemistry in the United States was that of the “Jewish” group and it was exactly this style which brought about their success after their forced emigration. To quote from Harwood’s defence against the reproach that his study serves national stereotypes:

I hope it is clear, however, that this stereotype actually bears little relation to the academic culture which I have ascribed to German-speaking scholars. Breadth of knowledge, for example, is evidently not part of this stereotype. And notice that the importance placed upon theory which I found among German [refugee] scholars is *not* the same as a fondness for ‘speculation’. While the stereotype suggests that German professors were typically armchair philosophers with little concern for empirical matters, my evidence indicates that the great majority of these scholars were engaged in empirical research but were nonetheless concerned to develop a theoretical understanding of their subject matter which integrated a relatively wider range of phenomena.⁷⁸

These research characteristics fit well those of the group of – mainly Jewish – biochemists analysed here. It was the unique combination of empirical research and theorising as well as the breadth of research and bridging of various scientific fields that characterised this group of biochemists in Germany or as refugees.

The emergence of this highly successful “German-Jewish biochemistry” in the first third of the twentieth century was a result of individual competences particularly of Jewish medical scientists, of model building and networking among Jewish scientists and of particularities of scientific and institutional developments of chemistry and biochemistry in Germany. The lack of career opportunities for talented Jewish biochemists at universities even before 1933 was not only the result of antisemitism but also of their research practices, which differed from those in mainstream physiology and medical biochemistry at universities. Landsteiner, Michaelis, and Meyerhof are typical examples of researchers who detested “this way of working”.

⁷⁸ Harwood, ‘National Differences’, p. 76 (emphasis in the original).

III. The Impact of Religious and Ideological Attitudes

Three Zionist Men of Science: Between Nature and Nurture*

Raphael Falk

Theodor Herzl (1860–1904) could promote Zionism precisely because it was completely embedded in the cultural and political milieu of Europe at the end of the nineteenth century. Neo-Romanticism of *fin de siècle* Europe, tangled between the fears and despairs of post-Enlightenment *Kultur* and the respect and awe for post-industrialist scientific rationality, or *Zivilisation*. This provided the stage for Herzl's utopia of rational exploitation of the achievements of science and technology on the one hand and social accountability of individuals and collectives of people on the other. Much of the history of Zionism may be viewed as a continuing struggle between the ideals of universal humanism and of ethnocentric nationalism or as a conflict between emphasizing either the historical-cultural or the historical-biological aspects of Judaism. Furthermore, Zionism needed to react to a concept of antisemitism which had become increasingly biological-racist in nature, and this made it inherently preoccupied with the biology of the Jews: the claim for a political entity in Palestine was founded on a claim of an immanent national *nature*, not merely on a contingent *nurture* of religious and cultural heritage.

Although Herzl founded Zionism thirty-two years after Francis Galton (1822–1911) conceived of eugenics, both pursued utopias based on similar intellectual and emotional backgrounds. Whereas eugenics aspired to redeem the human species – more precisely, the European human species – by forcing it to face the realities of its biological nature, Zionism aspired to redeem the Jewish people by forcing it to face the realities of its biological existence. Furthermore, Zionism like early eugenics was affected, although to a lesser extent, by the misconstrued social notions of Darwinism. The Zionist cause appeared to make sense not only as a socio-political solution to the “Jewish problem”, but also as one conforming to the insights of the early twentieth century science of genetics of the distinct Jewish ethnic properties.

* In memory of my friend and colleague Jacob Wahrman (1924–2005). I wish to acknowledge the constructive manuscript-editing of Gabriele Rahaman.

Theodor Herzl published his utopian novel *Altneuland* in 1902; Francis Galton wrote his utopia *Kantsaywhere* in 1910, but only fragments of it were published by Karl Pearson many years later.¹ Although both utopias inspired many people to have a deep emotional involvement with the ideas of a new social and political world so that they were ready to devote their skills to the accomplishment of these utopias, their fates greatly diverged. Eugenics radiated and appealed mainly socially upwards, not only to the intelligentsia, the scientists and physicians, but also to the dominating circles in politics and economics. Zionism, on the other hand, radiated socially downwards, it appealed to the masses of socially and economically deprived Jews in Eastern Europe and elsewhere. So it came about that while one culminated in the catastrophe of Nazi racial ideology in the Third Reich, the other led to the establishment of a national homeland for the Jewish people in Israel.

Notwithstanding these later developments, in the first decades of the twentieth century men and women were avidly promoting both eugenics and Zionism. In this article I will discuss three Jewish men of science of diametrically different backgrounds, who were captured by Zionist ideology but also adopted and combined it with notions of eugenics current in the first decades of the twentieth century:

Shneur Zalman Bychowski was born into a hasidic family in the Jewish pale and studied science in Vienna and Warsaw. He became a physician and settled as a psychiatrist and neurologist in Warsaw. He was deeply involved in the public life of his community and was committed to Zionism. Although he visited Palestine twice, and had friends amongst its intellectual figures, he never managed to emigrate.

Redcliffe Nathan Salaman belonged to an upper class Jewish family in England, with many relations in the circles of science, art, and politics. He became a physician and virologist and an active member of the British Eugenics Society. Being deeply involved in public activities in his community he volunteered to be a doctor of the Jewish troops in Egypt and Palestine during First World War. He joined the Zionist cause and was later involved in its activities as a trustee of the Hebrew University and elsewhere. He never intended to settle in Palestine.

Fritz Shimon Bodenheimer was the son of one of Herzl's early followers. He started as a German national patriot, but reverted to Jewish nationalism. He studied applied entomology because he believed that this would be of importance for the Zionist settlement of Palestine. He emigrated to Palestine in 1922 and became one of the first professors at the Hebrew University.

¹ Karl Pearson, *The Life, Letters and Labours of Francis Galton*, vol. 1–3, Cambridge 1914–1930, pp. 411 ff.

As a scientist interested in the dynamics of living populations he also became involved in human “geopolitics” and hence in the problems of eugenics.

Shneor Zalman Bychowski (1865–1934)

Shneor Zalman (Zygmunt) Bychowski was born in 1865 in Koritz (Wollin) into a wealthy hasidic family. He left home at the age of seventeen to study philosophy and natural sciences in Vienna against the wishes of his parents. After his father retracted his banishment and supported him, Bychowski completed his matriculation late as an external student, and eventually graduated in medicine in Warsaw.

Bychowski was active in the *Chibat Zion* movement, and served as a delegate to the First Zionist Congress in Basle in 1897. Although he participated in several later congresses and visited Palestine, once after he finished his studies and again shortly before his death, he never settled there. He died in Warsaw on 14 September 1934.²

Bychowski specialised in psychiatry and was active as a neurologist in a (non-Jewish) hospital in the Praga suburb of Warsaw. He founded and ran for years what has been referred to as a “medical seminar” for the research of mental and physical conditions of the Jews. Bychowski was also active in public affairs. He was an avid writer and published many articles in professional medical and other journals in Polish, German, Russian, French, Yiddish and Hebrew on medicine and hygiene, as well as on community affairs.

Many of Bychowski’s articles were published in the Yiddish dailies such as *Haynt* and *Moment*. In Hebrew, he contributed to the literary periodicals *Ha-Zefrah* and *Ha-Tekufah*. His writings included reports from Zionist congresses and from post-revolutionary Russia, as well as from medical meetings in Poland and abroad. Many articles refer to Jewish matters, like the hygiene of Jewish slaughter laws. Some are on pure psycho-medical matters, such as one on epilepsy or another one entitled ‘On sleep’. He also translated books and wrote introductory chapters to medical texts in Yiddish, for instance to Gershon Levin’s *Hygiene bei Yidden Amol un Azind* (Hygiene of Jews: Past and Present) published in 1925. Unlike many east European Jewish intellectuals in the early decades of the twentieth century, who sublimated their traditional Jewish life patterns by seemingly integrating with the so-called progressive society of their countries of domicile, Bychowski did not “assimilate”, but rather maintained a deep identification with his people.³

² Raphael Falk, ‘Nervous Diseases and Eugenics of the Jews: A View from 1918’, in *Korot* 20 (2003–2004), pp. 23–46.

³ I. M. Neimann, in an obituary in *Haynt* of 18 September 1934, p. 6, related that “He was one of the few who, although taken by the national ideas, also appreciated the

He was, however, often torn between the hope for a new Jewish life in the revolutionary new socialist order in Eastern Europe and the appeal of the Zionist promise for a revival of Jewish national life in the ancient homeland in Palestine.⁴ His public activities included serving as a member of the Warsaw municipality and, after the First World War, founding the *Maccabi* organisation in Poland and heading it for many years.

In 1918 Bychowski published an article entitled 'Nervous diseases and eugenics among the Jews' in the Hebrew periodical *Ha-Tekufah*.⁵

It is agreed and settled among experts of neuropathology that Jews are especially prone to nervous diseases. Nevertheless, this opinion has no solid foundations; pursuing it would reveal that it deserves examination and must be further contemplated and doubted.⁶

This was an epidemiological analysis of nervous diseases among the Jews in search of their etiology. But beyond the professional aspects, the importance of Bychowski's article is in his dealing more specifically with the social and political predicaments of Eastern European Jews facing the challenges of Jewish emancipation and Zionism. This article was followed three years later by a more journalistic essay in Yiddish on 'Jewish nerves [neuropathies] and Jewish degeneration', in which Bychowski traced the origins of Charcot's notion of the "Wandering Jew" neuropathy⁷ and, as we shall see, tried to rebuff this and other legends that the Jewish race was degenerating. As he noted: "For years I have been occupying myself with that problem [of Jewish

virtues of the Salon-assimilationists. The apparent internal conflict bothered him only slightly: He saw the whole picture. ... He belonged to the Warsaw generation that carried the pillars of Jewish Renaissance."

⁴ *Ibid.*, "A year ago, during an intimate discussion between Warsaw intellectuals, a young lady, a known Salon-leftist, had spoken with flame and fiery enthusiasm against Jewish nationalism. Bychowski, in his good-natured tone commented that he too has had dreams of all peoples' brotherhood. At present, however, it is winter in the world ... and in winter, one must wear a fur. When the day of the Spring of Nations will arrive, we Jews too will discard the fur."

⁵ *Ha-Tekufah* was founded in 1918 in Moscow by Abraham Joseph Stybel, shortly before the implementation of the decree of the Bolshevik regime that forbade publications in the Hebrew language and confiscated its printing-presses. The publishing house was moved to Warsaw and later to Berlin (the periodical was eventually published in Tel-Aviv and finally in New York, until 1950); Dania Amichay-Michlin, *The Love of A. J. Stybel*, Jerusalem 2000, p.62 [Hebrew]; *Encyclopedia Judaica*, vol. 7, Jerusalem 1971, p. 1469.

⁶ Shneur Zalman Bychowski, 'Nervous Diseases and Eugenics in Jews', in *Ha-Tekufah* 2 (1918), pp. 289–307, here p. 289 (Hebrew).

⁷ The French neurologist, Jean-Martin Charcot (1825–1893) – Sigmund Freud was one of his students – defined the "Wandering Jew" (*le juif errant*) syndrome as a special disease, which Bychowski described in tragic and comic colours; see also Jan Goldstein, 'The Wandering Jew and the Problem of Psychiatric Anti-Semitism in Fin-de-Siècle France', in *Journal of Contemporary History* 20 (1985), pp. 521–52.

nervous diseases and Jewish degeneration]. It interests me as a doctor, it irritates me as a Jew, and it torments me as a Zionist.”⁸

Like many at the time, Bychowski believed in the absolute power of science not only in finding the truth about the material world, but also in its impact on social affairs. As such, and although his knowledge in genetics was limited, Bychowski was enthusiastic about the eugenic idea and fervently advocated harsh measures to prevent the degeneration of the Jewish nation in order to uphold its viability. Yet he categorically denied that the specific Jewish neuropathies were of a hereditary nature against which eugenic measures would be effective. Criticising many of the methods used for collecting the evidence, he asserted that the presumed proneness of Jews to neuropathies was due to two cultural factors: one was the Jewish bias of frequently consulting doctors; the roots of which were deeply ingrained in the Jewish cultural tradition and thus in their mental make-up; the other was gentile antisemitism, primarily in Eastern Europe where persecutions had made Jews’ life extremely miserable and precarious.

What are the mental factors that make the Jew value health to such an extent that any effort and expense is not too much for him as long as he will find the path to elusive health? ... First of all, deep in the heart of the Jew is a complete faith in the power of science and the wise men that carry it out. ... Health is the most precious gift according to the Jewish conception ... [Second,] in the Jewish soul there is no determinism, no surrender to blind fate, but rather a belief in supreme grace. Even when a sharp sword is pointed at one’s throat, said the sages, one should not despair of [receiving] mercy.⁹

Whereas,

[i]n Russia there were 6–7 million Jews. ... All the laws created for the Jews had only one single purpose: to shorten the time to the desired moment of the annihilation of all the Jews in Russia. Under such circumstances it was frivolous to deal with the eugenic aspect of the problem [of comparative pathology] for the Jews: the Czarist henchmen had already taken care of the problem in their own way.¹⁰

Bychowski was aware that “even the best friends of the Jewish people ([Cesare] Lombroso, [Max] Nordau) believe that the nerves of the Jews are fragile and that they are liable to various diseases, leading to the degeneration of our race”.¹¹ Yet, he rejected out of hand as “sheer nonsense” the claim of exogenous factors, like those of “thousands of years of the nation’s existence” producing traits such as “immunity against drunkenness and syphilis”.¹²

⁸ Shneur Zalman Bychowski, ‘Yiddishe Nerven Un Yiddishe Degeneratie’, in *Almanac for the 10th Jubileum of Moment*, Warsaw 1921, pp. 115–26, here p. 117, (Yiddish).

⁹ Bychowski, ‘Nervous Diseases’, pp. 292 f.

¹⁰ *Ibid.*, p. 294.

¹¹ *Ibid.*

¹² *Ibid.*, pp. 296 f.; it should be noted that Bychowski was not a researcher-scientist.

As far as endogenous factors were concerned, these were usually characterised, according to Bychowski, by inborn anatomical changes detectable in the nervous system. Judging by his personal impression, some such nervous diseases accompanied by malformations, were indeed relatively frequent among Jews:

It seems to me that some endogenous diseases that are inherited, like dystrophy of the muscles, ... are rare among Jews. But "Friedrich's disease", the intermittent paralysis of hands and feet and myasthenia, are relatively frequent in our people. There is one hereditary nervous disease, a severe one that has no medical relief, which is present almost exclusively among Jews. This is "Tay-Sachs disease" or "familial amaurotic idiocy", a major characteristic of which is total blindness. It must, however, be pointed out that most of these diseases which are of great scientific interest in neuropathology, are of little eugenic significance. They hardly affect the civil life of humanity and (usually) do not affect its mental development. Most of these diseases are detected already in early childhood ... only rarely do these individuals reach maturity and produce children, thus it is not common that they will transmit their disease to others.¹³

Obviously, Bychowski conceived of the hereditary nature of the diseases, but he failed to appreciate the insight of Mendelian genetics, of how a disease like Tay-Sachs is propagated by the heterozygous relatives of the patients, rather than by the patients themselves. Thus, although he noted that "consanguineous matings" are common among Jews and that "it is known that the Jews are strictly careful in keeping the purity of their race and thus avoid intermarriages"¹⁴, he rejected the assessment of consanguinity and its impact on the problem of the degeneration of the Jews. He brought evidence from plants and animals, and from human communities that indicated to him the misfit of "hybrids". Accordingly, Bychowski asserted that only the preservation of the purity of the stock, sometimes even the purity of the family, lest foreign blood penetrate it, would guarantee the capacity to go on and produce excellent progeny. Furthermore, he found no evidence for claims that nations undergo consecutive developmental periods analogous to those of individuals – childhood, maturity, and senescence – and were, accordingly, doomed to inevitable death.

As far as actual hereditary traits were concerned, Bychowski had no hesitation in recommending harsh eugenic means against individuals who threaten the integrity of a community, and in the present context, the efforts of the Zionists in securing the future of the Jewish nation:

He was a practising physician, and the evidence he cited was based on his clinical experience.

¹³ Bychowski, 'Nervous Diseases', pp. 298 f.

¹⁴ *Ibid.*, pp. 299 f.

It is deplorable that we must mention here the habit spread among Polish and Lithuanian Jews, not to let a man remain bachelor even when he is sick and may transmit the disease to his progeny. ... Such a prejudice, which may cause a great loss to the nation, we must fight with all our means. This must be especially noted by those who construct the future of the nation – the Zionists. The resurrection of the nation in its homeland will be possible only if the “human material” that will go there will be healthy. In this respect it will be necessary to apply from the beginning strict means, like the “law” against immigration that has been introduced in the United States. It is of special significance that the Zionists should learn to view marriage not as a personal act that one may handle as one’s heart may wish, but rather as an important public act, on which depends the future of the race, the flourishing of the nation and its hopes – the next generation. If there are reasons to believe that a marriage may produce sick children, this must be strictly forbidden. The Zionists must be especially careful, when they come to rebuild anew the life of the nation. It is necessary to make much propaganda in Palestine also against the notion of [having only] “one or two children,” which leads to the annihilation of the race.¹⁵

However, as for the common neuropathies of the Jews, Bychowski suggested adding to the *exogenic* and *endogenic* factors of nervous diseases also *perigenic* causes – “factors that depend on the environment”¹⁶ – which include influences such as education in early childhood and the atmosphere at home and in school. By exogenic factors Bychowski meant general causes, like religion, tradition (intermarriage), or climate, whereas when using the term perigenic factors he referred to more specific, individual causes, like poverty, personal persecution, and education. “Current neuropathology aims for practical targets, striving to cure body and soul, and therefore pays special attention to these perigenic factors.”¹⁷ Even more significantly, the perigenic etiology differs from the etiology of external and internal factors which are much more difficult to change.

Bychowski noted that the patients who provided research material for Charcot’s work on the “Wandering Jew” syndrome all belonged to the group he termed “neurostens” and “psychostens” and that “as a rule, most of these patients are not hindered by their sufferings from pursuing various occupations that demand much effort and mental activities. ... Even when they are sick, they go on enjoying this world and live full and extensive lives. All neuropathologists attest that Jews from Russia and Poland constitute the majority of that kind of patient.” But already among the progeny of these people who were born in America, “the number of nervous disturbances is decreasing, whereas that of syphilis patients and drunkards increases”.¹⁸ The evidence for the perigenic rather than the endogenic etiology of the Jewish

¹⁵ *Ibid.*, p. 299.

¹⁶ *Ibid.*, p. 302.

¹⁷ *Ibid.*, p. 302.

¹⁸ *Ibid.*, p. 303.

neuropathies like that of the “Wandering Jew,” was, according to Bychowski, that they were critically linked to the actual living conditions of the Jews in Eastern Europe, or more specifically, in Tsarist Russia. It was merely the life of the Jews of Russia that was riddled with so many conflicts, full of anomalies and sickness, all of which must have led to the diminishment of physical capacities; moreover, Jews had also been oppressed by hard work and their life of suffering.

Among the Jews of Russia and Poland we do not find the usual kind of struggle for existence encountered all over Europe. Their lives were a specific “Jewish” struggle for each piece of bread, for a sip of water to drink, and for some air to breathe. This was a struggle for the privilege to stay overnight outside a goods-truck, for the right to enrol in school and even for the right to receive medical attention. ... Thus they have been living a life of fear, hunger and worries about pogroms and alarms. Inevitably, such life had a pathological effect on the souls of individuals, especially those blessed by a soft heart, by a fragile and sensitive spirit, one that is easily impressed by external circumstances.¹⁹

However from the eugenic perspective there was no reason to fear for the future. As Bychowski had shown, “contrary to the exogenic and endogenic factors, the impressions that the perigenic factors leave are temporary and may be erased. The nervous systems of the Jews have remained whole, with no permanent defect”.²⁰

But then, according to Bychowski’s perception, things began to change: “Now, as the sun of freedom has been shining over this [Russian] empire, and after the heavy shackles have been taken off millions of its inhabitants, many of whom are Jews, the problem obtains special significance”.²¹ Since “the Russian revolution has abolished all our restrictions it provides a wonderful cure for the nerves of the sons of Israel. ... In the free Russia there will be no room for ‘our nervousness’. The ‘Wandering Jew’ will remain only in the world of stories and fantasies.”²²

The eugenically minded Bychowski ended his article “with the presentation of some ideas that have practical significance”: he had no doubt that the moment the universities opened their gates to Jews they would flock in their thousands to the traditional professions of Law and Medicine.

I wonder if from a eugenic perspective this is to be recommended. For the Jews it would be preferable that the new generation will strengthen its physical powers, that its nerves which were strained under difficult and bitter conditions, will rest somewhat, and will absorb new impressions and the will and energy of our young people would be revealed in new professions. Therefore, I think it is preferable that the young people of Israel enter agricultural and technical schools. ... Obviously one should not

¹⁹ *Ibid.*, pp. 304 f.

²⁰ *Ibid.*, p. 306.

²¹ *Ibid.*, p. 294.

²² *Ibid.*, p. 307.

oppose the inclinations of a youngster to a specific profession. It is, however, well known that most young persons entering higher education do not consider all the consequences concerning the profession they chose.²³

Bychowski was concerned with the future of the Jews as a nation. He repeatedly emphasised that with due respect to the inclinations and the needs of individuals, rationally the good of the community must get priority over that of the individuals, hence his support for eugenics on the one hand and for Zionism on the other. His concern was, however, also with the new liberty given to Jews, and the future that it promised the Jewish individuals. Thus, he called for a major educational and propaganda effort that would bring about a social, rather than a eugenic reform among the Jews, on their way to becoming “citizens with equal rights among nations,” for the good of the race and for future generations.

Bychowski reveals the genuine concern of the general intellectual community about the role of eugenic, or race hygiene, in the future of nations, often without proper understanding of its biological foundations. Jewish researchers and politicians alike often accepted the largely antisemitic claims that the Jewish people had become “biologically” degenerate.²⁴ Bychowski, too, seemed to accept this general notion, but he mobilised all his intellectual and professional capacities to prove that this was *not* the cause for the “typical Jewish” neuropathologies. His article is a vibrant illustration of the tension and expectations of an intellectual Jew after the First World War: he was a believer in rational thinking, though aware of its methodological pitfalls, as well as a social-democratic man of the world who also expected to fulfil his people’s longing for national expression within such a rational socio-democratic framework.

Redcliffe Nathan Salaman (1874–1955)

Soon after the establishment of the science of genetics, the *Journal of Genetics* published a paper in 1911 on the ‘Heredity of the Jews’ in its very first volume.²⁵ The author, Redcliffe N. Salaman, a British biologist and medical

²³ *Ibid.*

²⁴ See John M. Efron, *Defenders of the Race: Jewish Doctors and Race Science in Fin-De-Siècle Europe*, New Haven, CT–London 1994; Raphael Falk, ‘Zionism and the Biology of the Jews’, in *Science in Context* 11 (1998), pp. 587–607; *idem*, ‘Zionism, Race and Eugenics’, in Geoffrey Cantor and Marc Swetlitz (eds.), *Jewish Tradition and the Challenge of Evolution*, Chicago (2006, in press); Mitchell B. Hart, *Social Science and the Politics of Modern Jewish Identity* (Stanford Series in Jewish History and Culture, edited by Aron Rodrigue and Steven J. Zipperstein), Stanford, CA 2000.

²⁵ Redcliffe N. Salaman, ‘Heredity and the Jew’, in *Journal of Genetics* 1 (1911), pp. 273–292.

doctor of Jewish origin and a friend of the founder of Mendelian genetics, William Bateson, was neither a professional anthropologist nor a student of Judaism. He selected the potato as the object of his research, and discovered the genetic resistance of potato blight in 1908. In 1926 he founded an institute for the investigation of viral plant diseases specialising in research on the potato plant. Salaman's interest in the heredity of the Jews as an extension of his involvement in plant genetics, stemmed primarily from his identification with his people. His family, originally from Romania, had settled three generations earlier in Britain and soon advanced to the well-established upper middle class of society. His sister, Brenda Z. Salaman, an anthropologist in her own right, was married to the Oxford anthropologist Charles G. Seligman, author of *Races of Africa*. His first wife, Nina (née Davis; 1877–1925), daughter of an engineer and a distinguished Bible scholar, was herself an outstanding scholar of the Spanish Hebrew period. Among their six children there were a pathologist, a medical practitioner, an engineer, an artist, and a singer.²⁶ Redcliffe Nathan Salaman was elected Fellow of the Royal Society in 1935. As his biographer testified, he “was a man of culture and wide interests” involved in many local and Jewish communal activities and “deeply interested in the Hebrew University of Jerusalem ... [who] did much to help in its earlier years”.²⁷ He was one of the three members of the Hartog Committee, the visiting committee that was instrumental in the reorganisation of the university in the mid 1930s, and “made an annual visit to Jerusalem for the meetings of the Board of Governors.” In 1917, during the First World War, although originally not interested in the formation of a Jewish battalion (or in Zionism), Salaman became medical officer to the Jewish regiment of the British army, and according to his own account treated over five thousand men.²⁸ In April 1918 he arrived in Egypt, and was later a member of the troops that conquered Palestine. Service in the Jewish regiment and the encounter with the settlers whom he met in Palestine was an experience the like of which he had never dreamt of. This marked a turning point in Sala-

²⁶ Kenneth M Smith, ‘Redcliffe Nathan Salaman, 1874–1955’, in *Biographical Memoirs of Fellows of the Royal Society* I (1955), pp. 239–245; also Elazar Barkan, *The Retreat of Scientific Racism*, Cambridge 1992, p. 31. For a recent detailed biography of Salaman see Todd M. Endelman, ‘Anglo-Jewish Scientists and the Science of Race’, in *Jewish Social Studies* 11 (2004), pp. 52–92; see also Dan Stone, ‘Of peas, potatoes, and Jews: Redcliffe N. Salaman and the British debate over Jewish racial origins’ in *Simon Dubnow Institute Yearbook* 3 (2004), pp. 221–240.

²⁷ Smith, ‘Redcliffe Nathan Salaman’, p. 243.

²⁸ Redcliffe N Salaman, ‘Some Notes on the Jewish Problem’, in Charles B. Davenport, Henry Fairfield Osborn, Clark Wissler and H. H. Laughlin (eds.), *Eugenics in Race and State: Second International Congress of Eugenics*, Baltimore, MD 1923, pp. 134–53, here p. 147.

man's attachment to Jewish nationalism.²⁹ He published his memoirs, entitled *Palestine Reclaimed*, in 1920.³⁰ As his paper of 1911 and the many later papers on the genetics of the Jews indicate, he was deeply committed to the establishment of a new academic subject concerning the biology of the Jews based on the new science of genetics:

The object of this paper is to lay before the Anthropologists some results in the domain of Ethnology which, though arrived by methods as yet foreign to anthropological research, promise a rich harvest in every direction. Mendelian methods ... have for the last decade been the all-powerful weapons of the modern student of heredity.³¹

Though not a professional anthropologist, Salaman's own education and his family made him well aware of the methodologies and theories of anthropology in general, and those concerning Jews in particular. Contrary to many Jewish scholars in Western countries he was convinced that the Jews of today constituted a cohesive biological entity, rather than merely a social or religious one. This by itself made his course closely interrelated with that of the Zionists. Although Salaman never drew the ultimate consequence of his Zionism, namely emigration to the Jewish homeland – or because of it, believing that in his position he could best help shape Zion as a Western haven for needy Jews³² – I contend that we should view him as an authentic representative of those Jews who considered their Jewishness primarily as a biological fact, and Zionism as its socio-political consequence.

Contrary to the East European physician Samuel Weissenberg's³³ equivocal claim that “[t]he Jew in an anthropological sense forms no specific type, but the facial expression is absolutely characteristic,” and that of the Ameri-

²⁹ Endelman, p. 71.

³⁰ Redcliffe N. Salaman, *Palestine Reclaimed*, London 1920.

³¹ Salaman, 'Heredity', p. 273.

³² In 1950 Salaman noted: “To-day we have to thank our most deadly enemy for determining the direction towards which our hopes and visions should be directed – once more back to the land of our ancestors. Even so, the Jew, happily Nature's most illogical creation, seems determined to go East but never to be orientalized. So strong is this eastward current of thought that there are not a few among us ... who think that the time has come for the liquidation of the *Galuth* – that all that is left for us to do is to pack and either migrate to Israel or lose ourselves finally in the Gentile ocean around us.” Redcliffe N. Salaman, 'Foreword', in Cecil Roth, *The Record of European Jewry*, London 1950, pp. 5 f.; as Endelman, p. 69, notes, Salaman “doubted that Western Jews felt sufficiently oppressed that they would choose to settle [in Israel] in order to live freer, more creative lives.”

³³ Samuel Abramovich Weissenberg (1867–1928) was born and died in Ukraine. He expanded the study of the physical anthropology of the Jews. Weissenberg visited many Jewish communities in Central Asia and the Middle East and believed that he had detected the typical *Urjude* in the scattered Jewish communities of Peki'in and Safed. Although Weissenberg attended the Zionist Congress in 1905, he seemed to remain “a tepid supporter” of the movement, and “[h]is commitment to the Diaspora Jews was far greater” (Efron, *Defenders of the Race*, pp. 92 ff.).

can demographer Maurice Fishberg who recognised in the characteristic facial expression of the Jews not strictly a physical trait but rather an expression of the soul,³⁴ Salaman set out to identify the “unmistakable Jewish expression” experimentally:

[C]onsider the relation which the existence of the *Kohanim* has to the question of the Jewish type. The *Kohanim* are the traditional descendants of the tribe of Aaron. ... no Kohen, according to the Jewish law, can marry a stranger, a proselyte or the daughter of a proselyte, or a divorcée: so we have a sect whose descent may be regarded as strictly Jewish.³⁵

Salaman, however, admitted that “[i]f now we review the physiognomies of the various *Kohanim*, it will be found that they exhibit no type in any way distinct from that of other Jews.”³⁶ Still, Salaman stated that “whether blonde or dark, tall or short, long headed or round headed, the Jew is a Jew because he looks like one.”³⁷ Accepting this as an axiomatic fact, Salaman exposed the Jewish facial features to empirical examination on Mendelian lines. He examined the progeny of 138 Jewish-Gentile alliances, and asked observers to classify them: 328 of the progeny were classified as “Gentile”, twenty-six as “Jew” and only eight as “Intermediate.” He concluded that “the Jewish facial type ... is a character which is subject to the Mendelian

³⁴ Maurice Fishberg (1872–1934), in his book *The Jews: A Study of Race and Environment*, London 1911, claimed that the difference between Jews and Christians are not everywhere racial, but may be solely the result of the social and political environment. He was optimistic with regard to the ultimate obliteration of all distinctions between Jews and Christians in Europe and America. His optimism, he claimed, was confirmed by conditions in Italy, Scandinavia, and Australia, where antisemitism was practically unknown. The Zionist claim for national identity only obstructed the process of the assimilation of the Jews (see also Hart, pp. 158–168).

³⁵ Salaman, ‘Heredity’, p. 279.

³⁶ This issue was nevertheless recycled again and again. Lately it has surfaced, utilising the most up-to-date molecular genotyping, and as usual, it is formulated in terms of pure scientific interest in “rates and mechanisms of Y-chromosome evolution”; this and the following statement are taken from Skorecki *et al.*, ‘Y-Chromosomes of Jewish Priests’, in *Nature* 385 (1997), p. 32: “Comparing the Y-chromosomes of priestly *Cohanim* lineage with lay Jews found a clear difference in the relative frequencies of certain sets of alleles at closely linked loci, consistent with the priesthood having been inherited paternally. Jewish priesthood predates the division of the world Jewry into Ashkenazi and Sephardi communities. Studies of these accumulated differences in the Y-chromosome during the relatively short time (ca. 3300 years) since establishment of the Jewish priesthood may help determine rates and mechanisms of Y-chromosome evolution.” The objective, disinterested scientific claim, however, was of little avail: the findings were heralded in newspapers all over the world. As I have been told by one of the paper’s authors, within days of appearance on the pages of the local newspapers this person was flooded with telephone calls from interested parties requesting to be examined in order to uphold one personal claim or another.

³⁷ Salaman, ‘Heredity’, p. 278.

law of Heredity".³⁸ In the best tradition of eugenics of that time, the features were determined by one gene and the Jewish allele³⁹ appeared to be recessive to the Gentile one. Salaman further followed the progeny of thirteen marriages of Jews to progeny of Jewish × Gentile marriages (that is, so-called "test crosses"⁴⁰), and claimed that the ratio of fifteen Jewish to seventeen Gentile children confirmed his model.

Armed with this genetic insight, Salaman proceeded to evaluate the origins and history of the Jewish gene pool, on the basis of textual, anthropological and Mendelian interpretations. According to this analysis, the purely Semitic "Abrahamic family" soon "met and freely mixed with two, possibly three, distinct races", the Hittite, Amorite, and Philistine races, each recognisable by its characteristic skull and facial features. However, according to Salaman, from the time of Ezra (500 B.C.) onward, "a cordon was drawn round the people and marriage became restricted to persons of the Jewish faith and blood", and although there was some infiltration of non-Jewish blood into the Jewish race, "we may safely conclude that the Ashkenazim up to 1800 of this era were racially substantially the same as their ancestors who reached Europe nearly two thousand years earlier".⁴¹

By advancing the notion that the Ashkenazi, rather than the Sephardi Jews, are the preservers of an original Jewish biological heritage, Salaman opposed most of the older German-Jewish experts of the *Wissenschaft des Judentums* and many contemporary Zionists. For them, the Sephardi Jew "represented the *Urjude*, the original Jew, the Jew, who could be authentically linked to both an ancient and glorious past, and by extension, could serve as a model for a future rejuvenated Jewry".⁴² As Efron noted, for the late nineteenth-century Jewish physical anthropologist, "it was primarily the physical features of the Sephardim which could serve as a primarily liberating force from the accusations of Jewish racial degeneracy." In reality, this "modern biological racism" was nothing but the heir of antisemitic tradition that "served to draw a distinction between contemporary Jews

³⁸ *Ibid.*, p. 285.

³⁹ One of the alternative forms of the gene. An individual who inherited from each of his parents a different allele of a gene is said to be heterozygous regarding this specific gene. Often the appearance of the heterozygous will be like that expected of an individual who inherited the same allele from both parents (a homozygote). This allele of the gene is said to be dominant to the hidden allele, or recessive allele.

⁴⁰ Crosses of the hybrid progeny to the parental type that was hidden (recessive) in the hybrid's progeny.

⁴¹ Salaman, *Palestine Reclaimed*, pp. 226 f. I shall use the form Ashkenazi and Sephardi unless the Hebrew plural form of Ashkenazim and Sephardim is used in the original quotations.

⁴² John M. Efron, 'Scientific Racism and the Mystique of Sephardic Racial Superiority' in *Leo Baeck Institute Year Book*, vol. 38 (1993), pp. 77–96, p. 77.

and ancient Israelites".⁴³ An overt relic of this disposition is the adoption of the Sephardi, rather than the Ashkenazi diction of the Modern Hebrew language in Palestine.

If ever Salaman had any such romantic notions of Sephardi and Oriental Jews, these seem to have been dispelled when this British officer encountered his 'native' brethren. In the section of his memoirs about his service as a medical officer in the First World War, Salaman gave this verdict on the Yemenites:

The Yemenites are for the most part undersized and rather poor-spirited *natives*. They are *not* racially Jews. They are black, long-headed, hybrid Arabs. ... The real Jew is the European Ashkenazi, and I back him against all-comers. ... [Yet] The Yemenites display a real passionate love for Judaism and have withstood centuries of bitter persecution.⁴⁴

Although such a statement corresponds with many of the declarations of the eugenicists who opposed foreign immigration into the United States and into West European countries, Salaman's agenda with respect to immigration was different from theirs. I contend that Salaman's reservations about the non-Ashkenazi Jews indirectly reflected his wish to provide a *defence* in favour of foreign immigration, albeit a selective one – primarily of East European Jews into Britain, but the same notion could also apply to his wish to gain British support for the Zionists' settlement in Palestine.⁴⁵

⁴³ *Ibid.*, p. 81.

⁴⁴ Salaman, *Palestine Reclaimed*, pp. 28 f.

⁴⁵ Falk, 'Zionism and the Biology of the Jews' p.596; the proposal of the British government to Herzl to settle Jews in East Africa gained support from those who claimed that the "white man" was essential for the development of these areas, especially after the experience of the Boer War, when not enough Britons could be obtained for the mission. Policy on population was fundamental to the underlying approach of both the practitioners and the theorists of contemporary British colonialism. It derived in part from the then virtually universal, "Darwinian" tendency to think in, and ascribe enormous importance to, ethnic categories. "The Negro", wrote Sir Harry Johnston, a contemporary authority on Africa, "seems to require the intervention of some superior race before he can be roused to any definite advance from the low stage of human development in which he has contentedly remained for many thousand years." ... "[W]e desire to make of the native a useful citizen and ... we consider the best means of doing so is to induce him to work for a period of his life for the European", quoted in David Vital, *Zionism: The Formative Years*, Oxford 1982, pp. 156–158. By introducing European settlers "the interests of all would be met: the 'civilized' would not be denied the economic progress they wished for and deserved; the 'primitive' would gradually gain promotion." However, a snag was that "Europeans were liable to be less docile than others, as the conflict in South Africa had so plainly demonstrated." Joseph Chamberlain, the Colonial Secretary, considered the settlement of the Jews in East Africa to be a pragmatic solution not only for the next-best to the 'civilized' Europeans, but also for diverting the Zionists' demands in the middle East and for stemming the "undesirable stream of immigration" into England "and the prospect of having to cope shortly with the unpleasantness of a Bill to be introduced into Parliament to bring it to a halt.", *ibid.*

For Salaman, a genetic determinist who was guided by the principle of Darwinian selection and the supremacy of Western culture, it was necessary to provide a *eugenicist's* argument for Jewish immigrants. It was essential to show that Jewish immigration was a *eugenic* rather than a *dysgenic* act. He accepted that “the tendency of society towards stratification is as natural as the sedimentation of rocks. ... [A]s in nature so in human society an inversion of the strata can only be affected by a vast cataclysmic upheaval. ... The study of genetics has but confirmed history”.⁴⁶ However, contemporary Jewish communities, he argued, were not built according to this stratification: “There has never been an aristocracy of the ghettos.” The Jew “differs from all other people in having always had an appreciation of much that modern eugenicists advocate”.⁴⁷ According to Salaman, Ashkenazi Jews should really be considered to be of a higher class because they have – without being aware of it – carried out a eugenic programme:

The Jewish scholar of the ghetto ... had drunk deep of the wisdom of his forefathers and their views were curiously enough extremely modern for they were essentially eugenic.

And hence it comes about that the Jewish communities of the last thousand years have been steadily increasing their intelligence at the expense of their lower classes and have existed without conscious class segregation.

The outstanding difference ... is that the emigrant Jews by reason of the peculiar circumstances ... are on the one hand of a higher intelligence than any other group of emigrants from European people and on the other reach their new home as it were in disguise. The external circumstances make them appear as members of the lower class whilst in point of fact they are an unsegregated but highly gifted mass, deficient in both the extremes common to a normal freely moving population – an aristocracy and a criminal class.⁴⁸

Salaman claimed selection worked not only for the unique spiritual and social properties of the Jews, but also at the physical level:

The lower death-rate [among Jews] is so general and so considerable in amount that it cannot be a matter of chance. ... The lower death-rate at all ages, especially after the first year, means that the Jew offers greater resistance throughout life to all the inimical influences of the environment, that he is on the whole tougher and a more resilient specimen of humanity, and no one, taking his general history into consideration, can doubt that this is a fact.⁴⁹

⁴⁶ Salaman, ‘Some Notes on the Jewish Problem’, p. 135.

⁴⁷ *Ibid.*, p. 151.

⁴⁸ *Ibid.*, pp. 136 f.

⁴⁹ *Ibid.*, p. 148.

All this “would seem to show perhaps unequivocally that it is nature rather than nurture which is on the side of the Jewish suckling”.⁵⁰ Jewish immigration would therefore not spoil the British genetic heritage, not even that of the upper classes. These arguments are clearly directed to curb the attempts of those who raised eugenic considerations in opposition to Jewish emigrants from Eastern Europe.⁵¹

There has been a tendency to raise barriers against their admission. There would appear to be no question more suitable for the consideration of eugenics than this. The whole problem is a relatively simple one: are these emigrants people of value to the state or not? Do they bring promise of greater gifts beneath their tattered garments than the jaundiced eye of a relieving officer can appreciate?⁵²

Contrary to the implied idea of Zionism that Jewish people, irrespective of their ethnicity, will assemble in their homeland, Salaman endeavoured to provide a genetic or eugenic rationale also for the maintenance of a Jewish minority within a modern state:

Whether the state gains more by the fusion of a small and gifted minority in the general population than by enjoying the concentrated output of a highly self-conscious group, is a very difficult question. If we could assume that the specific and hereditary intelligence of the Jew were controlled by Mendelian factors, it is highly probable that the decision should be against amalgamation when the minority is as small as it is in most countries. Whilst where the numbers of the minority group approximate to those of the rest of the population, fusion might well be in the best interest of the whole.⁵³

Recapitulating his conclusions about the effect of natural selection on Jewish communities during the centuries they had lived in the Diaspora, he asserts that “[i]f these conclusions are correct, then there would appear but one answer to our question. The Jewish emigrant is a bearer of qualities which are of essential value to any civilized state.”⁵⁴

Objective or not so objective as the scientists involved believed their research projects were, Salaman insisted that his interest in the Zionist enterprise was primarily professional, and that the Zionist experience provided a unique opportunity to examine at least some universal population genetics and Darwinian evolutionary principles in humans.⁵⁵ The Zionist settlements

⁵⁰ *Ibid.*, p. 149.

⁵¹ See, for example, Karl Pearson and Margaret Moul, ‘The problem of alien immigration into Great Britain, illustrated by an examination of Russian and Polish Jewish children’, in *Annals of Eugenics* 1 (1925), pp. 5–55.

⁵² Salaman, ‘Some Notes on the Jewish Problem’, p. 152.

⁵³ *Ibid.*

⁵⁴ *Ibid.*, p. 153, see Falk, ‘Zionism and the Biology of the Jews’, p. 596.

⁵⁵ “But to me the interest of the whole Zionist movement is, I think, much more scientific than idealistic. ... What will evolve from an unchained Jew on a land in an atmosphere of his own? We shall hardly see it ourselves unless it be a failure, but if not a

of Jewish farmers also provided him with an opportunity to follow selection as it affected the Jewish gene pool. Furthermore, it revealed, in his opinion, an interesting anthropological aspect of the history of the Jewish people:

It is with no small amount of hesitation that one attempts to deal with a problem the subject matter of which has hitherto been the legitimate terrain of the Historian and Archaeologist. The origin of the Philistines ... is only known to us from the Bible where they played an unenviable part of feared and dangerous foe and rival to the Israelites. ... But it is as a student of Genetics, that youngest offshoot of Biology, that I venture to attack the problem and attempt to show not only who the Philistine was, but where he disappeared and where he may still be found.⁵⁶

To begin with, screening the Jewish population of contemporary London, Salaman found that:

[A]mongst Jews of the purest Jewish descent it is common to find that there occur individuals who are usually considered to be quite non-Jewish looking. By non-Jewish it is found that what is meant is that the facial appearance is totally unlike the Hittite type and very different from the Semitic. ... The general cast of features is predominantly Western European in character. ... [I]ndividuals of this type may be quite fair. ... In Cairo and Palestine the same type was found amongst the Sephardim as well as the Ashkenazim.⁵⁷

These features “together with the small delicate features” led some authors, such as Fishberg, to the view that their presence in the Jewish community was due to an admixture of Teutonic and Slavonic blood. Salaman, however, believed this to be erroneous. He rejected the claim that “the Jewish type varies directly with that of the surrounding non-Jewish population” as a consequence of intermixture, since,

[I]ntermarriage would perforce have been on such a scale that it becomes increasingly difficult to understand why there is neither historical evidence for such admixture, nor why the resultant community should have remained so loyal to their faith in face of the manifold disadvantages it conferred on them vis-à-vis their neighbours.⁵⁸

Salaman admitted that in certain cases, such as in the Caucasus and in the Yemen, facts support the lore that the Jewish stock has been largely blended with local native blood. Also “in the Mediterranean basin where the Jewish communities are darker in colour than those of the rest of Europe, this is due to the fact that such communities are made up of Sephardic Jews, who as Marranos brought with them into exile no small amount of Moorish and

failure, then the fine fruits cannot be expected till we have a third and fourth generation on the land.”, Salaman, *Palestine Reclaimed*, p. 192.

⁵⁶ Redcliffe N. Salaman, ‘What Has Become of the Philistines?’, in *Quarterly Statement of Palestine Exploration Fund* 57 (1925), pp. 1–17, here pp. 1 f.

⁵⁷ *Ibid.*, pp. 3 f.

⁵⁸ *Ibid.*, p. 5.

Iberian admixture.” However, he reiterated that “in the rest of Europe up till fifty years ago admixture was very rare”. Excluding adaptation to the environment as the source of the “gentile” features among Jews, Salaman concluded that the source of the pseudo-Gentile attributes among Jews were no others than the Philistines.⁵⁹

[T]here is good reason to believe that their disappearance as a national and racial entity coincided with their complete absorption into the body of the Jewish Nation.⁶⁰

The outstanding character of all the people represented, no matter where found, is that in appearance they form a group who are unquestionably European in countenance. ... It is more over a markedly dolichocephalic race with which we are dealing. ... [The] two differential features of dress, the helmet and the shield, give the clue as to the more immediate origin of these proto-Philistines, as we may call them. Both the head-dress and the shield are typical of Caria, which was the Cretan settlement in the South-West corner of Asia Minor.⁶¹

Based on the Biblical text Salaman thus concluded that “The Philistine was gradually absorbed into the Israelite nation – he was never lost. His persistence with us today is proved by the existence of the Pseudo-Gentile type in our midst.”⁶²

This way Salaman was able to uphold his claims that the Jews of today have maintained their so-called “racial purity” in spite of living for centuries among Gentiles: He “proved” that the racial heterogeneity that had been claimed to be a European element introduced into the race during the Diaspora period, rather than being of Teutonic nature, actually stems from the multi-racial origin of the Jews in ancient times.⁶³ Furthermore, it allowed him to claim that it was not the Jewish race which had been contaminated by the introduction of gentile blood over the last two thousand years. Quite the opposite: it was the Hellenic race into which Jewish or Jewish-related blood had been introduced! Still, “the recessive Pseudo-Gentile type asserts itself as the laws of Mendel would lead us to expect, and gives us today Jews

⁵⁹ The idea was apparently expressed already in 1892 by the German anthropologist Felix von Luschan. It was emphatically rejected by Fishberg. In 1934 it was considered again by a Lemberg (Lvov) doctor S. Tschurtakover, author of ‘The origin of the yellowish Jews’, in *Harefuah*, 14 (1934/5), pp. 106–10, (Hebrew), and rejected by him.

⁶⁰ Salaman, ‘What Has Become of the Philistines?’, p. 8.

⁶¹ *Ibid.*, p. 11.

⁶² *Ibid.*, p. 16.

⁶³ See also Endelman, p. 62: Endelman claims that Salaman’s account of the genetic history of the Jews targeted two assumptions of contemporary racial antisemitism: the Jews were not a “semitic” people pure and simple, and “it was the non-Semitic Hittites who stamped their physical type ‘indelibly’ on the majority of the Jews.” Also, “Salaman’s account undercut ‘Aryan’ claims to exclusive ownership to Nordic or Teutonic physical features by linking the presence of blue eyes, fair hair, and light complexions among Jews to the Philistines rather than to north European gentiles.”

who are physically indistinguishable from their Philistine enemy of old.”⁶⁴ After this claimed evidence against both intermarriage and the Lamarckian effects of environmental conditions on the Jewish type – at least as far as the Ashkenazi Jews were concerned – Salaman went one step further in his eugenics: based on his experience in Palestine he found that

[C]ertain facts became clear as his [the writer’s] knowledge of the people became more intimate. In the first place the younger generation of Colonists are physically well developed and muscular. In sports they held their own against all teams of Gymnasts in the British Egyptian Expeditionary Force. Their average height was certainly greater than that of the Judeans soldiers recruited from Russia and America.

It was, however, the facial type, of the younger generation that was most interesting. The outstanding fact was that the Palestinian youths presented a very considerably higher proportion of Pseudo-Gentile faces than did their foreign brethren of the other battalione [*sic*]. Indeed it would appear that some force was at work which was bringing into existence again the old Philistine type in the land of the Philistines.⁶⁵

The living conditions of the Zionist settlers were so radically different from those of the Jews in the Diaspora that they exerted an opposite Darwinian selection pressure in favour of the Philistine genetic element of the Jewish gene pool to that which had been gradually selected-against in the Diaspora. In the years of exile selection for other genes revealed the “correlations between mental character and the three physical facial types which have been discussed”:

An examination of a large collection of portraits of Anglo-Jewish worthies showed that those leaders who had been in their time outstanding philanthropists ... were almost all of an outspoken Hittite type of countenance.

It may therefore be forgiven the writer if, when looking at the young home-born Palestinian Jews as they were marshalled under their Zionist banner on the plain of Sharon, and noticing the prevalence of the Pseudo-Gentile type of face he fancied that here, too, perhaps was evidence of another correlation, a correlation between the spirit of adventure and the Pseudo-Gentile type of face. Which would become active as a selection agent in respect to those immigrants who come to Palestine to found a new Judea.⁶⁶

⁶⁴ Salaman, ‘What Has Become of the Philistines?’, p. 16; Salaman apparently forgot that he claimed Jewish features to be “recessive” to the gentile ones, or did he intend to claim that “pseudo-gentile” features were inherited by different genes than those responsible for gentile features, these being recessive to the Jewish features? See, however Endelman, p. 62 and Stone, p. 229, both of whom point out that Salaman was thinking of more than one factor affecting “Jewish features”: whereas “the Jewish facial expression” was according to Salaman recessive to the Teutonic or Nordic type, the non-Jewish-looking Jew (the “pseudo-gentile”) type was recessive to the fully Jewish type. Obviously, it was the ideology that dictated the “biological facts” rather than the other way round.

⁶⁵ Salaman, ‘What Has Become of the Philistines?’, p. 17.

⁶⁶ *Ibid.*

Contrary to environmentalist ideas of a change in the physique of Jews as a consequence of their transfer to “normal” conditions, Salaman believed that environmental conditions selected another component of the genetic heterogeneity of the Jewish race than that which was selected for in the Diaspora:

And so it may be that, in the old home of the Philistine, there is being recreated that ancient race from the bowels of its one time enemy and victor, a race which, be its faults or its virtues what they may, was certainly dominated by that spirit of adventure and hardihood which made the Aegean of old the Viking of his day.⁶⁷

Fritz Shimon Bodenheimer (1897–1959)

F. S. Bodenheimer classified himself as a member of the Old Guard of Herzlian Zionism by stating that he belonged to “a very small number of prominent Western Jews [who] found their way from extreme assimilationism to nationalistic Judaism.” Upon his birth Herzl wrote to his father, Max Bodenheimer, “may he grow up ... as the first Zionist of the second generation”.⁶⁸

Bodenheimer was a Jewish patriot. Being dubbed a Zionist by Theodor Herzl himself entailed an obligation, “and ever since I have always been faithful to the teaching of our great leader”.⁶⁹ But to begin with, he was a German patriot. At the age of seventeen he volunteered to join the first cavalry division of the Kaiser’s *Jäger zu Pferde* in the First World War. He believed that having been brought up as a Zionist he was equipped “to endure petty anti-Semitic offences of everyday life”, in spite of “the anti-Semitic attitude of the officers that was frank and open.” As he testified, “neither the Russian pogroms of 1906/1907 nor the Baylis case in Kiev” drew his attention to the necessity of a Zionist solution. “Conviction came through reading the books expounding the concept of German nationalism,” in particu-

⁶⁷ *Ibid.*; no wonder that this comment by Salaman was taken up by Fritz Lenz in his discussion of the Jewish racial characteristics in the chapter on “Racial Psychology” in the notorious *Menschliche Erblichkeitskunde*: “In the Zionist attempt to resettle Palestine with Jews, it has been interesting to find that few of the settlers are conspicuously Jewish in type; manifestly they are recruited for the most part out of the non-Jewish racial elements which have been incorporated among the Ashkenazic or eastern European Jews.”, Erwin Baur, Eugen Fischer, and Fritz Lenz, *Human Heredity*, New York 1931, p. 669. Lenz, however, misrepresented Salaman’s conclusions to fit his context: the Philistine element is a non-Jewish element within the genuine Jewish race, which for Lenz was the Ashkenazi Jewish type. Lenz’s conclusion is accordingly that “[o]wing to their deficient talent or inclination for the primary work of production it would seem that a State system consisting exclusively of Jews would be impossible.”, *ibid.*, p. 669.

⁶⁸ Fritz Shimon Bodenheimer, *A Biologist in Israel: A Book of Reminiscences*, Jerusalem 1959, p. 3.

⁶⁹ *Ibid.*, p. 6.

lar passages from Johann Gottfried Herder's *Ideas on the Philosophy of the History of Mankind*.⁷⁰ However, it was the confrontation with the Jewish communities of Eastern Europe, notably that of Vilno, during his army service that finally brought about a different sense of allegiance: "I would never have dreamt that Jewish cultural life could be so national in character".⁷¹

Early on Bodenheimer was fascinated by Ernst Haeckel, especially his *Natural History of Creation*, and following in his footsteps Bodenheimer wished to study biology. After his father was persuaded at a Zionist conference that agricultural entomology was "of the utmost importance for Palestine," and his own reading of Karl Escherich's book on applied entomology, he made up his mind. He studied agricultural entomology in Bonn, Hamburg and finally in Portici (near Naples), with the explicit intention of being instrumental in the Zionist realisation of the settlement of Palestine.

When he was offered a position as an entomologist in the newly founded Agricultural Experiment Station of the Jewish Agency in Tel Aviv he immigrated to Palestine on 15 March 1922. His relationship with the institute (which was later moved to Rehovot) continued until 1947, although he took up a position at the Hebrew University in 1928.

Bodenheimer stressed that he "was particularly enthralled by Howard's theory of equilibrium in nature as undisturbed by man"⁷², a subject that no doubt also affected his attitude towards eugenics. The notions of the unity of the organic and inorganic world, the world as being in an eternal process of material evolution (progressivism) and of man being part of this evolution, greatly appealed to him. He accepted Ernst Haeckel's denial of free will and the submission to the "will-power" of matter and ether, and adopted a Haeckelian comprehensive view of nature. In his autobiography he noted that "human wisdom" was a unification of science and humanism; modern science without "values" was nothing but techniques.⁷³ Bodenheimer saw synthesis – Haeckelian synthesis – as the goal: principles and rules do exist, and it was the task of the researcher to uncover and comprehend them. Once this was done, if then exceptions from these rules were discovered, or if the facts did not tally with the synthesis, it was too bad for the facts. In response to Patrick Alfred Buxton of the Institute for Tropical Hygiene in England (who served in 1921 as entomologist in the medical department in Palestine), he asserted regarding inaccuracies in Bodenheimer's zoogeographic data: "Buxton is right to a certain degree, but were he wholly so, no zoogeography and no animal elements would

⁷⁰ *Ibid.*, p. 4.

⁷¹ *Ibid.*, p. 6.

⁷² *Ibid.*, p. 10.

⁷³ *Ibid.*, p. 1.

exist at all, and then only a very artificial structure of man. Every experience in nature demonstrates the contrary.”⁷⁴

Bodenheimer was very productive. He travelled much in Palestine and the neighbouring countries, and was “the author of over fifty volumes and bulletins and some 400 scientific papers”.⁷⁵ Intellectually, besides Haeckel, Bodenheimer considered himself also a successor of Henry Baker Tristram (1822–1906), the traveller and explorer of Palestine. He claimed to have laid the foundation of the agricultural entomology of Palestine (*Schädlingsfauna Palästina's*), as well as of the knowledge of the fauna of this country (*Animal Life in Palestine*). He also stressed that he was a pioneer in animal population dynamics (*Animal Ecology Today*), and a historian of biology (*History of Biology*).⁷⁶

Bodenheimer saw his nationalistic Zionism as a facet of his Haeckel-style “universal humanism.” He joined the *Haganah*, the illegal Jewish defence organisation, shortly after immigrating to Palestine, but found it too timid and consequently joined more aggressive resistance organisations. In May 1948, at the age of fifty-one, in spite of his poor health, he “succeeded in being admitted” to the Israel Defence Forces, commenting: “It is not my task here to recount my great and glorious front-line experiences.”⁷⁷

Bodenheimer’s intensive involvement in patriotic Zionism and his deep commitment to insect and rodent population dynamics were expressed also in his ideas about the biological foundations of human population dynamics.⁷⁸ His attention was drawn to Raymond Pearl’s early 1920s study of the logistic curve of population growth.

This sigmoid or logistic curve is observed again and again wherever the growth of an animal population is studied. ... As long as the environmental conditions remain approximately constant, the population is of genetically comparable stock, we always get growth in a logistic curve.⁷⁹

The logistic curve was of such importance to him because it established “that density is an essential factor in regulating population density.” But “[t]he logistic curve is not, as we believed with Pearl for a long time, a *biological law* of extreme importance in the self regulation of populations. It is actually a

⁷⁴ *Ibid.*, p. 283.

⁷⁵ See dustcover of Bodenheimer, *A Biologist*.

⁷⁶ *Ibid.*

⁷⁷ Bodenheimer, *A Biologist*, p. 34.

⁷⁸ In 1951, being a student of Bodenheimer, I remember that when Theodosius Dobzhansky, the population geneticist, joined Edmund W. Sinnott and Leslie C. Dunn as author of the fourth edition of their textbook *Principles of Genetics* (Edmund W. Sinnott, Leslie C. Dunn, and Theodosius Dobzhansky, *Principles of Genetics*, 4th edn., New York 1950), Bodenheimer insisted that we, his students, should study genetics exclusively from this version of the textbook.

⁷⁹ Bodenheimer, *A Biologist*, p. 324.

purely formalistic rule.” This led Bodenheimer to conclude that “the total product of the inhibiting as well as the stimulating factors must be dissected into their individual components ... Thus in the case of human demography, every individual growth of a group or a country must be analysed on its own merits.”⁸⁰

In the early 1930s Bodenheimer wrote several papers on “Geopolitik,” in which he believed to have proven “that the animal ecologist should no longer be excluded from future team-work in human demography”⁸¹:

I endeavoured to show that climate is the determining factor of human development, that Pearl’s logistic curve is a decisive factor for the cultural and political development of man, the recognition of human society as a self-regulating biological unit, and the biology of big towns.⁸²

In 1936 Bodenheimer published his book *The Biological Background of the Human Population Theory* in Hebrew.⁸³ The last chapter is an appendix on ‘Race, inheritance and eugenics in humans’.⁸⁴ In the preface Bodenheimer noted that the book was written “in order to call the attention of the Hebrew public in Palestine to the biological background of the human-being in general, and more specifically to that of national politics”.⁸⁵ It is based on the lectures of the author to the audience of the university-courses in Tel Aviv.

In his reminiscences Bodenheimer expressed his “humble opinion” that the book is “still worthy of the attention of specialists, with due toning-down of exaggeration in political conclusions”.⁸⁶ Still, he seized the opportunity to make a confession, which emphatically reflects his Haeckelian notions of the “human wisdom” in claiming that the unification of science and humanism is possible:

One of my greatest mistakes in judgment was in estimating the beginnings of Fascism on its apparent merits. While in Italy in 1919, as one convinced of Ranke’s organistic theory of the state, I was deeply impressed by the falling apart of all organized life there ... Observing that this infant Fascism was trying hard to maintain cultural values and achieve a revolution bloodlessly, I was certain the regime would be the salvation of the

⁸⁰ *Ibid.*, pp. 331 f., emphasis in original.

⁸¹ *Ibid.*, p. 366.

⁸² *Ibid.*, p. 364.

⁸³ Although this is the English title used by Bodenheimer for his book that was published in Hebrew, a more accurate translation of the title is *The Biological Foundations of Populations Theory*, which I shall use henceforth. Fritz Shimon Bodenheimer, *The Biological Foundations of Populations Theory*, Tel-Aviv 1936 (Hebrew).

⁸⁴ *Ibid.*, *The Biological Foundations*, pp. 137–152.

⁸⁵ *Ibid.*, n.p.

⁸⁶ *Idem*, *A Biologist*, p. 365. Bodenheimer refers to “a lengthy extract” of the book that appeared “in a European language” as “Über die biologischen Grundlagen der menschlichen Bevölkerungslehre” in *Genus* once as 1(1934), pp. 43–90, and again as 1(1937) pp. 3–50.

lovable Italian people and nation. In the case of the uglier rise of Nazism in Germany, I assumed that the worst aspects would disappear once the aim of the revolution, the ascent to power was achieved. I admired in both cases the spiritual force uniting a divided people in organizing economy and culture.⁸⁷

Still he noted that he shared the view “that a given race will settle a given area in lines of equal population density according to the environmental potential wealth of agriculture, mining, etc.”⁸⁸

With such a background it is not surprising that in the chapter on race, inheritance and eugenics in humans Bodenheimer emphasized the significance of the inheritance of mental qualities in man. The “normal” function of an organism depends on the *harmony and symmetry* of the structure of the body, the relative development of the different parts of the body, together with the mental composition of the individual. Races are types that reflect such norms: “The term ‘race’ in humans is a type that is similar in its physical and mental foundations.” But,

Every nation of historical significance is formed of a huge mixing of several different races. Furthermore, several investigators are of the opinion that racial mixture is a necessary precondition for the cultural prosperity of a nation. Although the mixture does not lead immediately to the production of culture; several generations are needed until all the elements of the mixture amalgamate into one entity, so as to stabilize the harmonious form, unique to the large majority of the nation or the new race.⁸⁹

Emphasis of the common biological roots of the Jews was obvious to all Zionists. However, for Bodenheimer, as for many Zionist settlers, the diversity of Jewish communities became a central issue of Jewish identity, because living next to each other in Palestine confronted them daily with the socio-economic gaps that were superimposed on the ethnic-cultural differences. Thus, Bodenheimer stressed, on the one hand, the continuity of a common biological, that is Jewish, element in guaranteeing a harmonious nation:

Concerning the contemporary Jewish person, we find in some cases pure types of Semitic, Hittites and Philistines of ancient times, exactly as depicted on the antique Assyrian and Egyptian statues. This allows a glimpse at the mysterious power of the maintenance of various human types.⁹⁰

On the other hand, intermarriages, which were important for the Zionist political cause of overcoming the threat of social disparity from within, were similarly conceived to be significant for the biological prosperity of the nation.

⁸⁷ *Ibid.*, p. 365.

⁸⁸ *Ibid.*

⁸⁹ Bodenheimer, *The Biological Foundations*, p. 138.

⁹⁰ *Ibid.*, pp. 137–138.

It may be assumed with certainty that elements of the Jewish race which we call the “Sephardi” had not participated in the great mixture with the Slavic and Tataric nations that profoundly affected the Ashkenazi during the Khazars times and in the days of Chmielnicki.⁹¹ On the other hand, we do not find among the Ashkenazi the mixture with the Black types, at least not to the great extent found among the Sephardi. The Semitic type is most prominent among the Yemenites. ... Zionism aspires directly, though not originally, to the unification of all the elements prevalent today among the Jewish race, in order to form a new harmonious Jewish type.⁹²

Furthermore, inter-ethnic marriages provided an answer to the threat of the faster reproductive rate of the indigenous Arabic population from without. “A fundamental problem of eugenics is the study of fertility at different levels of a nation.”⁹³ As long as a nation grows normally, one finds that the constant decrease in births of the upper social classes is compensated for by the high reproductive rate of the lower classes. If, however, fertility rates of the upper and lower classes approach equality, history indicates that either closed (upper) sects are formed, like in India and China, or pressure from below brings about social revolutions, like in France and Russia. “None of these are desirable from the eugenic perspective, since in such cases upper classes totally disappear.”⁹⁴

Concerning the situation of the *Yishuv* in Palestine, it is just the lower sections that are on a low cultural level, which are the most fertile among us. Consequently, if we ignore the immigration, the part of the progeny of these groups among our people will increase in the future among the Jews in Palestine. This development is of great virtue, because the *Yishuv* is in great danger from the incomparable reproductive rate among the Arabs ... Thus, it is important for the *Yishuv* that there are among us elements who have small needs and know to live under harsh conditions, that are rather outstanding in fertility.⁹⁵

Bodenheimer’s notion that combining Sephardi high birth rates with Ashkenazi socio-cultural superiority might help win the competition of the Jewish community with the indigenous Arab population reflects a European nationalistic paternalistic approach not uncommon among many Zionists.

Concluding Remarks

In this article I tried to show how the convergence of *prima facie* conflicting concepts of nationalism and universal humanism managed to bring together under the roof of Zionism persons as distinct as Redcliffe Nathan Salaman,

⁹¹ The riots during the Cossack revolt lead by Bogdan Chmielnicki (1648–1649).

⁹² Bodenheimer, *The Biological Foundations*, pp. 138 f.

⁹³ *Ibid.*, p. 140.

⁹⁴ *Ibid.*, p. 141.

⁹⁵ *Ibid.*, pp. 141 f.

who proudly endeavoured to establish the biological uniqueness of his people and to promote their status within the social and political conception of his adopted British heritage, Shneur Zalman Bychowski with his grass-roots conceptions of Jewish humanism, and Fritz Shimon Bodenheimer with his Haeckelian monist nationalistic erudition. All three hoped to re-establish a Jewish entity within its ancient natural biological context in the name of universal human values. I suggest that this humanistic version of nationalism also allowed maintaining, especially among the practising Zionist settlers, explicit racial and eugenic notions in spite of, and long after the inception of the ominous developments in Nazi Germany. These notions have persisted, though in a thinly disguised mode, in post-Second World War Israel.

Above all, I suggest that the history of the relationship of Zionism and scientific biology, which has made an effort to single out Jews from non-Jews on the one hand, and to unite the distinct Jewish communities on the other hand, provides a paradigmatic case of the utilisation of biological arguments as “evidence” for whatever social, economic, or political notion that has been put forward. During the hundred years since the establishment of political Zionism, the only logical causative sequence that can be discerned is the one leading from the prejudices of the persons involved – Zionists and anti-Zionists alike – to whatever biological facts they choose to claim. And, in spite of the changing circumstances and contexts, the same old issues have been recycled again and again, where each side has utilised the evidence in its own way.⁹⁶

We may conclude with Francis Bacon’s time-honoured pronouncement of what we now call “confirmation bias”:

The human understanding when it has once adopted an opinion ... draws all things else to support and agree with it. And though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises ... in order that by this great and pernicious predetermination the authority of its former conclusions may remain inviolate.⁹⁷

⁹⁶ Hardly a week goes by without the media publishing one kind of report or another, “supported by scientific evidence”, about the biology of the Jews in general, or of the “real” biological ties to Judaism of one community or another. Sometimes scientists are even accused of suppressing evidence for socio-political reasons. See, for example, Yaron London, ‘What the geneticists do not want to tell us?’, in the newspaper *Yediot Aharonot Supplement* (2 February 1996).

⁹⁷ Francis Bacon, *Novum Organum: Aphorisms concerning The Interpretation of Nature and the Kingdom of Man*, London 1620; aphorism XLVI.

Aaron Bernstein's "Nächster Großer Reformator" – Einstein, Reform Judaism, and the Fries School

Ulrich Charpa

1) Introduction

In this article I will advocate the thesis of Einstein as a Jewish scientist in a very specific sense. I will argue that there is more than a mere 'accidental' relationship between some of Einstein's metascientific opinions and his acting as a scientist on the one side and his Jewish background on the other.¹ Such particularism does not undermine the acceptance of Relativity Theory as a universal theory. My thesis on Einstein as a Jewish scientist does *not* relate to Relativity Theory as it is formulated in standard textbooks or as it is discussed by the scientific community in general. The arguments put forward refer mainly to Einstein's specific 'framing' of Relativity Theory: his metascientific views, especially his quasi-religious metaphysics, his style of presenting Relativity Theory, and above all his extensive usage of thought experiments. That Einstein in this regard was inspired by another Jewish writer has not been totally overlooked by Einstein historians, but the religious and philosophical background of this author, namely Aaron Bernstein, has not been dealt with.

I will try to make the appraisal of Einstein, respectively, as Jewish scientist and metascientist plausible by tracing the history of his metaphysics, his attitude towards religion, his separation of the 'personal' and the 'impersonal' and his special liking for thought experiments. These will be related to the writings of Aaron Bernstein, a trained rabbi and prolific writer and a remarkable nineteenth century Jewish figure, and the 'enlightened' Reform Jewish tendencies as well as the traditional Jewish background of Bernstein. This reconstruction is combined with the formulation of a thesis on the impact of the Fries School on the Jewish Reform movement, especially on Leopold Zunz, which itself via Bernstein's *Naturwissenschaftliche Schriften* transposed some traits of Friesian philosophy into metascientific positions.

¹ Cf. in contrast John Stachel, 'Einstein's Jewish Identity', in *idem*, *Einstein from 'B' to 'Z'*, Boston 2002, pp. 57–75.

An overview of the historical succession as presented here is given in the figure below.

Many other topics need to be taken into account if we are to achieve even a partial list of important background factors. Among them are

- the influences on Einstein of Heinrich Friedrich Weber's laboratory at Zurich²
- the techniques of exact imagination transmitted to Einstein at the patent office³
- Einstein's private reading and discussions, for instance, of Poincaré's writings.

Not even the 'Jewish' materials can be exhaustively discussed here, that is the very specific story of Jewish professionals in electrical engineering, including that of the family's electrical factory Jakob Einstein und Cie.⁴ Also not examined here is the 'Jewishness' of Einstein's position on the landscape of metascientific views, if we relate it to the antisemitic philosophies of science of the time, as put forward by Eugen Dühring, Hugo Dingler, Bruno Thüring and others.⁵ We confine ourselves to the connections provisionally sketched above.

One may argue that Einstein's most important philosophical inspiration has been left out, namely that of Spinoza. In section two a few critical remarks are made on this topic. But the relevance of Spinoza to Einstein should not be overestimated. This does not mean that Einstein's own emphasis on references to Spinoza stands for nothing. They are part of the strategy of presenting himself as an isolated 'genius' – and drawing parallels between himself and another 'isolated' figure. This 'genialism' is a counterdraft to the antisemitic stereotype of the epigonic Jew in science and has been discussed elsewhere.⁶

If we want to know where Einstein's idea of God stems from and where some of the related ideas (such as that of contributing to universal science as a

² David Cahan, 'The Young Einstein's Physics Education: H F Weber, Hermann von Helmholtz, and the Zurich Polytechnic Physics Institute', in Don Howard and John Stachel (eds.), *Einstein: the Formative Years, 1879–1909*, Boston 2000, pp. 43–82.

³ Cf. especially Thomas P. Hughes, 'Einstein, Inventors, and Invention', in *Science in Context*, 6 (1993) pp. 25–42.

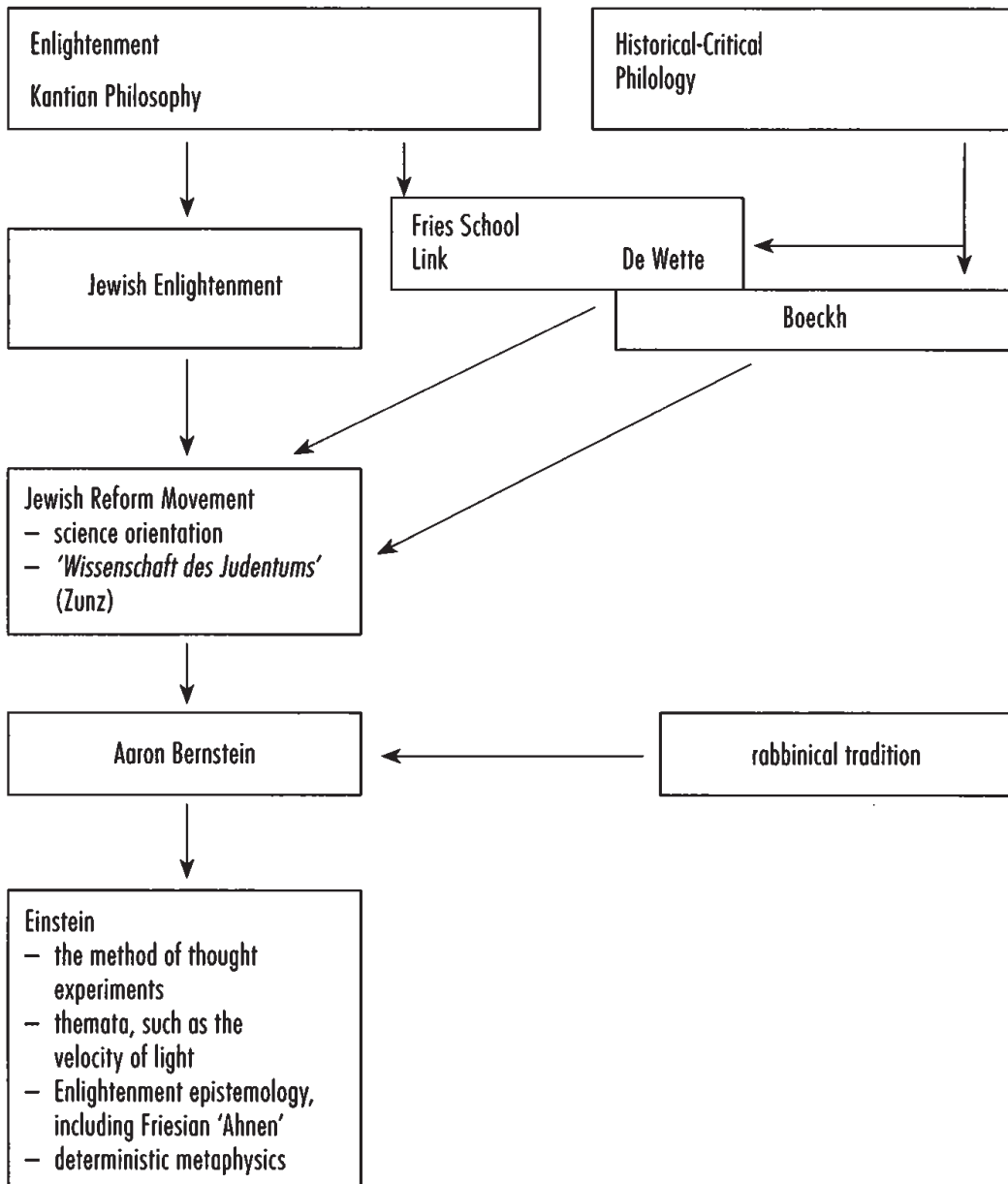
⁴ On this see Stefan Siemer, 'Im hellsten Bogenlampen und Glühlichte. Die Elektrotechnische Fabrik Jakob Einstein und Cie', in Jürgen Renn (ed.), *Albert Einstein. Ingenieur des Universums*, Weinheim 2005, pp. 128–133.

⁵ Cf. some introductory considerations on this in Ulrich Charpa, 'Judentum und wissenschaftliche Forschung. Einstellungscluster im späten 19. Jahrhundert und ihr Fortwirken', in *Simon Dubnow Institute Yearbook* 3, 2004, pp. 175–198.

⁶ Ulrich Charpa and Ute Deichmann, 'Jewish Scientists as Geniuses and Epigones – Scientific Practices and Attitudes towards them: Albert Einstein, Ferdinand Cohn, Richard Goldschmidt', in *Studia Rosenthaliana*, vol. 38, 2006, forthcoming.

kind of religious service, a *means* to religion in its most abstract form) and even some of Einstein's scientific strategies arose, we have to search elsewhere. This will also shed some new light on the problem of the 'Jewishness' of Einstein as scientist and thinker on science. Before we go into detail with the proposed 'genealogy', it makes sense to review these attitudes and why they are peculiar enough to deserve a commentary that affects Judaism (see section 2).

Overview



2) Einstein's Views on Acting, 'Thinking' and Religion

Max Jammer opens his comprehensive commentary on Einstein's relationship to religion with the famous distinction drawn by Einstein in the opening contribution to the Schilpp-volume:

... the essential in the being of a man of my type lies precisely in *what* he thinks and *how* he thinks, not in what he does or suffers.⁷

When Einstein speaks of his own "thinking" he means the straight way to objective knowledge, the truth, more appropriately said: true beliefs. To him the realm of his thinking is identical to the sphere of believing in what is true. By 'doing' in the sense presented here we can think of his political and social activities – a lot of them in favour of Jews (see above). But according to his own appraisal this realm is not the relevant sphere. His case as a scientist is seen to be determined by an individual 'thinking' in the sphere of the 'impersonal' and not that of an actor and the 'personal'. Einstein connects his discovery of the 'impersonal' with his early impressions, with a certain 'sensing' towards a relation of God, music, and nature. These early impressions, (the German expression for something of this kind is *'Ahnung'*) have the status of anticipations of the *Weltanschauung* in his later years, taking for granted the non-existence of a personal God, and the existence of a superior spirit who – as the famous dictum in his exchange with Max Born says – "does not play dice". Nature is totally determined by all embracing laws – a fact one can develop a feeling for from childhood on. If we use the modern buzzwords to characterise Einstein's epistemological attitude, it is autonomistic, universalist, decontextualist – and knowledge is a scientifically justified belief – positions which have their roots in an early sense for the regularity of the world and the human capacity for knowing it due to a superior being.

Indeed, it is not accidental that Einstein's metascientific thinking, in particular his quasi-religious deterministic metaphysics, has been linked to the writings of Spinoza by some historians of science. They have been led to this track by Einstein himself,⁸ who repeatedly paid credit to Spinoza's philosophy and even wrote an introduction to a Spinoza dictionary as well as to a Spinoza biography. "How I love this noble man, more than I with words say can", are the opening lines of a poem on Spinoza's *Ethics*.⁹ But reading the great philosopher and admiring him is one thing: the structure of Einstein's metascience is another. As Max Jammer rightly ascertains, Spinoza's God *as*

⁷ Albert Einstein, 'Autobiographical Notes', in Paul A. Schilpp (ed.), *Albert Einstein: Philosopher-Scientist*, Evanston 1949, pp. 1–94, here p. 33.

⁸ See for instance Gerald Holton, 'Einstein's Third Paradise', in *Daedalus*, Fall 2002, pp. 26–34.

⁹ Reprinted in Max Jammer, *Einstein and Religion*, Princeton 1999, appendix, p. 267.

nature (*deus sive natura*) is not the same as Einstein's God as a superior spirit regulating the natural world. To Einstein, God is a principle *behind* the curtain of the natural phenomena, something we 'sense' (the adequate German expression is 'ahnen') when observing the phenomena and when theoretically reconstructing the laws that determine them. It is often overlooked that Einstein's famous dictum "I believe in Spinoza's God" continues as follows – "who reveals Himself in the orderly harmony of what exists, not in a God who concerns himself with fates and actions of human beings"¹⁰. But a God 'revealing' himself in nature is not Spinoza's God. It is the God of the Enlightenment Natural Theology – *and* the God of the German Jewish Reform movement.

Where the positions of Spinoza and Einstein run parallel without Einstein having taken notice of it is in the practical consequence: if there is any kind of religious life left it is that of an individual facing nature. To Einstein, the only adequate kind of modern religious worship is scientific work. In the domain of science and especially with regard to scientific progress religious authority appears as an obstacle. Einstein expressed this attitude in an essay on Galilei (another 'genius') in which he reiterates the popular picture of Galilei as a victim of religious authorities and celebrates him as a rebel against them:

I perceive as leitmotif of Galilei's writings the passionate fight against any belief which is based on authority. To him, only experience and diligent deliberation are criteria for truth. Today we can hardly imagine how strange and revolutionary such an attitude appeared to be in Galilei's time.¹¹

History of science has meanwhile taught us that Galilei's fight was in fact a battle between divergent authorities and in favour of a specific type of authority which he connected to himself.¹² What Einstein advocates is an idealisation corresponding to the Kantian *sapere aude*, the Enlightenment ideal of hard epistemic autonomy which conflicts with the factual epistemic inequalities and the testimonial structure of any effective form of science.¹³ Successful scientific research does not come into being in isolation: it does not start from an epistemic zero point. It is always based on trust in the work and the opinions of others who are considered authorities in their respective disciplines. Even the most extreme critical attitude within the domain of

¹⁰ Schilpp (ed.), pp. 659 – 660.

¹¹ Albert Einstein, 'Galileo Galilei', in Roman U. Sexl and Karl von Meyenn (eds.), *Galileo Galilei. Dialog über die beiden hauptsächlichsten Weltsysteme. Das Ptolemäische und das Kopernikanische*, Darmstadt 1982, pp. VII–XII, here p. XI–XII.

¹² Cf. for instance Mario Biagioli, *Galileo, Courtier: The Practice of Science in the Culture of Absolutism*, Chicago 1993.

¹³ Ulrich Charpa, *Wissen und Handeln. Grundzüge einer Forschungstheorie*, Stuttgart 2001.

science has a prehistory of scientists getting acquainted with the already existing theories, experimental strategies etc. In this respect the perspective of rabbinic Judaism, conceiving religious knowledge from accounts of religious experience mediated by a reliable chain of transmission,¹⁴ is much more in line with scientific practice than the popular Enlightenment myth of the lone hero fighting against the authorities. Einstein rejects the idea of religious authority in general, does not pay any attention to the specifics of the Jewish tradition in this regard and pleads on behalf of an ideal that – taken seriously – would bring an end to all our institutions of learning and research.

Another point worth noticing in addition to Jammer's commentary is that Einstein's distinctions of the 'personal' and the 'impersonal' as well as of action and belief are even turning the Jewish tradition upside down: of course, Torah and Talmud do not make any religious sense if we do not take for granted that God exists and that he is in a certain relationship with all human beings and in a more specific one with the Jewish people. But Jewish tradition cannot be characterised as an attempt to reach a more precise and obligatory opinion on these basic presuppositions. There are endless discussions on the nature of God and His concern about mankind in general and Jews in particular. But this should not prevent us from seeing that in the Torah there are *no* articles of faith in terms of believing something – instead there are the well-known commandments of acting.

And as regards the contents of the Talmud it has been convincingly argued that it presents *emunah* (normally translated as 'faith'), at best secondary, as a set of beliefs. Primarily, according to the Talmud, being a good Jew means trusting in God (whatever He may be from a philosophical-theological point of view) and acting as a halakhic person.¹⁵ In a way, Einstein's thinking on religion is to a large extent contrary to what halakhic Judaism presupposes and explicitly provides. Einstein's 'genialistic' pose suggests that this thinking has no history apart from his own reflections. But the obvious accordance with Enlightenment deism and epistemology proves him wrong in this instance.

¹⁴ Cf. Moshe Z. Sokol, 'Personal Autonomy and Religious Authority', in Moshe Z. Sokol (ed.), *Rabbinic Authority and Personal Autonomy*, Northvale 1992, pp. 169–216; the author's stance seems rather too cautious because he is obviously not acquainted with anti-egalitarian and anti-autonomist tendencies in modern epistemology.

¹⁵ Cf. Menachem Kellner, *Must a Jew Believe Anything?*, London 1999.

3) The German-Jewish Reform Movement and its 'Friesian' Background

As already stated, trying to characterise Einstein's attitude towards religion directly leads to its categorisation as an Enlightenment position, more precisely, that of the typical Enlightenment reduction of religion to a 'natural theology', a metaphysics supporting science. This seems to leave no room for anything like 'Jewishness' as a relevant factor. But this perspective does not take into account at what time Einstein's views were advocated and how the philosophical ingredients he used were developed in the course of the nineteenth and twentieth centuries. If we do not take those small academic groups celebrating their ideal of 'purity' of science for the German society in general, the Enlightenment attitudes, emphasising religious tolerance, rationalism, and scientific progress, were subjected to a process of marginalisation until the end of the century. In the late nineteenth century confession-ism, anti-rationalism, particularism, to some extent even nationalism in science, were on the agenda.

If the fate of philosophy mirrors intellectual history in general, it would not be incorrect to characterise the history of philosophy in Germany from Kant's death in 1804 to the Weimar Republic as a process of the marginalisation of central Enlightenment tendencies. Hegelian ignorance of scientific developments, Dilthey's 'Philosophy of Life' (*Lebensphilosophie*), relativistic cultural criticism (Nietzsche) were condensed into popular habits, while authentic Kantianism, a field to which many Jewish writers contributed (for instance Cohen, Eisler, Cassirer), appeared as dry and old-fashioned. As to the role of the natural sciences in intellectual contexts it was prominent to the extent that it was connected to quasi-religious (Büchner, Haeckel) and ideological approaches (social and racist Darwinisms) and/or considered a part of national glory (Robert Koch, Paul Ehrlich, Fritz Haber etc.). If we look at society as a whole we see that science was hardly recognised as an intellectual achievement to be held in high esteem insofar as it was intertwined with logic, methodology and 'boring' rationalist or empiricist philosophies. Instead science was widely connected to *Weltanschauung*, not of the modest type of a science supporting metaphysics, as in Einstein's 'enlightened' thinking, but to social-political ideology, as for example in the Haeckel movement. Anyway, according to these concepts science is an acknowledged source of knowledge. At least as influential were approaches repudiating the importance of the sciences' role in the search for knowledge in favour of mere philosophical speculation or essayistic paradoxography.

If we go through the Jewish journals of the late nineteenth century, they suggest that there is something 'old-fashioned' among many German Jews of the time – holding on to the Enlightenment concept of universal know-

ledge, independent of specific religious and social contexts, while the zeitgeisty majority society at the fin de siècle had long walked along a different path. It is true that there were also many German Jewish intellectuals who contributed to the mainstream tendency (perhaps the positive stereotype of the Jewish intellectual up to the time of Walter Benjamin is shaped by their orientation), but this should not obscure what one could call a philosophical ‘retardation’ of wide circles of German Jewry – presupposing one considers the dominance of anti-scientific orientations as philosophical ‘progress’.

In order to understand such tendencies, one has to look at the early nineteenth century development of German philosophy. The diverging attitudes towards science go back to the alternatives offered by the Kantian scientist-philosopher Fries and the trained theologian Hegel. The predominance of anti-scientific attitudes being in line with anti-Enlightenment motives in German philosophy has to do with the triumph of speculative Idealism and the marginalisation of the Kantian Fries and his philosophical school: led by political motives, the Prussian university policy strongly favoured Hegel, the admirer of Prussian monarchy, and his disciples.¹⁶ In contrast, Fries, the late Enlightenment democrat, physicist and philosopher of science was banned and academic philosophy lost touch with the advancement of nineteenth century science.¹⁷ The admirers of Fries among the scientists of his time (such as Gauss, Henle, Link, Schleiden, Weber) saw their own views in total contrast to the mainstream of German academic philosophy as it developed in the course of the nineteenth century as a speculative enterprise. Even Helmholtz, who always behaved more cautiously as far as general academic policy was concerned, has been under suspicion of having perceived German academic philosophy with contempt as a subject for ignoramuses.¹⁸

That this antagonism and the role of the Fries school is widely neglected in intellectual history and the history of philosophy is itself one of the results of the historical process – the ‘Hegelianisation’ of German academic philosophy under the Prussian regime. This even had a lasting impact on the historiography of science which until today tends to overestimate the role of idealistic *Naturphilosophie* as an inspiring source of scientific achievements in

¹⁶ Cf. August Boeckh who mentions the “höchst verkehrte Begünstigung seiner [Hegel’s] Anhänger von oben herab“, in Letter to Niebuhr 24 October 1826, printed in Max Hoffmann, *August Boeckh. Lebensbeschreibung und Auswahl aus seinem wissenschaftlichen Briefwechsel*, Leipzig 1901, pp. 224 f., here p. 224.

¹⁷ See the articles by Bonsiepen, Charpa, Pulte in Wolfram Hogrebe and Kay Herrmann (eds.), *Jakob Friedrich Fries. Philosoph, Naturwissenschaftler und Mathematiker*, Frankfurt 1999.

¹⁸ This accusation – combined with an antisemitic anecdote – can be found in the constructivist’s Hugo Dingler’s *Der Zusammenbruch der Wissenschaft*, München 1926, p. 133.

the first half of the nineteenth century.¹⁹ Today Fries is not in focus and it is not easy to trace his influence. Ironically, if Fries, who himself was a hard-boiled anti-Judaist²⁰, is not totally forgotten, this is not least due to the impact his work had on Jewish thinkers up to Leonard Nelson, Otto Meyerhof, and Karl Popper. The next section will stress the fact that a core element of Reformism, the *Wissenschaft des Judentums* is not, as it is often portrayed,²¹ a result of Hegelianism, but exemplifies the way Fries saw successful research established.

Apart from some Hegelians among its advocates (especially Immanuel Wolf) German Reform Judaism displays features that relate it to Fries's philosophy of science and also Fries's anti-Judaic attacks, the latter in a similar way as the model to the sand mould. That this is not a mere analogy but represents a real impact is made clear by the historical facts, especially by the academic prehistory of Leopold Zunz's work influenced by Fries and the explicit Jewish reaction to him and the anti-Jewish essay by him.

Fries' *Über die Gefährdung des Wohlstandes und Charakters der Deutschen durch die Juden*²² was taken notice of by antisemitic and anti-Jewish circles as well as by German-speaking Jews. Among the small number of the founding members of the Berlin *Wissenschaftszirkel*²³, the forerunner of the *Verein für Kultur und Wissenschaft der Juden* (founded in 1819), we find two men whose first publications were rejoinders to the article by Fries, namely Immanuel Wolf (1799–1847) and Siegmund Wilhelm Zimmern (1796–1830).²⁴ An-

¹⁹ Cf. for instance Andrew Cunningham and Nicholas Jardine (eds.), *Romanticism and the Sciences*, Cambridge 1990; cf. also Nicholas Jardine, *The Scenes of Inquiry: On the Reality of Questions in the Sciences*, Oxford 1991; see also many of the articles in Thomas Bach and Olaf Breidbach (eds.), *Naturphilosophie nach Schelling*, Stuttgart-Bad Cannstatt 2005.

²⁰ In this regard he is a follower of Kant. Whether his anti-Judaism (mainly based on the idea of Judaism as an 'old-fashioned' authoritarian religion) is a form of antisemitism is difficult to decide. On this see Gerald Hubmann, 'Menschenwürde und Anti-Judaismus. Zur politischen Philosophie von J. F. Fries', in *Fries, Philosoph, Naturwissenschaftler und Mathematiker*, pp. 141–163.

²¹ Ironically, this probably goes back to Graetz' polemics, who characterised the *Kulturverein* as "Schleppenträger" of the philosophical "Seiltänzer" Hegel. Graetz takes out Zunz and even cites him as witness, but does not discuss Zunz' specific philosophical background. See Heinrich Graetz, *Geschichte der Juden von den ältesten Zeiten bis zur Gegenwart*, vol. 11, 2nd edn., Leipzig 1900, pp. 409–418.

²² Reprinted in Gert König and Lutz Geldsetzer (eds.), *Jakob Friedrich Fries. Sämtliche Schriften*, vol. 25, Aalen 1996, pp. 150–173.

²³ On this group see Hanns G. Reissner, 'Der Berliner "Wissenschaftszirkel" (1816/17). Jean Pauls Einfluß auf den Stil von Leopold Zunz', in *Bulletin des Leo Baeck Instituts*, 6/1963, pp. 101–112; Siegfried Ucko, 'Geistesgeschichtliche Grundlagen der Wissenschaft des Judentums (Motive des Kulturvereins vom Jahre 1819)', in *Zeitschrift für die Geschichte der Juden in Deutschland*, 5/1935, pp. 1–34, especially pp. 3 f.

²⁴ Immanuel Wolf and Gotthold Salomon, *Der Charakter des Judenthums nebst einer Beleuchtung der unlängst gegen die Juden von Prof. Ruehs und Fries erschienenen Schriften*, Leipzig

other rejoinder had been published at the same time by a Frankfurt partisan of Reform Judaism, Jacob Weil (1792–1864).²⁵

To Fries and Kant²⁶ Judaism is essentially a relic of a pre-Enlightened world in two regards: firstly, it is exclusive ('arrogant') – a transgression against the principle of *universalism* – secondly, it is *testimonial and authoritarian* – a transgression against the Enlightenment idea of autonomy.

The first accusation aims at the 'exclusiveness' of being Jewish from theological and social points of view, shown by dismissing missionary activities and by the professional uneven distribution of Jews. For obvious reasons, the Reform Movement could not react to Fries's criticism by opening Judaism to everyone with the consequence of turning it into a missionary religion: but it made efforts to rebut the categorisation of the Jews as a merchant caste. As did the vocational ORT school movement later on, Jacob Weil propagated Jewish handicraft and was among the founders of the *Verein zur Beförderung der Handwerke unter den Juden*. In Zunz's writings we find similar reactions.

Fries's second important allegation refers to the 'authoritarianism' of the rabbis on whom less informed observant Jews rely. In Fries's view, this does not only work as an obstacle to the social, economical and political progress of mankind, it is also considered disastrous from an epistemological perspec-

1817; Siegmund Wilhelm Zimmern, *Versuch einer Würdigung der Angriffe des Herrn Professor Fries auf die Juden*, Heidelberg 1816, reprinted in Gert König and Lutz Geldsetzer (eds.), *Jakob Friedrich Fries. Sämtliche Schriften*, vol. 25, Aalen 1996, pp. 785–815. Another member of the *Wissenschaftszirkel* was the historian and teacher Isaak Marcus Jost who mentions Fries' attack in his *Neuere Geschichte der Israeliten von 1815–1845*, Berlin 1846–47, vol. 1, p. 51. The impact of Fries's essay, formally not more than a review article, is also stressed by Graetz, *Geschichte der Juden*, vol. 11, Leipzig 1900, pp. 323–4.

²⁵ Jacob Weil, *Bemerkungen zu den Schriften der Herren Professoren Rühls und Fries über die Juden und Deren Ansprüche auf das Deutsche Bürgerrecht*, Frankfurt 1816. On Weil's importance to Zimmern, see Zimmern, *Versuch*, pp. 794–804, where he refers to Weil's apologetic collection *Fragmente aus dem Talmud und den Rabbinen*, Frankfurt 1809.

²⁶ That Fries's anti-Judaism is more vitriolic than Kant's, probably has to do with his biographical background. He grew up in the pietist Herrnhut Community at Niesky, and there is some evidence that the non-conformist attitude of its founder, Count Zinzendorf, had led its members into a difficult situation. Being overconfident in his missionary attempts to proselytise Jews to Christianity, he did not hesitate to introduce *kashrut* and *shabbat*, even elements of the Jewish wedding ceremony and a form of *Yom Kippur* into his communities' practice. *Difficile est* ... But writing a satire is not a pietist exercise. The strategy of Zinzendorf's – in other respects very apologetic – biographers is to keep quiet about this or at least to play it down. This makes clear that the topic was considered awkward among the members of the community. Nevertheless, probably due to reverence for Zinzendorf, the Herrnhuter's prayer-book in Fries's times, and still today contains "jüdisch teutsche Psalmen" and a bizarre intercession in favour of Jews („Die zehn stämme Israels von ihrer gelbsucht und raserey erlösen, und ihre versiegelten bewahren: Den stamm juda zu seiner zeit nachholen, und seine erstlinge unter uns [a specific type of converts] segnen“ (quoted in Christiane Dithmar, *Zinzendorf's nonkonformistische Haltung zum Judentum*, Heidelberg 2000, p. 218). To Fries, Judaism was strongly connected to such moments of his own original religious affiliation he did not feel comfortable with.

tive. The 'Cartesian' tradition, the common basis not merely of the 'Enlightened' Kantian and post-Kantian attitudes towards knowledge, is universalist and autonomistic (*sapere aude*) – which was Kant's famous motto for his reflections on what Enlightenment is. To him as well as to Fries the world of knowledge is independent of individual or group differences and individuals are called upon to proceed independently with the process of gaining knowledge and within the process of justifying their opinions as knowledge. The rabbinical conception of a reliable 'chain of tradition' (valid for Jews and no one else) forged by the learned authorities is not compatible with the Enlightenment idea of the path to knowledge (the question of whether some types of particularism and testimonialism do not fit much better to the *real* practice of scientific learning and research is another topic which will not be dealt with here).

If we read the documents of the authors of the Reform movement within this context we come across polemical formulations like "dull isolation"²⁷ of the rabbis and an emphasis on projects like that of writing Jewish history "from a totally independent point of view"²⁸. The reader is further informed that science stands "elevated above partiality, passion, and prejudices of ordinary life"²⁹. In his rejoinder to Fries, Zimmern accepts every reproach concerning the "disadvantages of the [Jewish] caste spirit" and expresses his hopes for a "completion of the break up that has already begun"³⁰; in terms of social science and social epistemology this means the step to egalitarianism has been taken.

In a historical report of the Berlin Reform community, written three decades after the modest attempts of the *Wissenschaftszirkel*, an interesting remark can be found: in 1840 the Jewish *Kulturverein* decided to put an end to the practice of giving specific support to Jewish authors and artists, because giving such a preference was suspected of giving particular chances or advantages to the applicants.³¹

Let us now turn our attention to the positive relationship between Reform Judaism and Fries's views. In this regard it is important to see to what extent the new tendency links itself to a revolutionary understanding of what Judaism is. The concept of 'Reform' is much too cautious to cover what happened here. To the Reformers Judaism no longer is in the first place a *practice*, and being a good Jew no longer primarily means to live according to the *ha-*

²⁷ Immanuel Wolf, 'Ueber den Begriff einer Wissenschaft des Judenthums', in *Zeitschrift für die Wissenschaft des Judenthums*, 1(1823) pp. 1–24, here p. 13.

²⁸ Wolf, *Begriff*, p. 16.

²⁹ *Ibid.*, p. 23.

³⁰ Zimmern, *Versuch*, p. 803.

³¹ Cf. Samuel Holdheim, *Geschichte der Entstehung und Entwicklung der jüdischen Reformgemeinde in Berlin*, Berlin 1857, p. 18.

lakhoth. Leading a Jewish life now was considered as being in a certain mental state, to *believe* something (that the contents of this belief are meagre corresponds to the views of the Reformers' hero Spinoza as well as to his later admirer Einstein). On the surface the emphasis on belief does not appear very original, it is in line with Protestant attitudes towards religion (*sola fide*). It goes without saying that this matches Fries's understanding of religion, as well as that of a large number of Protestant philosophers starting with Martin Luther himself.

Examined more closely, this is more than a variant of the general Protestant belief orientation; it reflects the role of principles in Fries's philosophy of science. The Jewish Reform agenda is not based on certain beliefs, on any 'Luther-like' spiritual experience and its propagation. It *reacts* to problems like the fact that a majority has seceded from traditional religious precepts.³² Meeting challenges of this kind calls for an agenda. To the reformers, belief is quintessentially a means to an end, a part of a programme aiming to solve the problem of being Jewish in the age of historical criticism of the Bible and the rapid progress of the natural sciences. Turning Jews into a community of 'minimalist' believers integrates them into the modern world. The author who best formulated this very precisely is Aaron Bernstein. Just like the Fries disciple Matthias Schleiden (1804–1881)³³, who started his *Grundzüge der wissenschaftlichen Botanik* with maxims the researcher should accept if he wants to work successfully, Bernstein and his allies in the *Genossenschaft für Reform im Judentum* couch the „*Grundzüge unserer Reform*” as “expressions of our religious will”³⁴ that is, as *maxims*. The slogan is: instead of “acting without belief ... we want belief”³⁵ – as the adequate reaction to the challenges of the modern world. This was written half a century before William James' *Will to Believe*, and it positions religious belief in the same way as being instrumental to successful modern living as the Fries school positions meta-scientific maxims as a means of successful scientific research.

4) Zunz, the 'Wissenschaft des Judentums' and the Fries School

In dealing with Reform Judaism in general we have already mentioned the '*Wissenschaft des Judentums*'. This conception is much more than a phenomenon in alliance with the Reform movement. As Ismar Schorsch has pointed

³² The quotations from the 1845 programme are taken from the reprint in Aaron Bernstein, *Ueber die Prinzipien der jüdischen Reformgemeinde*, Berlin 1865, p. 9.

³³ Ulrich Charpa, 'Matthias Jacob Schleiden' in Breidbach and Bach (eds.), *Naturphilosophie*, pp. 627–653.

³⁴ Bernstein, *Prinzipien*, p. 27.

³⁵ *Ibid.*, p. 9.

out³⁶, the main tendency of the Reform movement itself is trusting in scholarship. The Reform Judaism of Zunz, Jost and many others is bound to the idea of professional research, based on the Enlightenment epistemology of autonomous, equal subjects without prejudices and without trust in second-hand traditional knowledge.

It is relatively easy to see how such a programme of a science of Judaism matches the philosophy of the Fries school, concretised by the methodology of the botanical sciences, as put forward by the Friesian botanist Schleiden. To Zunz as to Schleiden, the type of study he has in mind is the result of a disciplinary formation (*Wissenschaft des Judentums*), trying to be consistent with other disciplines, based on empirical materials guided by disciplinary principles in harmony with universal principles of scientific work.³⁷ The Science of Judaism was conceived as an explanatory enterprise,³⁸ and as an open-ended process as far as the contents are concerned. The objective of this endeavour is truth, or to avoid this figurative way of speaking, of making true statements in historical and systematic Jewish domains. Zunz's conception as outlined in *Etwas über die rabbinische Literatur*³⁹ is to treat rabbinical literature as a part of a universal culture. His approach to interpretation is no longer halakhic, that means oriented normatively with regard to a certain group. It is universalist and scholarly⁴⁰, according to the historical-critical method, as practiced in classical philology by August Boeckh (1785–1867) and in Biblical Studies by Wilhelm Martin Leberecht de Wette (1780–1849). If there is anything like a normative purpose of Zunz's scholarly enterprise it is to integrate Jewish culture into the general progress of mankind. The way scholarly work fits into the modern world is in a similar way instrumental, as is the turning to belief with a relatively sparse content to life in a secularised context.

To see the philosophical differences one has to keep in mind that Hegelianism was the most influential philosophical tendency of nineteenth cen-

³⁶ Ismar Schorsch, 'The Ethos of Modern Jewish Scholarship', in *LBI Yearbook*, vol. 35 (1990), pp. 55–71, *idem*, 'Scholarship in the Service of Reform', *ibid.*, pp. 73–101.

³⁷ Similar to Steinschneider's work, Zunz's contribution is often considered unsystematic and not guided by principles. In my view, in this as well as in Steinschneider's case, such principles can be extracted without much effort from the texts of *Etwas über die rabbinische Literatur* (1818) and *Die gottesdienstlichen Vorträge der Juden* (1832). There is no space to discuss this question here.

³⁸ Zunz attempted to find a causal historical-literary explanation for the huge variety and richness of Jewish liturgy, fighting against any possible form of dogmatism vis-à-vis this dynamical liturgical tradition', Wout Jac. Van Bekkum, 'Leopold Zunz and Hebrew Poetry', in *EJJS Newsletter* 15 (2004), pp. 24–32, p.30.

³⁹ Leopold Zunz, *Etwas über die rabbinische Literatur. Nebst Nachrichten über ein altes bis jetzt ungedrucktes hebräisches Werk*, Berlin 1818.

⁴⁰ Cf. on this Céline Trautmann-Weller, *Philologie allemande et tradition juive. Le parcours intellectuel de Leopold Zunz*, Paris 1998.

ture Germany and that it advocated the opposite ideas: that is, it was not content with mere maxims as starting points, instead it aimed at creating 'eternal' fundamental knowledge, and this irrespective of disciplinary boundaries, by mere reflection and deducing disciplinary opinions from 'above'. This generated the gap between philosophy and science in nineteenth century Germany that still exists today. The Hegelian approach was heavily criticised not only by the Fries School but also (if not totally ignored) by the scientific experts of the time (the best occasion was provided by Hegel's *a priori* construction of the number of planets which was made to look ridiculous after the discovery of the, from the philosopher's point of view, 'unnecessary' Uranus⁴¹).

Zunz never attended a lecture by Fries (and, if we take his attitude towards another professor and antisemitic partisan of Fries into consideration, he probably would never have done so⁴²). But he was the student of two Berlin professors who were close friends of Fries and also a pupil of a third teacher who had great sympathies for Fries's approach to philosophy. Zunz's academic teacher on the *tenakh* was de Wette with whom he had personal contact,⁴³ and who was one of Fries's most faithful followers.⁴⁴ Like his teacher Fries, de Wette was a democrat who was put under political pressure. He lost his chair in Berlin in 1819 and spent the rest of his career at Basel. In the following, we will ignore political aspects, including political similarities between Bernstein and Einstein. More interesting with regard to our topic is Zunz's programme of opening Jewish learning to secular knowledge.

Zunz himself attended lectures on mathematics and on mathematical astronomy at Berlin University and in his encyclopaedic prospectus of Jewish learning he gave the natural sciences in connection with mathematics (in contrast to the anti-mathematical *Naturphilosophie* in the romantic style) a prominent position.⁴⁵ Zunz also attended lectures of Fries's friend

⁴¹ On the criticism of Hegel's *a priori* astronomy, physiology etc. by Matthias Schleiden, Ernst Friedrich Apelt and others see Charpa, 'Schleidens Kritik an Hegel und Schelling. Abriß einer 'rehabilitistischen' Methodologie', in Hogebe and Herrmann (eds.), *Fries*, pp. 255–281.

⁴² He did not attend Friedrich Rüh's lectures – although he had already entered his name (and paid) for it. Cf. Ucko, 'Geistesgeschichtliche Grundlagen' p. 4

⁴³ Cf. the letter by Zunz to S. M. Ehrenberg, 11 July 1817, in Nahum Glatzer, *Leopold Zunz, Jude – Deutscher – Europäer*, Tübingen 1964, p. 86; other material in this regard in Ludwig Geiger, 'Zunz im Umgang mit Behörden und Hochgestellten', in *Monatsschrift für Geschichte und Wissenschaft des Judentums*, 60 (1916), pp. 245–262.

⁴⁴ See their exchange of letters in Jacob Friedrich Fries, *Sämtliche Schriften*, vol. 27, pp. 587–717.

⁴⁵ Cf. Birgit Börner-Klein, 'Leopold Zunz on Enlightenment, Education and Reform', in *EJJS Newsletter* 15 (2004), pp. 61–71.

Heinrich Friedrich Link⁴⁶ (to whom Fries⁴⁷ and, following Fries's statement, some historians of the scientific method pay tribute as being the first advocate of the falsification-principle which Karl Popper then made prominent in twentieth century philosophy of science). In a book published two years before Zunz attended his lectures, Link, a botanist, launched an attack against romantic *Naturphilosophie* and emphasised that its heyday was over: "A disproportional tendency towards speculation that took possession of many German authors is, in my view, dangerous to the issue. The exaggeration out of which one believed that nature can be constructed out of a few natural philosophical principles, faded. Mathematical physics as currently accepted remains unshakeable."⁴⁸ If there is anything like a litmus test to decide whether a scholar of this epoch was oriented towards romantic *Naturphilosophie*, that is, mainly towards speculative science, it is his attitude towards the importance of mathematics which the romantics programmatically denied. Zunz was among those observers who complained about the neglect of mathematics at Berlin University.⁴⁹

German Reform Judaism was not only oriented at academic research, in its beginnings it also had a close relationship with Kantian science-oriented philosophy. As made plausible earlier, the fact that the same scholars who referred to the 'Friesians' de Wette, Schleiden (who was not only a defender of Judaism as a writer, but was also the key figure in the background of H. Graetz's doctorate at Jena)⁵⁰, Bessel, Dove and others did not refer to the head of the movement itself, can be easily explained by Fries's anti-Judaism, which drew attention from the Jewish Reform movement.⁵¹

In this regard it was a late stage of the Enlightenment movement. There is no evidence of Einstein ever having read a treatise of Zunz or any other well-known protagonist of the Reform movement (we will come to the

⁴⁶ Cf. Céline Trautmann-Waller, 'Man of Words and Action: On the Cultural Biography of Leopold Zunz', in *Eajs Newsletter* 15 (2004), pp. 4–23, here p. 8.

⁴⁷ Gert König u. Lutz Geldsetzer (eds.), *Jacob Friedrich Fries. Sämtliche Schriften*, vol. 13 (*Die mathematische Naturphilosophie nach philosophischer Methode bearbeitet (1822)*), Aalen 1979, p. 23.

⁴⁸ Heinrich Friedrich Link, *Idee zu einer philosophischen Naturkunde*, Breslau 1814, pp. III–V.

⁴⁹ Cf. Trautmann-Waller, 'Man of Words', p. 9.

⁵⁰ This was found by Marcus Pyka (cf. his *Jüdische Identität bei Heinrich Graetz*, Göttingen 2006); on the connection of his supporters to Schleiden see Charpa, 'Matthias Jakob Schleiden (1804–1881): The History of Jewish Interest in Science and the Methodology of Microscopic Botany', in *Aleph – Historical Studies in Science and Judaism* 3 (2003), pp. 213–245, here p. 219.

⁵¹ Cf. the rejoinders of Wolf and Zimmern (see fn. 24); a first neutral reference to Jost's work by Schleiden can be found in his *Ueber den Materialismus*, Leipzig 1863, reprinted in Ulrich Charpa (ed.), *Wissenschaftsphilosophische Schriften*, Cologne 1989, pp. 264–309, here p. 273.

'missing-link' soon). As to his acquaintance with Enlightenment thinking we know of his early reading of Kant's *Critique of Pure Reason*. This work has some very strong ties to the development of classical mechanics, but it only alludes to its most general notions, that of time and space. This may have been of some importance for the stimulation of Einstein's thinking on these issues, but the style, and Kant's central question, namely that of *transcendental* preconditions, do not play an important role in Einstein's work. As to the latter it is easy to see that Einstein's conception of 'thinking' as the formation of right belief represents a non-Kantian type of epistemology. Kantian transcendentalism discusses the preconditions of the possibility of knowledge, or to put it more simply, the condition of being right or wrong.

If there is any Kantianism in Einstein's reflections on right beliefs and their origin in vague intuitions, it is not due to Kant's own position but resembles the Friesian concept of *Ahnung* which judges nature as determined, as purposeful, and relates this impression to the idea of a higher spirit, that is Einstein's God who does not play dice. This concept of *Ahnung* is a key concept for an adequate understanding of the late form of the Jewish Enlightenment in the nineteenth century. Kant himself had criticised the concept of *Ahnung* polemically,⁵² but later on it gained a meaning that fits the Kantian approach very well. What is meant is not a feeling, but to some extent, or totally, a *cognitive* result of an experience.

At this point we should be very careful, because we are confronted with two tracks that were in the beginning close to each other but subsequently went into different directions. One is that of the philosophy of Schleiermacher: his *Reden über die Religion* (1799) is a book that for good reasons has been considered an inspiring source for Zunz.⁵³ Schleiermacher spoke of the "sense" ("*Sinn*") that is excited for holy and divine things", and according to his approach religion is characterised as "sense and taste for the eternal" ("*Sinn und Geschmack für's Unendliche*").⁵⁴ It is neither thinking nor acting but sensible intuition and feeling.⁵⁵ Against mere emotionalism Schleiermacher added that "feeling without sensible intuition is nothing" ("*Gefühl ohne Anschauung ist nichts*").⁵⁶ Quite close to Schleiermacher's reflections on a specific 'sense', Fries uses the concept of *Ahnung* to name the aesthetic sense for the "eternal order in the finiteness of nature".⁵⁷ In both cases one may see at

⁵² Kant, 'Von einem neuerdings erhobenen vornehmen Ton in der Philosophie', in *Berlinische Monatsschrift*, 27 (1796), pp. 387–426.

⁵³ Börner-Klein, pp. 68–69.

⁵⁴ Friedrich Schleiermacher, *Über die Religion. Rede an die Gebildeten unter ihren Verächtern*, Hamburg 1958, p. 9.

⁵⁵ Schleiermacher, p. 46.

⁵⁶ Schleiermacher, p. 46.

⁵⁷ Jakob Friedrich Fries, *Wissen, Glaube und Ahndung*, Jena 1805.

least partly a re-enactment of the Natural Theology of the early Enlightenment at work that had its heyday in the pre-Kantian Enlightenment and was the object of criticism in the *Kritik der reinen Vernunft* and other writings. The difference between the two philosophers is that Fries's conception is more epistemically oriented, while Schleiermacher opens the gates to romantic enthusiasm. The next step of a person with *Ahnung* for the Fries school (as well as, later, Bernstein and Einstein) was along more or less justified beliefs towards true beliefs, scientific knowledge.

Keeping in mind at what time Zunz was studying in Berlin, that is from 1815–1819, we have to take into account that in the second decade of the nineteenth century Schleiermacher had moved further towards a romantic emotionalism. Religion according to him is a matter of mere feeling, as documented in his *Predigten* (Sermons). One cannot deny that these sermons influenced Zunz, and inspired him, as evident in his demand to deepen religious life emotionally by using the Hebrew language⁵⁸; but if we are interested in the ties between Reform Judaism and academic history we do not come across a 'Schleiermacherian', that is a 'romantic' story. In the years from 1815–1819, Schleiermacher and de Wette, Zunz's favourite teacher, were already in total opposition to each other. De Wette's ally at Berlin University was August Boeckh.⁵⁹ Politically and philosophically Schleiermacher was de Wette's *bête noire* and to Boeckh, Schleiermacher, who was his friend, nevertheless was his antagonist in the field of academic policy – as far as idealist philosophy was concerned.⁶⁰ If Zunz later became celebrated as the 'Jewish Boeckh' it does fit much better into the academic scenery of those years if we situate Boeckh's close friend de Wette in the background – in place of Schleiermacher, a leading spirit of romanticism and partisan of speculative German idealism.

What perhaps was even more relevant for Zunz, the later founder of the German Reform movement, were the different attitudes towards Judaism. According to Schleiermacher and his *Reden über die Religion*, the definite article attached to 'religion' in the title of this work is not an accidental fact. Before he says anything on Judaism, he lets the reader know the following:

⁵⁸ Cf. Börner-Klein, p. 68.

⁵⁹ On Boeckh's impact see Giuseppe Veltri, 'Altertumswissenschaft und Wissenschaft des Judentums. Leopold Zunz und seine Lehrer F. A. Wolf und A. Böckh', in *Friedrich August Wolf Studien. Studien, Dokumente über die Religion, Bibliographie*, Stuttgart 1999, pp. 32–47.

⁶⁰ Compare for instance de Wette's report on his and Boeckh's activities against Schleiermacher's politics on behalf of Hegel, Schelling, Steffens and others. Letter to Fries, 30 March 1816, printed in Gert König and Lutz Geldsetzer (eds.), *Jacob Friedrich Fries. Sämtliche Schriften*, vol. 27, Aalen 1997, pp. 641–647.

In fact, I should talk only about one [religion]. Judaism has been for a long time a dead religion, and those who are adhering to it even now, in reality are sitting by the imperishable mummy complaining and crying over its death and its sad desolation.”⁶¹

The specific sense of ‘religion’ is one that cannot be found in Judaism: “Look at the essential religiosity in it, tell me what is the idea of the universe shining through everywhere?”⁶² To Schleiermacher Judaism is not even a religion to be taken seriously.

It is rewarding to compare Schleiermacher’s attitude to de Wette’s appraisal of Judaism with the concept of *Ahnung* in mind. In contrast to Schleiermacher, de Wette does not hesitate to compare Christianity with Judaism. Similar to Schleiermacher, in his view the essence of religion does not consist of dogmas but basic moods (*Grundstimmungen*) towards nature, God and man. And far from Schleiermacher’s contempt, de Wette concedes Judaism a sphere where such mood, *Ahnung*, is made possible (this is not clear to the same extent when examining his characterisations of Catholicism in the same context).⁶³

At the time when Zunz was studying at Berlin University, the periodical *Sulamit* reprinted Moses Mendelssohn’s poem written in 1777, *Ode zum Lobe Gottes, nach einem Donnerwetter*, which praised God in the style of Natural Theology as the creator and regulator of nature. There is nothing original about this piece; one can find hundreds of such poetic attempts in German literature, all with the same message “How mighty are your works, oh Lord”⁶⁴, but not in 1817, more than one generation after Mendelssohn’s death. 1817 was the year of the *Wartburgfest*; the German literary scene at that time was dominated by Uhland’s poetry, Chamisso’s *Schlemihl*, Eichendorff’s *Marmorbild*, Brentano’s fairy tales, and E. T. A. Hoffmann’s *Nachtstücke*, which judging by the metaphorical title and its contents was an anti-Enlightenment manifesto. During the following decades there was no revival of Enlightenment positions in the intellectual and literary mainstreams of the nineteenth century. There were only a few writers in the middle of the nineteenth century who were committed to the Enlightenment view on nature, among them the Fries dis-

⁶¹ Schleiermacher, *ibid.*, p. 159.

⁶² *Ibid.*, p. 159.

⁶³ Cf. his letter to Fries 26 September 1811, in *Sämtliche Schriften*, vol. 27, pp. 604–616. Bernstein’s journal, the *Volkszeitung*, reports Königsberg University’s refusal to accept Catholics and Jews as full professors but emphasises the fact that Jews found advocates among the professors of the *Concilium generale*, unlike Catholics. Later on this decision was changed, see *Volkszeitung* 7 July 1861; that *Volkszeitung* was considered a good source with regard to such topics is obvious as the *Allgemeine akademische Zeitung* very often simply reprinted reports of the *Volkszeitung*. Cf. in this case *Allgemeine akademische Zeitung*, 14 July 1861.

⁶⁴ Moses Mendelssohn, ‘Ode zum Lobe Gottes, nach einem Donnerwetter’, 1777, reprinted in: *Sulamit* 5/1817, pp. 286–89.

ciple Schleiden, a leading botanist and key-figure in the history of cell theory, who among many other activities published poetry under the pseudonym of Ernst, and presented the Enlightenment God as an "unconditional cause of life". To make the philosophy underlying this poem transparent he entitled it *Kantianismus*⁶⁵.

The Jewish publication *Sulamit* itself provides an example of the view proposed here. This journal, the first for a Jewish readership in German and committed to the Enlightenment heritage of Moses Mendelssohn, appeared until 1843. One may relate this fact to the mere idea of a nineteenth-century journal devoted to the heritage of Kant – but not aiming at a pure academic readership, in other words, something like *Kant-Studien* as a popular magazine. Somewhat later than the Enlightenment of non-Jews there existed a robust, scientifically oriented Jewish Enlightenment movement which historical-philosophical research has neglected, concentrating instead on Jewish Romantics, Hegelians, Nietzscheans and so on.

The agreement with the Kantian-Friesian approach to science is not limited to the Reform Jewish project, and it is illuminating to compare the reaction formulated by 'Friesian' authors to that of the orthodox journal *Jeschurun* regarding the materialism-controversy. The main counter argument⁶⁶ is exactly on the same lines as what Schleiden, the advocate of the Fries-School, wrote on the same topic:⁶⁷ Materialism is a *Weltanschauung* which may be stimulated by some scientific results, but does not originate from them. As 'learners' religious as well as non-religious individuals ought to hold scientific research in high esteem. But no serious religious question is answered or proved worthless by science itself.

5) Aaron Bernstein and Einstein

If we are looking for a prolific nineteenth century writer on science, who – in contrast to many others – was more than cautious as far as its ideological functionalisation is concerned, for someone, who ridiculed Hegel for the same reasons as the Fries School did,⁶⁸ and to whom the relationship of reli-

⁶⁵ Ernst [M. J. Schleiden], *Gedichte*, Leipzig 1856, p. 24.

⁶⁶ Anonymus, 'Der Materialismus in der Naturwissenschaft', in *Jeschurun*, 2 (1856) no. 5, pp. 271–279; cf. also Josua Sternschuß, 'Zur Würdigung der Ansprüche des neuen Materialismus', in *Jeschurun*, 5 (1859) no. 10, pp. 586–592; 6 (1859) no. 2, pp. 99–106; 6 (1860) no. 5, pp. 270–284.

⁶⁷ Schleiden, *Materialismus*. This is also the first publication where Schleiden refers to Jews – his later topic (see above fn. 50).

⁶⁸ See Frederick Gregory, 'The Mysteries and Wonders of Natural Science: Aaron Bernstein's *Naturwissenschaftliche Volksbücher* and the Adolescent Einstein', in Howard and Stachel (eds.), pp. 23–24, here p. 39.

gion to science had explicitly to do with *Ahnung* – it is almost unavoidable to come across Aaron Bernstein. And here we have the ‘missing link’, someone whose books Einstein thoroughly read in his youth and held in high esteem when he was already the most prominent scientist of his age. In the 1920s Max Talmey (Talmud), his private tutor, reported:

The boy was profoundly impressed by them [Bernstein’s books] which describe physical phenomena lucidly and engagingly, had a great influence on Albert, and enhanced considerably his interest in physical science. He never forgot Bernstein’s books. Even since he became famous, he has often praised them On the occasion of a visit of Professor and Mrs. Einstein to my home, in 1921, I asked him what he thought of the vilification of Bernstein’s books by a biographer who calls them an obsolete work of “sham science”. These are almost the words of Professor Einstein’s reply: Bernstein’s work is a very good book even now, and at that time it was the best of its kind. It has exerted a very great influence on my whole development.⁶⁹

In his autobiographical remarks Einstein even gives a (unfortunately not very helpful) hint as to which edition he had read.⁷⁰ As already mentioned in the beginning, these remarks did not remain unnoticed by historians of science. But apart from a few exceptions⁷¹ the author has not yet drawn much attention to himself. Who was Aaron Bernstein, or A. Rebenstein (an anagrammatic pseudonym he used even within the Berlin Jewish Reform Community⁷²) or A. Bernstein (as he preferred to sign⁷³)? The reason why this figure promises to be a rewarding topic for a whole range of investigations becomes clear once we know more about his life: Born in Gdansk in 1812, the only professional education he ever received was rabbinical training in a *yeshivah* at a small town in the Prussian province of Posen (Poznan), and in Gdansk, his hometown. It has been reported that even at an advanced age he was still able “to write in the style and spirit of a Polish rabbi”.⁷⁴

⁶⁹ Max Talmey, *The Relativity Theory Simplified and the Formative Period of Its Inventor*, New York 1932, p. 162 f.

⁷⁰ In Einstein, ‘Autobiographical Notes’, p. 2, he speaks of five or six volumes. The existing copies of the *Volksbücher* show that the books appeared in many variations. This would match the first series of the Duncker edition from 1867 but also to later Duncker editions. *Naturwissenschaftliche Volksbücher. Wohlfeile Gesamt-Ausgabe*, Stuttgart 1876, includes the last version in five volumes with a green cover; the Stuttgart edition is used here.

⁷¹ See Gregory.

⁷² See Samuel Holdheim, *Geschichte und Entstehung und Entwicklung der jüdischen Reformgemeinde in Berlin*, Berlin 1857, pp. 30, 37, *passim*.

⁷³ The biographical materials still available are presented and commented by Julius H. Schoeps, *Bürgerliche Aufklärung und liberales Freiheitsdenken. Aaron Bernstein in seiner Zeit*, Stuttgart 1992.

⁷⁴ ‘Aaron Bernstein’, in *Jewish Encyclopedia*, sub nomen. The source referred to is *Ha-Zefirah*, 1875. Its founder was the well-known Chaim Selig Slonimsky who was a regular visitor at Bernstein’s home and interested in mathematics, natural science and technical developments. He and Bernstein experimented in order to improve the telegraph.

His father was a rabbi who was in charge of a public library – the appropriate German word for such an institution at this time would have been *Volksbücherei* or *Volksbücherhaus*. We do not know why Bernstein entitled his twenty-one volume work *Naturwissenschaftliche Volksbücher* but it is without any doubt that the word *Volksbuch* (which relates to popular fifteenth and sixteenth century tales like *Eulenspiegel*, *Schildbürger* etc.) is not a probable source. Another and the most plausible meaning lies in its resonance with concepts like *Volksheil*, *Volkswohl*, *Volksbildung* he uses in the programme⁷⁵ of the journal he edited, the *Volks-Zeitung* (!). More important than the origin of Bernstein's vocabulary is its correspondence to all kinds of egalitarianism, including the ideas of *Volksbildung*, matching with *egalitarian epistemology* (see above).

As with Moses Mendelssohn in the century before, the young Bernstein left his home region and went to Berlin to further his studies.⁷⁶ Two years after his arrival he produced a philologically convincing translation of the *Song of Songs* into German, which was published with a preface and bibliographical annotations by Leopold Zunz.⁷⁷ The method is historical-critical, following the methods of Zunz, and that of Zunz's teachers Boeckh and de Wette. If there was anyone in Berlin who could have functioned as a leading figure to Bernstein, it was Zunz: over many years, Zunz, the 'founder' of the *Wissenschaft des Judentums* (considered by many an extraordinary boring type of dry philology) and author of the even drier *Gottesdienstliche Vorträge der Juden* worked as a humorous journalist for the *Spener'sche Zeitung*. He wrote satires, aphorisms, fables, and was involved in the democratic movement of 1848.⁷⁸

Thus Bernstein's contact to Reform Judaism was intertwined with scholarship right from the beginning. His early achievement would also have fitted into the beginning of a career as a figure of the literary world. Indeed, he published a lot of poetry and had enormous success with it. Literary history has ranked him highly as the founder of the ghetto novel and his novels have been published in many editions – one appeared half a century after his death in 1884.⁷⁹ Throughout his entire life he remained active as poetic

See an anecdotal reminiscence in Julius Bernstein, *Erinnerungen an das elterliche Haus*, n. p. 1913, p. 33. According to the younger Bernstein's humorous narrative Slonimsky was always very anxious whether 'di gojim' would be able to comprehend what they had invented.

⁷⁵ Cf. Frölich, *Die Berliner Volks-Zeitung* (see fn. 81), pp. 28 ff.

⁷⁶ Traits of a self-portrait can be found in his story of *Vögele der Maggid*, Berlin 1840, where two *yeshiva bachurim* make up their minds to go to Berlin.

⁷⁷ On this cf. Schoeps, pp. 46–47.

⁷⁸ See Ludwig Geiger, 'Aus L. Zunz' Nachlaß', in *Zeitschrift für die Geschichte der Juden in Deutschland*, vol. 5 (1892), pp. 223–268.

⁷⁹ Published by Schocken: Aaron Bernstein, *Vögele der Maggid. Eine Novelle*, Berlin 1934.

writer, but at the same time he also became a public figure as a political journalist. In 1849 he founded the political monthly *Urwähler-Zeitung. Organ für Jedermann aus dem Volke*, which expressed the urgent need for a social and political reform. Not much to our surprise we find his *spiritus rector* Zunz among his readers.⁸⁰

The journal was suppressed by the Prussian authorities and Bernstein was imprisoned for some months. The successor to the *Urwählerzeitung* was the Berlin daily *Volkszeitung* with Bernstein, author of the *Volksbücher*, as chief editorial writer for over three decades. This journal had a large circulation.⁸¹ It was the organ of the progressive, liberally minded, anti-communist faction with a broad readership ranging from workers to industrialists. We do not know whether Einstein's father Hermann was among the subscribers, but this liberally minded man would have been a typical example of the readership.

Already in the *Urwähler-Zeitung* Bernstein began to write on natural science. From a professional point of view his qualifications to do so were based on next to nothing. However, we do know that what is normally the most serious obstacle to developing a sufficient understanding of relevant topics, namely a lack of mathematical training, did not cause him any difficulties. Bearing in mind that in Bernstein's time mathematical education in schools, the Gymnasium included, was more than poor (even if we do not compare it with, for instance, Lagrange's *Mécanique analytique*, but only with an understanding of elementary books like the *Lehrbuch der Physik* by Müller-Pouillet-Pfaundler⁸²). But Bernstein had demonstrated an easy autodidactic access to mathematics and to science in his *Treatise on the Rotation of Planets* (1843). Here he at first discusses the relationship of light rays and moving bodies which resembles later ideas of James Clerk Maxwell in this field. According to Bernstein's own report, the expert he contacted to discuss his understanding was Friedrich Wilhelm Bessel (1784–1846), the Königsberg astronomer.⁸³ Here again we come across the social dimension in attitudes towards science: Bessel, the leading astronomer of his time, was also totally in line with the Fries school in their fight against Hegel, Schelling and romantic natural philosophy.⁸⁴

⁸⁰ See the citation of an article in a letter by Leopold Zunz to Philipp and Julie Ehrenberg in Glatzer, p. 274.

⁸¹ On this, see Jürgen Frölich, *Die Berliner Volks-Zeitung 1853 bis 1867. Preussischer Linksliberalismus zwischen „Reaktion“ und „Revolution von oben“*, Frankfurt 1990, pp. 58–72.

⁸² 8th edition, Braunschweig 1876.

⁸³ Schoeps, p. 48, reports that his own attempt to find evidence for an exchange of letters between Bernstein and Bessel (of which a popular magazine gives an account (see Aaron Bernstein. 'Ein deutscher Zeitungsschreiber', *Die Gartenlaube* 29 (1861), pp. 453–456) was not successful.

⁸⁴ Cf. Matthias Jakob Schleiden, *Schelling's und Hegel's Verhältnis zur Naturwissenschaft*, 1843, reprinted in: Schleiden, *Schriften*, pp. 196–264, p. 261.

Well worth mentioning with regard to Bernstein is also Bessel's activity as a popular writer on science. One year before the *Urwähler-Zeitung* was founded, where Bernstein published his first essays on popular science, Bessel's *Populäre Vorlesungen über wissenschaftliche Gegenstände* were published. One should perhaps add that in the same year (1848) Matthias Schleiden, the Friesian botanist, started his career as a popular writer on scientific topics. In line with their democratic political tendencies, and in total disagreement with the elitist tradition of Hegel, Schelling and others, they were all involved in the universalist project of *Volksbildung*. Bessel's, Schleiden's, and Bernstein's type of popular writing is forgotten today, but everyone who reads Einstein's popular treatises, written many decades later, is already acquainted with this world where the readers are addressed as 'liebe Leser':

Certainly also you, dear reader, as a boy or a girl, have made acquaintance with EUCLID's proud edifice of geometry, and you certainly remember with more respect than love the proud edifice on whose high steps you were chased around by conscientious teachers for countless hours. By virtue of this past excellence you would certainly ignore anyone who declared even the most remote little sentence of this science to be wrong. But this feeling of proud security would perhaps disappear if someone asked you: 'What do you mean by the assertion that these sentences are true?' Let us remain with this question for a while.

This is the simple, universalist style of *Volksbildung*, and this is how Einstein's *Über die spezielle und die allgemeine Relativitätstheorie* (1917) begins.

Returning to Bernstein, the biographical picture is completed with the honorary doctorate awarded by Tübingen University in 1877, due to the initiative of Paul Du Bois-Reymond, professor of mathematics and brother of the physiologist Emil Du Bois-Reymond.⁸⁵ During the many years he worked as a journalist Bernstein was also an amateur scientist who tried to back up the popular scientific explanations published in the *Volkszeitung* and later on in the *Volksbücher* with his own experiments.

The contents of the *Naturwissenschaftliche Volksbücher* and their forerunner *Aus dem Reiche der Naturwissenschaften*⁸⁶ have been summed up in detail by Frederick Gregory.⁸⁷ Suffice to say, the *Volksbücher* deal extensively with many issues that are to varying degrees important to Einstein's physics. This underlines the impact Bernstein's books may have had on Einstein thematically. But there is one issue that is mentioned but not discussed by Gregory, namely the ubiquity of thought experiments. And there are some other features of Bernstein's opinions which Gregory interprets vaguely as relics of German Romantic natural philosophy, an interpretation that in my opinion

⁸⁵ Schoeps, p. 267.

⁸⁶ 12 vols., Berlin 1853.

⁸⁷ See Gregory.

leads in the wrong direction. Bernstein's usage of modest determinist metaphysics as well as his practice of following leading principles, such as simplicity, is not due to the dogmatic *Naturphilosophie* of the Romantic era. What is at stake in both respects has to do with Bernstein's Jewish background. Here we come across Bernstein's traditional rabbinical education as well as his 'Zunzian' Reform Judaism including 'Friesian' tendencies.

Let us start with some remarks about the traditional element: as is well known, there is no other figure in the history of science who has made such extensive use of thought experiments as Einstein. And there is no other popular writer on science except Bernstein who shared the same preference. The volumes of the *Volksbücher* are filled with horse-riders on electro-magnetic waves etc. As is well known, the use of thought experiments itself is not a new method. We find such idealised counterfactual experimenting in the writings of many great scientists (there are thought experiments even in the works of Aristotle and the Aristotelians⁸⁸ who are often blamed for having stuck to everyday experiences) and this practice has been commented on extensively by philosophers and historians of science. The relevant fact here is that we do not find this methodological device as a tool in Weber's Zurich laboratory, where the young Einstein received his physics education. As far as we are informed about Weber's approach to physics, it was a research focussing on exact empirical work, based on precise instrumentation and experiment.⁸⁹ Such a laboratory education is not balanced by the occasional reading of more hypothetically minded authors and we cannot take it as a matter of course that a young scientist learning in this 'Helmholtzian' climate felt the urgent need to get acquainted with works of a divergent orientation. If we take the Zurich context into consideration, Einstein's mere liking of thought experiments appears as an exotic fact. And what we are facing in Einstein's writing is something more spectacular: the remarkable proportion of this practice in Einstein's theoretical work. In contrast to other authors, to Einstein subtle thinking on fictional, or rather pseudo-empirical facts, is not an occasional matter, it is Einstein's preferred way of tackling very difficult problems. If we try to explain this, it makes sense to presuppose something like a broader pre-intuition about what scientific research includes in the realm of thinking.

Returning to Bernstein, whose *Volksbücher* offer themselves as probable sources of this attitude, we should ask: where does Bernstein's preference stem from? Obviously, not from Reform Judaism. As already discussed, Reform Judaism's methodological orientation is that of starting from the real

⁸⁸ Cf. Amos Funkenstein, *Theology and Scientific Imagination from the Middle Ages to the Seventeenth Century*, Princeton 1986, pp. 152–179.

⁸⁹ Cf. Cahan, 'Education'.

phenomena and integrating them with the help of philosophical principles. The empirical 'data' of the *Wissenschaft des Judentums* were historical documents whose methodological function is comparable to natural or experimentally generated phenomena in Friesian science. Neither to Bernstein as the Reform Jew, nor to Einstein, who did not practice any religious Judaism at all, can we establish a link with a specific affinity to thought experiments on this line. It is easy to see what was the most likely source: it was the *rabbinical* culture of the 'dark' past, the "dull isolation"⁹⁰ that Reform Judaism had resolved to overcome.

In Einstein's case, that of someone to whom the *Psalms* (!) appeared as the essence of Jewish religion, obviously *no* direct connection to this culture ever existed. But he was an eager reader of the *Naturwissenschaftliche Volksbücher*, and their author Bernstein was rabbinically trained in Poland in an 'old-fashioned' style, not in Enlightened Breslau or Berlin. Irrespective of his later reform enthusiasm, his religious competencies were due to a traditional education starting in childhood. With this in mind, it is not surprising to see an author coming up with fictitious situations and discussing them penetratively. To anyone who has at least a superficial acquaintance with rabbinical practice the high status of counterfactual thinking is beyond any doubt. One needs only to make plain to oneself that complete treatises and many paragraphs of the Talmud had already lost their *real* basis when the text was codified – not to speak of subsequent discussion of these pieces. What is at issue in Talmudic debates of old and recent times includes an inexhaustible mass of problems related to mere thinking, such as, for instance, assessing the duties of the priests and levites (*trumoth*) or making certain sacrifices (*sevakhim*), leaving aside the trivial fact that there is no longer any temple. In such cases the Talmudic debate circles around problems of the type "What would need to be done *if* the temple still existed?" Furthermore, that something is a 'real' difficulty does not confine the Talmudic discussion to our everyday experience: in *Old Wine – New Flasks* Roald Hoffmann and Shira Leibowitz Schmidt entertain and inspire their readers by presenting the case of an elephant to be used as a wall for the *sukkah* (a harvest festival hut).⁹¹

The non-existence of a situation is an ideal starting point to Bernstein as well as to the Talmudic rabbis. "What would light be, if the eyes did not exist?"⁹² asks Bernstein and he invites the reader to follow his discussion. Or on the problem of the velocity of light:

⁹⁰ See Wolf, p. 16.

⁹¹ Roald Hoffmann and Shira Leibowitz Schmidt, *Old Wine – New Flasks. Reflections on Science and Jewish Tradition*, New York 1997, pp. 62–68.

⁹² Aaron Bernstein, *Volksbücher*, vol. 5, book 19, Stuttgart 1876, p. 91.

Let us imagine that a wilful criminal fires a bullet at a speeding train and that the bullet is strong enough to pass through both walls of the carriage so that it enters one side and leaves it again through the opposite wall.⁹³

Or to cite another thought experiment: if we were to make an imaginary journey through the universe, what would happen if we dropped our hats between the moon and the earth?⁹⁴ The *Volksbücher* include hundreds of such pseudo-empirical discussions. Is there, irrespective of the Talmudic method, any traditional religious content left in the *Volksbücher*? The answer is negative. If we look for anything like a religious tendency in Bernstein's work we come across an abstract version of the Reform Jewish programme.

In one of the very rare paragraphs of the *Volksbücher* where Bernstein refers to religion, he connects it to the *Ahnung* of the moral and scientific progress of mankind. This *Ahnung* is – just as in Einstein's later reflections (see above) – directed to what is true. And among Bernstein's *Ahnungen* we find the core element of Einstein's deterministic metaphysics and its connection to the idea of our capability of understanding the laws of nature. Or, as Bernstein formulated it:

Already in this dark consciousness there exists a natural necessity without which human beings cannot be conceived of at all.⁹⁵

Completing this view, the *Volksbücher* inform the reader of something like Bernstein's personal *Ahnung* related to the further development of science and religion: in future, for the best of mankind, an undogmatic religious sense (*Religiosität*) and progressive natural science will be unified. This is the task of someone he calls (paying homage to reformed Christianity) the “next great reformer” (“*nächste[r] großer Reformator*”)⁹⁶.

I think we will agree that, all in all, the world after Bernstein did not present itself as “reformed” and that Bernstein's “truth” is very far from existing in the real course of history. And one could also agree that Bernstein's concept of scientific as well as of religious progress would soon get into difficulties under closer examination. But imagine we had an elephant to serve as wall of the *sukkah*, or could occasionally let our hat drop between the moon and the earth, or – to become more serious in our thought experiments – twentieth century history would have taken a different course, we could at least present an interesting candidate for being the ‘great reformer’ fulfilling the hopes of a nearly forgotten nineteenth century Reform Jew.

⁹³ *Ibid.*, vol. 2, book 8, p. 141.

⁹⁴ *Ibid.*, vol. 4, book 16, p. 20.

⁹⁵ *Ibid.*, vol. 3, book 12, p. 55.

⁹⁶ *Ibid.*, vol. 3, book 15, p. 145.

Genetic Studies of Ethnic Communities in Israel: A Case of Values – Motivated Research Work

Nurit Kirsh

In the young State of Israel, the vast majority of its scientists and physicians were Jews who had grown up in Central Europe and were educated in the framework of German culture. Having internalised German intellectual tradition, these scientists left an imprint of a strong German character on the Israeli institution of the Hebrew University.¹ This study tests the German influence within the scientific field of human population genetics. I examine the scientific work of three Israeli researchers, former German or Austrian citizens: physicians Chaim Sheba and Joseph Gurevitch and geneticist Elisabeth Goldschmidt. All were central figures in the Israeli medical and academic communities. The research teams they led conducted many studies on hereditary traits among Jewish populations in Israel during the 1950s and early 1960s.

Their research involved the estimation of the incidence of specific genetically determined characteristics in different Jewish ethnic communities (*edot*). Goldschmidt's, Gurevitch's and Sheba's scientific publications reveal internalisation of a German intellectual tradition side by side with internalisation of Zionist values.² The three researchers made attempts to uncover Jewish genetic origins by studying the frequency of blood groups and hereditary biochemical disorders. My aim in this article is to expose and uncover internalisation of a German intellectual tradition that can be detected in their scientific work, as well as internalisation of the dominant values of Israeli society that influenced Goldschmidt, Gurevitch and Sheba.

The first section of this article presents short profiles of the prominent Israeli researchers in the field of human genetics during the 1950s and early 1960s. In the second section I argue that the researchers' focus was more on Oriental (that is non-European) Jews, and that a distinction was made between these and Ashkenazi Jews (Jews of European origin, excluding those

¹ Nurit Kirsh, 'Immigrants among Immigrants: The Story of Four Scientists at the Hebrew University of Jerusalem', in *Physis, Rivista Internazionale di Storia della Scienza* (forthcoming).

² Here I neglect differences between developments in Germany and Austria and the Austrian Hungarian Empire.

from the Balkan countries). The next section describes the ways in which the three researchers highlighted and stressed certain aspects of their results, while minimising or ignoring others. In the final section the context of the internalisation of the Zionist values and German intellectual traditions that penetrated the researchers' scientific activity and writings will be studied.

The Researchers and their Scientific Work

Joseph Gurevitch (1898–1960) was born in Munich and studied medicine in Czechoslovakia. After he had immigrated to Mandate Palestine in 1921, he worked in the fields and built roads. In 1930, he joined the staff of Rothschild Hadassah Hospital in Jerusalem as a bacteriologist, and in 1949 he became one of the first lecturers in the medical school that had just opened at the Hebrew University of Jerusalem. Gurevitch was the head of the Clinical Microbiological Department in Hadassah Hospital and headed the blood bank.³

Gurevitch and his team devoted much of their time and efforts to studies of blood groups among Jewish ethnic communities.⁴ They focused only on ABO, MN and Rh, the three categories of blood groups that were discovered by Karl Landsteiner together with his students and colleagues, in 1901–1902, 1927 and 1940 respectively.

Chaim Sheba (1908–1971) was born into a hasidic family in a small village in Bucovina (then part of the Austro-Hungarian Empire). He graduated from the Vienna Medical School in 1932, and emigrated to Mandate Palestine one year later. Sheba headed the medical service of the *Hagana*, (the largest pre-state military organisation) and later the medical service of the Israel Defence Forces. He was director-general of the Health Ministry, and one of the chief founders of the medical schools in Jerusalem and Tel Aviv. From 1953 he was the director of Tel Hashomer hospital, which today bears his name.⁵

Sheba's main focus in human population genetics was on deficiencies of the Glucose-6-phosphate dehydrogenase enzyme (G6PD), in the red blood

³ L. Olitsky, 'The late Professor Joseph Gurevitch', in *The Hebrew University of Jerusalem News* (December 1960), p. 33; *idem*, 'In Memory of Prof. Joseph Gurevitch (Zl)', in *Harefuah* 60, 3, (1961), pp. 101 f.; V. Zilberstein, 'The Scientific Contribution of the late Joseph Gurevitch', in *Harefuah* 60, 3, (1961), pp. 102 f. (all in Hebrew).

⁴ This subject was studied in the early 1930s by the European researcher Rene Younovitch. Her results were published in a French Journal, and are quoted in A. Brzezinski, J. Gurevitch, D. Hermoni, and G. Mundel, 'Blood Groups in Jews from the Yemen', *Annals of Eugenics* 16 (1952), pp. 335–337, and J. Gurevitch, E. Hasson and E. Margolis, 'Blood Groups in Persian Jews', in *Annals of Human Genetics* 21 (1956), pp. 135–138.

⁵ Batsheva Bonne, 'Chaim Sheba (1908–1971)', in *American Journal of Physical Anthropology* 36 (1972), pp. 309–314; Ruth Bondi, *Sheba: A Doctor for Everyone*, Tel-Aviv 1981 (in Hebrew).



Joseph Gurevitch
(1898–1960)



Chaim Sheba
(1908–1971)

cells. This trait may be expressed by favism, severe allergy to broad beans, or by developing hemolytic crises upon intake of sulfa drugs. The disparity in the incidence of G6PD deficiency between Jews of different ethnic communities is enormous: among Iraqi Jews, the incidence is 25 per cent and among Jews from Kurdistan it is 58 per cent, whereas it is only 0.4 per cent in Ashkenazis. G6PD deficiency was the main genetical disorder studied by this research group, but other genetically-determined characteristics were also investigated. One was taste sensitivity to phenylthiourea (PTC). The other was colour blindness, the gene of which, as with the gene for G6PD, is located on the X chromosome.

Elisabeth Goldschmidt (1912–1970) was born into an Orthodox Jewish family in Frankfurt am Main. She began her studies at the Faculty of Medicine at Frankfurt University, but in 1933 she had to leave the university. Goldschmidt was accepted at London University but was not admitted to the second year of medical studies and, reluctantly, began to study zoology. In 1936, after she graduated she emigrated to Mandate Palestine and wrote her doctoral thesis at the Hebrew University in Jerusalem. Goldschmidt was the first chairwoman of the Genetics Society of Israel; the founder of the De-



Elisabeth Goldschmidt
(1912–1970)

partment of Genetics at the Hebrew University; and in many ways she was the first geneticist in Israel.⁶

Goldschmidt and her colleagues and students conducted research on Thalassemia, a hemolytic anaemia that is common among Jews from Kurdistan.⁷ They also studied the distribution of the different haptoglobulin types in human serum, and that of colour blindness, a non-lethal genetic defect.

⁶ More on Elisabeth Goldschmidt can be read in Nurit Kirsh, 'Geneticist Elisabeth Goldschmidt: A Twofold Pioneering Story', in *Israel Studies, Science in Israel: A special Issue*, 9 (02) (2004), pp. 71–105.

⁷ Tirza Cohen, Nava Bloch, Elisabeth Goldschmidt, Y. Matoth, and Avinoam Adam, 'High Frequency of G6PD Deficiency and Thalassemia in Jews from Kurdistan', in Elisabeth Goldschmidt (ed.), *The Genetics of Migrant and Isolate Populations*, New York 1963, pp. 272–275.

The next sections are based on an examination of scientific writings that were written by Gurevitch, Sheba, and Goldschmidt and published during 1951–1963. The period between 1951 and 1963 has been selected because it defines the initial and most intense period of population genetics research in Israel. 1951 marks the beginning of the spate of publications on the subject. In 1963 the proceedings of the The Genetics of Migrant and Isolate Populations conference were published, and that year marked the pinnacle of population genetic studies in Israel.⁸

“Ashkenazis and non-Ashkenazis”

Gurevitch, Sheba and Goldschmidt emigrated to pre-state Israel from Central Europe. Other Israeli researchers in the field of human population genetics were of European origin, too, while the subjects of their research were mostly Oriental, non-European Jews. There are several reasons, why more attention was given to the new immigrants from Asia and Africa and less to those who came from Europe:

High rates of genetic diseases – some of the oriental communities were small and isolated groups with high rates of consanguinity. As a result of this, and also due to environmental factors, there were high rates of rare traits.

Family structure – the traditional clan of oriental Jews consisted of a large family that included a number of generations. One is able to generate much more genetic information when studying extended family members. The number of children per couple in these families was often large, and this fact was also a benefit for the geneticist. In most Jewish families from Europe, on the other hand, the older part of the family did not arrive in Israel as a result of the holocaust, and the number of children per couple was much smaller.

Exotic untested populations – the field of human population genetics was popular in many places around the world. The financial situation of the Israeli geneticists and the availability of modern scientific instruments were problematic, but they had a big advantage – they could easily test many non-European populations.

Zionist activity – the Israeli society during its first decades was a very ideological one. Working with the new immigrants from Asia and Africa offered

⁸ I have examined eighteen scientific articles, authored or co-authored by Goldschmidt, Gurevich or Sheba. The eighteen articles selected are *all* the articles written by the three researchers on genetics of ethnic communities in Israel that were published in respected scientific journals during 1951–1963. I have read and analysed two popular papers that appeared in 1960 in this field, one by Goldschmidt and the other by Sheba. I also examined two papers and five posters presented by them at the international conference in 1961 in Jerusalem entitled ‘The Genetics of Migrant and Isolate Populations’.

the opportunity to indulge in ideological activity. The genetic research was used, among other things, as a vehicle for establishing a national identity and for confirming the Zionist narrative. This was done by confirming that the Jews were authentic to this geographical area no less than the Arab population, by showing that they carry genes from the Mediterranean gene pool.

More studies were carried out on the genetic characteristics of Oriental Jews and more papers were devoted to them compared to those devoted to Ashkenazi Jews. In addition, a meta-division of the Israeli population into two groups was created; one group was defined by the concept "Ashkenazi", and the other by the negative concept "non-Ashkenazi". In many articles the Ashkenazis appeared as a homogeneous ethnic community, without any division into countries of origin, and without any attempt to explain or justify this approach. In contrast, the rest of the ethnic communities were almost always divided according to country of origin,⁹ but were also presented under the super-category of "non-Ashkenazi". The dichotomy Ashkenazi/non-Ashkenazi thereby created a distinction between "us" and "others".

In the State of Israel during the 1950s the Ashkenazis were the élite, but their demographic advantage was reduced to only sixty per cent of Israel's Jewish population due to large waves of immigrations.¹⁰ In order to protect their cultural and political hegemony, they highlighted their group identity and the distinction between them and all the "others", the "non-Ashkenazis". It was assumed that there was an Ashkenazi culture on which the Israeli national culture was based, and that the exotic, non-Ashkenazi cultures would soon be integrated into the leading "national" one.¹¹ It seems that cultural distinctions then current also permeated the biological-scientific field. The Israeli geneticists, by using the accepted categorisation, reinforced it and gave it a kind of scientific stamp of approval.

The emphasis given to genetic studies of Jews from Asia and Africa and the dichotomy between Ashkenazis and "non-Ashkenazis" may look like a classic colonial case, but a second look reveals that it is not that simple. On the one hand the Israeli geneticists held the colonialist point of view of European researchers who studied primitive non-European populations. On the other hand, they looked at those Oriental Jewish communities in a way, as

⁹ For example: Chaim Sheba, Israel Ashkenazi, and Aryeh Szeinberg, 'Taste Sensitivity to Phenylthiourea among the Jewish Population Groups in Israel', in *American Journal of Human Genetics* 14 (1962), pp. 44–51; Elisabeth Goldschmidt, 'Changes in the Genetic structure of populations in Israel', in *Mada*, 4, pp. 12–19, especially pp. 13 f. (in Hebrew).

¹⁰ Oz Almog, *The Sabra: Aa Profile*, Tel-Aviv 1997, p. 135 (in Hebrew).

¹¹ Shmuel N. Eisenstadt, 'New Directions in the Study of Oriental Jews', in Naama Cohen and Ora Ahimeir (eds.), *New Directions in the Study of Ethnic Communities*, Jerusalem 1984, pp. 5–12 (in Hebrew).

their lost brothers.¹² The tendency to emphasise the similarities between all the Jews was dominant in the interpretations of their findings.

Ideological Motifs and Biased Interpretations

In the beginning, so runs the Zionist narrative, the Jewish people were an independent nation in the land of Israel,¹³ from which they were later exiled for two millennia; this is followed by the happy ending – the return of the Jewish people to their ancient homeland. In the Diaspora, the narrative tells us, groups of Jews wandered in isolation from each other, but maintained their religious and genetic identity. An examination of the studies by Goldschmidt, Sheba and Gurevitch shows that they reached conclusions that did not contradict the accepted Zionist narrative, and indeed, even supported it.

Manipulation of Differences

In comparative studies the nature of the comparison determines the results and the conclusions that can be derived from these. Finding differences between the ethnic communities confronted the Israeli researchers with the possibility that there was no common origin for all Jews or, at least, that there had been a penetration of genes from neighbouring non-Jewish populations. Presumably for this reason, by choosing appropriate comparisons they tried to minimise the differences they found as much as possible. For instance, in six different articles on the occurrence of blood types in different communities, Gurevitch *et al.* chose to compare the ethnic community being examined only with other Oriental ethnic communities.¹⁴ In this way, they showed mainly similarities, whereas, had the results been compared to

¹² More on these two opposite tendencies concerning the distinction between Ashkenazi and Oriental Jews may be found in Nurit Kirsh, 'Genetic Research on Israel's Populations: Two Opposite Tendencies', in Volker Roelcke and Giovanni Maio (eds.), *Twentieth Century Ethics of Human Subjects Research: Historical Perspectives on Values, Practices, and Regulations*, Stuttgart 2004, pp. 309–317.

¹³ The first words in the Israeli Declaration of Independence are: "The land of Israel was the birthplace of the Jewish people ..." This is in contrast with the biblical version, which regards Egypt as the birthplace of the Jewish people.

¹⁴ E. Margolis, J. Gurevitch and E. Hasson, 'Blood Groups in Jews From Morocco and Tunisia', in *Annals of Human Genetics* 22 (1957), pp. 65–68; *idem*, 'Persian Jews'; E. Margolis, J. Gurevitch and D. Hermoni, 'Blood Groups in Sephardic Jews', in *American Journal of Physical Anthropology* 18 (1960), pp. 197–199; *idem*, 'Blood Groups in Kurdistani Jews', in *Annals of Eugenics*, 18 (1953), pp. 94–95; J. Gurevitch, E. Hasson, E. Margolis and C. Poliakoff, 'Blood Groups in Jews from Cochin, India', in *Annals of Human Genetics* 19 (1955), pp. 254–256; *idem*, 'Blood Groups in Jews from Tripolitania', in *Annals of Human Genetics* 19 (1955), pp. 260 f.

the incidence of blood types in Ashkenazi communities, more significant differences would have been revealed.

Intra-population explanations

The researchers preferred to see the Jewish subject population as a closed population, unaffected genetically by non-Jewish neighbours. As a result, they tended to provide intra-population explanations of differences between the communities, and avoided speculating about the prevalence of intermarriage. Their explanations included:

- Marriage to relatives – Due to the small size of some Jewish ethnic communities, there was no escape from marrying relatives, and the effect of genetic drift was significant.¹⁵ When the incidence of thalassemia and G6PD deficiency was found to be significantly higher in Jews from Kurdistan, the researchers' main explanation was that traditional consanguineous marriages had led to the high frequency of the particular genes.¹⁶
- Selective environmental influence – An allele of a gene (one of the two copies that humans possess of every gene) can have adaptive benefits leading to an increase in its frequency in some conditions. For example, in an area where malaria is common, selection will lead to an increase in the proportion of an allele that contributes to resistance to this disease. In a collaborative article with researchers from the United States, Elisabeth Goldschmidt used directional selection pressure as a possible explanation for the similarity in the incidence of colour blindness in Ashkenazi Jews and a non-Jewish European population.¹⁷

¹⁵ "Genetic drift" refers to variations in gene frequencies that are the result of random changes. The smaller the population, the greater the importance of genetic drift. With regard to taste sensitivity to PTC, Sheba *et al.* explained the high percentage of non-tasters among Jews from Cochin (32 per cent) and the Jerbas (41 per cent) compared to 14 – 21 per cent in other communities, by the fact that these communities were isolated, with a high level of consanguineous marriage (Sheba, Ashkenazi and Szeinberg, 'Taste Sensitivity').

¹⁶ T. Cohen, Elisabeth Goldschmidt, A. Adam, Y. Matoth, E. Theodor and M. A. Szabo, 'The Frequency of Rheumatic Heart Disease, Glutathione Instability and Thalassemia in Children of Kurdish Jews', in *Harefuah* 57 (1959), pp. 233–236 (in Hebrew).

¹⁷ H. Kalmus, A. Amir, Ona Levine, Elisheva Barak and Elisabeth Goldschmidt, 'The Frequency of Inherited Defects of Colour Vision in Some Israeli Populations', in *Annals of Human Genetics* 25 (1961), pp. 51–55.

Inter-population explanations: limitations and qualifications

Even after exploiting the intra-population explanations to their fullest, the Israeli researchers at times could not avoid admitting the possibility of inter-marriage with non-Jews. This was rarely admitted, and when it was, the researchers did not expand on the subject, using general technical terms such as “gene influx” rather than “intermarriage”, and they avoided discussion of the historical process in which this influx might have occurred.¹⁸ In many of those cases, the researchers qualified the matter in one of the following ways:

- Reducing the scope of the phenomenon – This was done, for instance, by stressing that gene influx occurred in only one or two generations, and not over hundreds of years. Another possibility was emphasising that gene influx is characteristic of only a marginal part of the population in question. For instance, in an article on the occurrence of different blood groups of Sephardic Jews, where a high percentage of the blood group ‘O’ was found, it was suggested that there had been a penetration of a North African genetic component. However, the researchers qualify this conclusion by stating, “in spite of the frequent contact over centuries this North African component has penetrated only to a limited extent”.¹⁹
- Stressing the importance of historical constraints – According to this explanation, mixed marriages or the conversion of Jews to other religions occurred only when there was absolutely no choice. In an article on the blood groups of Persian Jews, Gurevitch *et al.* mentioned that “it is difficult to assume that the Persian Jews ... can be considered anthropologically pure”²⁰, but also stressed that these Jews “carefully guarded themselves against all foreign influences” and converted only when they were forced to do so.

In explaining why the enzyme deficiency G6PD is almost non-existent in Ashkenazi Jews, Sheba built up a whole story combining both the limited time element and the idea of historical constraint. He argued that the Roman exile was an exile of male prisoners-of-war. These Jewish men were forced to marry non-Jewish women, whose X chromosomes did not carry the gene for favism. “The children born to mixed marriages were, already in the first generation, free of the deficiency, although they continued to live as Jews and practiced the beliefs of their Jewish fathers.”²¹

¹⁸ For instance Margolis, Gurevitch and Hasson, ‘Morocco and Tunisia’; E. Margolis, J. Gurevitch and D. Hermoni, ‘Blood Groups in Ashkenazi Jews’, in *American Journal of Physical Anthropology* 18 (1960), pp. 201–203.

¹⁹ Margolis, Gurevitch and Hermoni, ‘Sephardic Jews’.

²⁰ Gurevitch, Hasson and Margolis, ‘Persian Jews’.

²¹ Chaim Sheba, Aryeh Szeinberg, Bracha Ramot, Avinoam Adam and Israel Ash-

This explanation makes a number of interesting assumptions: (i) Inter-marriage was a temporary phenomenon, extending for only two or three generations; (ii) Marriages to non-Jewish women were forced, and not a result of choice; (iii) The men continued to practise their religious traditions. In a popular paper Sheba wrote that these women were female servants from the Alps, thus explaining the presence of blonds among the Ashkenazis. He also emphasised that the maidservants were converted to Judaism.²²

- Assuming uni-directional gene flow – This was another way of qualifying conclusions derived from the genetic similarity between Jews and non-Jews, and leaving the Jewish gene pool “pure” and unalterable. When a high incidence of G6PD deficiency was found in both Jewish ethnic communities and the non-Jewish inhabitants of the islands of Sicily, Sardinia and Rhodes, it was proposed that the ancient Hebrews and Canaanites had reached these islands via the sea and settled there.²³ In the co-authors’ opinion, this explained the similarity between the inhabitants of the Mediterranean islands and Israelis “who have survived in comparative ethnic purity to this day”. The writers obviously assumed that the ancient Hebrews contributed genes to the local island populations, but did not themselves receive any genes from them. Consequently, the Jewish population remained genetically “pure”.

Circumventing problematic issues

In addition to qualifying and reducing the scope of any conclusions that may have implied intermarriage, the researchers also used a mode of writing and rhetoric that avoided contradicting the accepted Zionist narrative:

- Avoiding drawing conclusions – In many articles the results reveal differences between Jews from various ethnic communities, but the researchers do not try to explain or interpret them.

A similarity between a Jewish population and a neighbouring non-Jewish population also caused problems. In the discussion section of an article by Sheba *et al.*, the authors wrote about the great similarity between the Cochin Jews and the non-Jewish Indian population, both with

kenazi, ‘Hemolytic Susceptibility due to G6PD Deficiency of Erythrocytes among Ashkenazic Jews’, in *Harefuah* 60 (1961), pp. 389–391 (in Hebrew).

²² Chaim Sheba, ‘An Attempt to Re-construct the Wanderings of the Children of Israel using Biochemical Tests’, in *Mada* 4 (1960), pp. 34–39 (in Hebrew).

²³ Aryeh Szeinberg and Chaim Sheba, ‘Hemolytic Trait in Oriental Jews Connected with an Hereditary Enzymatic Abnormmality of Erythrocytes’, in *Israel Medical Journal* 17 (1958), pp. 158–168.

regard to taste sensitivity to PTC and the ABO blood system, but they did not suggest an explanation for this phenomenon.²⁴

- Quoting somebody else’s conclusions – When it appears that the similarity between the Jews from Morocco and Tunisia and the Berbers is greater than between them and Sephardi Jews from the Balkan states, this is presented very subtly. Gurevitch *et al.*, quote the British researcher Mourant: “Mourant has suggested that this may be due to the acquisition of a Basque component by Sephardic Jews”, without expressing their own opinion. In the same article, when the subject is less sensitive because it is a Berber tribe with Jewish customs, the writers argue that the members of this group are not of Jewish origin, although, as in the former example, they could have just cited Mourant.²⁵ Similarly, Goldschmidt also relies on Mourant when discussing the presence of cDe chromosomes (classified as Rh positive) in Jews: “This characteristic, which is shared by Moslems of the Near East, is taken by Mourant as indicative of some African admixture.”²⁶
- A question of proportion – The researchers stressed every point of similarity found between Jews from different ethnic communities. Points of difference were stressed far less, and usually an interpretation was suggested that by-passed problematic issues like gene-influx from a foreign population and intermarriage. On the basis of results that were not unambiguous, it was claimed that clear proof was found for the existence of a Mediterranean gene pool in Jews from Europe and North America, and for the genetic similarity between sections of the Jewish people.²⁷

When Sheba *et al.* discovered that G6PD deficiency appears in Ashkenazis, they reported this in a special article pointing out that finding this attribute in Ashkenazis constituted biochemical evidence supporting a genetic link between the various Jewish ethnic communities.²⁸ This finding should have been given a more careful formulation however. As mentioned earlier, the disparity in the incidence of G6PD deficiency is enormous.

I want to stress that by highlighting the intra-population and inter-population explanations and the rhetorical techniques used I am not suggesting that the explanations given by the Israeli researchers were unlikely or wrong. My claim is simply that the range of explanations that were proposed was biased

²⁴ Sheba, Ashkenazi and Szeinberg, ‘Taste Sensitivity’.

²⁵ Margolis, Gurevitch and Hasson, ‘Morocco and Tunisia’.

²⁶ Elisabeth. Goldschmidt, P. Bayani-Sioson, H. E. Sutton, K. Fried, A. Sandor and N. Bloch, ‘Haptoglobin Frequencies in Jewish Communities’, in *Annals of Human Genetics* 26 (1962), pp. 39–46.

²⁷ *Ibid.*; Margolis, Gurevitch and Hermoni, ‘Sephardic Jews’.

²⁸ Sheba, Szeinberg, Ramot, Adam and Ashkenazi, ‘Hemolytic Susceptibility’.

and did not take into account other possible, and equally plausible, interpretations of the data. Taken individually, the articles complied with all the normal scientific standards, as their publication in prestigious journals testifies. Obviously, in any scientific research there is no article that discusses *all* possibilities, and different research groups naturally stress different aspects of the issues they study. However, the biases in the three research groups were systematic, and formed a clear trend. It seems that the scientists were immersed in a particular perception of history and might have been themselves unaware of the biases this introduced into their research.

Discussion: German Influences and Zionist Values

This study underscores that genetics of human populations in Israel during the fifties and early sixties was a field of research that was considerably affected by ideology and social perceptions. The assimilation of the psychological-ideological *Zeitgeist* – the Zionist ethos – was both powerful and pervasive. Gurevitch, Sheba and Goldschmidt made a distinction between Ashkenazi and Oriental Jews, but also interpreted their results according to the Zionist idea of common biological origin of all Jews.

It is not difficult to get the impression that Goldschmidt's, Gurevitch's and Sheba's choice of studying the genetics of ethnic communities was, in essence, a Zionist choice and that emphasising the common biological origin of all Jews was a result of a Zionist point of view. Yet, there is another feasible and plausible source of influence on the research of the three scientists – a German intellectual tradition. These leading Israeli researchers spent their formative years in Central Europe: Goldschmidt in Germany, Gurevitch in Czechoslovakia and Sheba in Austria. Few decades before, at the turn of the century, the most vocal and influential Jewish race anthropologists were German Zionists and their arguments often sounded similar to those of the antisemites.²⁹ The Zionist movement adopted the conceptual framework of the European national movements, which took biological factors into consideration. In this context it is worth using the terminology of “ethnic” versus “civic” nationhood, coined by the historian and pioneer of nationality research Hans Kohn. According to Kohn's dichotomy, the State of Israel could be classified, like Germany, as a proverbially ethnic state.³⁰

Common biological origin and similarities of the Jews is, ironically, a central idea both in German antisemitic movements and in the Zionist ideology,

²⁹ John M. Efron, *Defenders of the Race: Jewish Doctors and Race Science in the Fin-de-Siècle Europe*, New Haven, CT – London 1994, pp. 24, 31.

³⁰ Hans Kohn, *The Idea of Nationalism*, New York 1944.

(while the values and practical conclusions attached to this idea are, needless to say, greatly different). Actually, the deep influence of German antisemitism on Jewish self-identity can be detected in many fields; a good illustration is the Israeli Law of Return. According to the 1970 reform of the Israeli law, the right to immigrate to Israel is given automatically to any person who is a grandson or granddaughter of a Jew, and to anyone who is married to a Jew. In the first supplementary decree of the Nuremberg Laws (14 November 1935), Jewishness was also determined using the criteria of third generation and marriage.³¹

Were the three researchers aware of the similarities and differences between their work and the German, even Nazi, bio-racial science? Gurevitch, Sheba and Goldschmidt never mentioned the presence or absence of eugenic and racial aspects in their research; nevertheless, they tried their best to use different terms and different criteria from those used in the German bio-racial science and eugenics. Unlike other human geneticists whose research included medical, anthropological, and psychometric aspects, the Israeli genetic researchers steered away from gathering anthropometric and anthropological data.³²

Goldschmidt's attitude toward Germany, her birthplace, can be detected from her decision not to visit Germany nor speak German.³³ As chairwoman of the Genetics Society of Israel, Goldschmidt was also active in the worldwide genetics community, and in 1960 became engaged in a bitter struggle to prevent an international conference on genetics from taking place in Germany.³⁴ There can be no doubt that Sheba, who was a Zionist activist both in the military and political framework, had deep feelings of being part of the Zionist movement and Israeli society. The same is true for Gurevitch,

³¹ In their definition of citizenship, both Israel in the Law of Return and Germany in the 1913 Law of Immigration and the 1949 Basic Law, gave greater emphasis to ethnic origin (*ius sanguinis*) and less to territory (*ius soli*). Yfaat Weiss, 'The Monster and its Creator' or How the Law of Return Made Israel a Multi-Ethnic State', in *Theory and Criticism* 19 (2001), pp. 45–69 (in Hebrew).

³² Goldschmidt and her collaborators preferred focusing on pathological traits and refrained as much as possible from anthropometric measurements; Goldschmidt to James V. Neel 30 January 1958, Goldschmidt to Neel 4 October 1961, Neel to Goldschmidt 13 October 1961, Neel, coll. American Philosophical Society Archives, Philadelphia.

³³ Interviews with her daughter, Yemima Ben-Menahem, 24 August 2002 and her son, Eliezer Goldschmidt, 8 August 1996; Karl H. Heile to the Faculty of Natural Sciences at the University of Jerusalem, 2 July 1959; Goldschmidt to Shmuel Sambursky, 16 July 1959, Zoology file, Hebrew University Archives.

³⁴ Goldschmidt to I. Michael Lerner, 21 February 1960; Goldschmidt to J. W. Boyes, 8 March 1960, MS. Coll. No. 27; Goldschmidt to James Schultz, 9 March 1960; Goldschmidt to Neel, 9 March 1960, Neel to Goldschmidt, 17 March 1960 Neel Coll., American Philosophical Society Archives, Philadelphia; see also Ute Deichmann, *Biologists under Hitler*, Cambridge, MA 1996, especially pp. 306–310, 332.

who immigrated to Mandate Palestine as early as 1921, and when he arrived, worked with other young idealistic pioneers in the fields and building roads. Nevertheless, the impact of a German intellectual tradition did not disappear and was among the factors that form their scientific attitude and style. Goldschmidt's, Gurevitch's and Sheba's scientific writings reveal internalisation of a German intellectual tradition side by side with internalisation of Zionist values.

German and Israeli Attitudes towards Reproductive Genetics and the Effect of Religion*

Yael Hashiloni-Dolev

Introduction

This paper is part of a larger project comparing the field of reproductive genetics in Israel and Germany.¹ Contemporary prenatal genetic diagnosis (PND) allows the detection of a rapidly-growing number of genetic conditions during pregnancy. Since genetic treatment and cure lag behind the power to discover abnormal conditions, reproductive genetics currently goes hand-in-hand with abortions, selecting embryos and fetuses on the basis of their expected health. Adopting these new genetic technologies provokes moral dilemmas related to the issues of abortion, human dignity of the disabled, eugenics, and interference with nature (or in religious terms, with God's creation), which are met with dissimilar responses in different nations.

* I am deeply grateful to the late Dorothy Wertz and John Fletcher for sharing their data with me, as well as to Irmgard Nippert and Gerhard Wolff for sharing data collected in Germany between 1993 and 1995. Yehouda Shenhav and Haim Hazan have supervised my PhD dissertation, on parts of which this paper is based, for which I am grateful. I am also deeply grateful to Ute Deichmann and Benno Mueller-Hill for supporting this work from its early stages and for inviting me to Germany. I specifically thank Ute Deichmann for pointing me to the role of religion. Furthermore, I wish to thank my colleagues and friends Svetlana Bolotin, Amit Kaplan, Sigal Gooldin, Michal Frenkel, Shai Lavi, Hagai Boaz and Shoham Melamed.

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¹ An interesting topic which is not examined here are attitudes of Israeli researchers and physicians with a specific German-Jewish background. If we take into consideration views prevalent among the older generation of Jewish geneticists (see for example the article of Raphael Falk in this volume) it is not hazardous to assume that they were similar to contemporary Israeli attitudes.

The decision to compare the field of reproductive genetics in Israel and Germany stemmed from the findings of a cross-national comparative study of genetics and ethics in thirty-seven countries² which showed that geneticists in Israel and Germany hold the most divergent views of genetics in the West.³ Given that genetic knowledge and the level of medicine in both countries are very similar, and that the national origins of both Israel and post-war Germany are deeply affected by the history of Nazi eugenics, I was eager to deepen my understanding of these dissimilarities. Based on questionnaires addressing reproductive genetics, which were distributed among genetic counsellors in Israel and Germany (N=295) in two time periods (1993 – 1995 and 2000 – 2001) as well as on in-depth interviews with genetic counsellors in both countries (N=32), and on analysis of legal, professional and media texts (for methodology see appendix), I have elsewhere⁴ demonstrated that whereas in Israel reproductive genetics is strongly encouraged by the medical establishment, as well as by the state and its laws, the situation in contemporary Germany is antithetical. This claim is best exemplified by Figure 1 which represents answers to the question posed to Israeli and German genetic counsellors: "How would you counsel about termination of pregnancy for the following conditions?"

Figure 1 shows that in 2000 – 2001 Israeli genetic counsellors were significantly more supportive of abortions in the cases of 21 out of 26 conditions, than their German counterparts. In the five other cases (mother's life in danger, sickle cell anemia, predisposition to schizophrenia or bipolar disorder, predisposition to Alzheimer's disease, child not being the sex desired by the parents), Israelis were more supportive of abortions, but the differences were not significant. Thus, the findings show that pessimistic counselling is the norm in Israel, while more tolerant or optimistic counselling characterises German counsellors. Accordingly, Israeli professionals counsel for getting rid of embryos (and fetuses) with imperfections that in Germany are not looked upon as justifying the termination of a pregnancy (Results of the survey conducted in 1993–1995 were very similar).

² Dorothy C. Wertz and John C. Fletcher (eds.), *Genetics and Ethics in Global Perspective*, Dordrecht 2004.

³ David Heyd, *Genethics: Moral Issues in the Creation of People*, Berkeley, CA 1992.

⁴ Yael Hashiloni-Dolev, *A Life (un)Worthy of Living? Reproductive Genetics in Germany and Israel*, Dordrecht (forthcoming); *idem*, 'Who is a Wanted Child? Selective Abortions Due to Sex-Chromosome Anomalies in Israel and Germany', in *Theory and Criticism* 25 (2004), pp. 97–123.

How would you counsel for and against abortion? 2000–2001

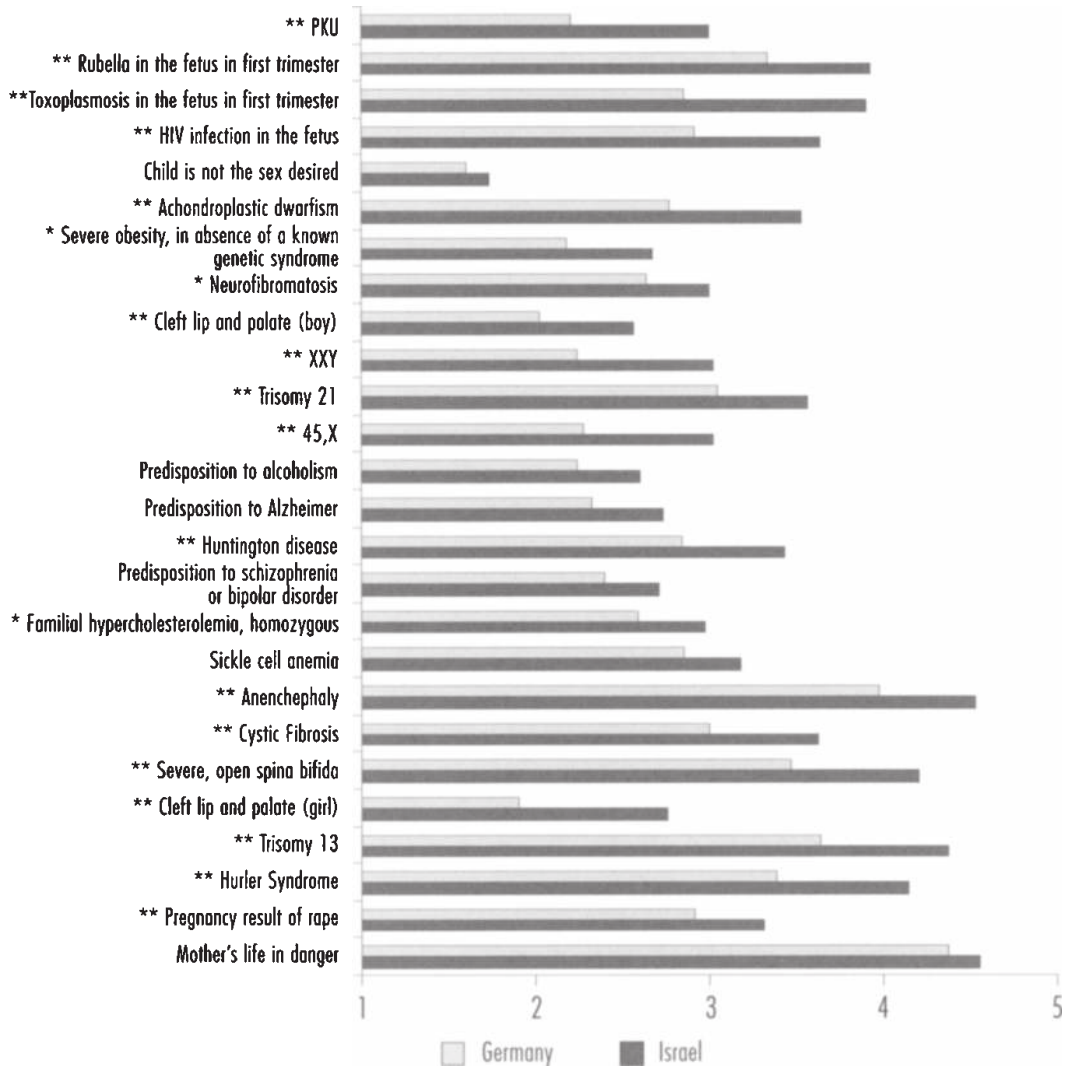


Figure 1: Options ranging from: 1. Urge carry to term 2. Emphasise positive aspects 3. Be unbiased as possible 4. Emphasise negative aspects 5. Urge termination.

While the existence of a strong opposition towards reproductive genetics in Germany⁵ as well as its relative absence in Israel⁶ are clearly related to different issues such as national history and national body ideals, which I have

⁵ Susan L. Erikson, 'Post-diagnostic abortion in Germany: reproduction gone awry, again?', in *Social Science and Medicine* 56 (2003), pp. 1987–2001; Tanja Krones and Gerd Richter, 'Preimplantation Genetic Diagnosis: European Perspectives and the German Situation', in *Journal of Medicine and Philosophy* 29 (2004), pp. 623–640.

⁶ Aviad Raz, "Important to test, important to support": Attitudes toward Disability Rights and Prenatal Diagnosis among Leaders of Support Groups for Genetic Disorders in Israel', in *Social Science and Medicine* 59 (2004), pp. 1857–1866; Larissa Remennick, 'The Quest after the Perfect Baby: Why Do Israeli Women Seek Prenatal Genetic Test-

discussed elsewhere⁷, this paper is specifically dedicated to studying the effect of religious cultures on the way reproductive genetics is being implemented in the societies concerned. In the following I will discuss Jewish and Christian religious understandings of abortion, eugenics, disability, suffering, and interference with God's creation, which are all relevant to how common ethical dilemmas provoked by reproductive genetics are understood in both nations.

The General Effect of Religion:

Table 2: Religious Affiliation of Genetic Counsellors in Both Countries:

	1993–1995		2000–2001	
	Germany	Israel	Germany	Israel
Jews	0.5 %	100 %	1.8 %	93.3 %
Protestant	42.9 %	–	51.8 %	–
Catholic	28.3 %	–	25 %	–
Muslim	0.5 %	–	–	–
None	27.7 %		19.6 %	6.7 %
	100 %	100 %	100 %	100 %
N	185	22	57	31

Table 2 shows that the dominant group among German counsellors in both periods of the study consisted of Protestants (42.9 %, and 51.8 %), followed by an almost equal percentage of Catholics and people without any religious affiliation (Catholic: 28.3 %; none: 27.7 %, Catholic: 25 %, none: 19.6 %). (The high percentage of German Jews in the second sample, 1.8 %, when they make up only 0.1 % of the current German population, may be explained by the fact that the questionnaire was sent by an Israeli Jew, and thus more Jews were inclined to return it.)

In Israel the major religious affiliation of counsellors is Jewish. Yet, in Israel stating an affiliation to the Jewish religion is used interchangeably with belonging to the Jewish people. Therefore the “none” category is problematic. Most secular Jews would answer “Jewish”, despite being secular. Al-

ing?’ in *Sociology of Health and Illness* 28(1) (2006), pp. 21–53; Hashiloni-Dolev, ‘What is a life (un)Worthy of Living?’, *passim*; Carron Sher (ed.), ‘Factors Affecting Performance of Prenatal Genetic Testing by Israeli Jewish Women’, in *American Journal of Medical Genetics*, 120A (2003), pp. 418–422; Tsipy Ivry, *Pregnant with Meaning: Conceptions of Pregnancy in Japan and Israel*, doctoral dissertation Hebrew University of Jerusalem, 2004.

⁷ Hashiloni-Dolev, *A Life (un)Worthy of Living*, *passim*.

though Muslims make up about 20% of the Israeli population, no Muslim counsellors worked in Israel at the time of the research.

Religiosity of counsellors in the two nations was measured by the question: “How important is religion in your life?”

Table 3: Religiosity of German and Israeli Genetic Counsellors:

	Germany Mean (s.d.)	Israel Mean (s.d.)	T-test	Significance
1993–5	2.37 (0.99)	1.73 (0.70)	–3.884	**
2000–1	2.56 (1.04)	1.80 (0.89)	–3.419	**

* < 0.05 ** < 0.01

s.d. = standard deviation

1–5 interval scale: not at all important; slightly important; moderately important, very important; extremely important

While generally counsellors in both countries were not found to consider religion as important in their lives, in both periods, religion was more important to German counsellors than to Israeli counsellors. When performing a T-test these differences were found to be significant (see table 3).

Paul Rabinow⁸, who studied the discourse of French bio-ethicists, philosophers, journalists, social critics and the like, concerning modern genetics, wrote that he found it striking that such forthrightly secular moderns deploy aspects of the imagery, vocabulary and even conceptual concerns which were articulated hundreds of years ago by Western Christianity. Accordingly, my own findings also suggest that – in contrast to the thesis of secularisation and its ideal of a modern separation between science and religion, or science, politics and society – in the words of Bruno Latour “we have never been modern”⁹ in the sense that we have never truly separated these ideologically autonomous spheres. In fact, religion is still an extremely important social factor in the modern world, and secularisation has never been completed.¹⁰ Concerning reproductive genetics, my claim is that it is not concrete religious practices and beliefs which shape reproductive gene-

⁸ Paul Rabinow, *French DNA: Trouble in Purgatory*, Chicago 1999.

⁹ Bruno Latour, *We have never Been Modern*, transl. by Catherine Porter, Cambridge, MA 1993.

¹⁰ Yehouda Shenhav, ‘Nationalism was never Modern – or Secular: On Hybridization and Purification in Latour’, in *Theory and Criticism* 26 (2005), pp. 75–89.

tics. Rather, religious ideas function as moral-mental structures which linger on in contemporary society, and thus can be traced in the way modern scientists, policy makers, as well as the disabled themselves interpret the moral dilemmas associated with reproductive genetics. Yet, the relationship between traditional religious ideas and modern scientific innovations and techniques is a complex one, and does not always work in a predictable manner, which restricts scientific innovations and their uses. To be more precise, some unexpected coalitions may be formed between the religious establishment and other social groups such as the disabled, feminists and the Green party (in Germany) or the medical establishment (in Israel), coalitions which may either restrict or enable the implementation of new controversial techniques.

However, regarding my field of study, at first glance it seems as if in both societies under investigation here, religion serves as a barrier to the implementation of new genetic technologies. Answering a question about who in their country opposes medical genetics, the counsellors questioned responded as follows:

Table 4: Opposition to Genetic Services (1993–5)

	Israel (% checked)	Germany (% checked)
Religious groups	68.2 %	56.2 %
Women's groups	4.5 %	61.8 %
Political parties*	18.2 %	28.3 %
Advocates for persons with disabilities	4.5 %	74.1 %

* In Israel opposing political parties, are religious parties.

Indeed, Table 4 presents the fact that reproductive genetics is facing very little opposition in Israeli society, most of it coming from religious groups, and not from women's groups, disability organisations, or political parties (since the opposing Israeli parties, are the religious parties). Furthermore, in the interviews I conducted with genetic counsellors, the vast majority of Israeli counsellors declared themselves to be "actively" secular, meaning that not only do they not obey religious rules, they also see them as "primitive" and contradictory to their scientific ways of thinking. Thus, a conflict occurs between secular counsellors and religious counsellees as described by Juan Chemke and Steinberg, two prominent Israeli geneticists:

A good number of clients of genetics in Israel are religious and obey the dictums of the rabbis in accordance with Jewish law. The geneticists themselves, however, are mostly irreligious, following the Western secular philosophy as their personal approach to the medical dilemmas in medical genetics. This creates some tension in certain communities: on the one hand, disagreement with the counselling, particularly when it results in abortion, causes lack of confidence in physicians, and suspicion of misconduct by the medical community on the part of the rabbis and their followers. On the other hand, there is anger and occasionally hatred on the part of the medical community at large and geneticists in particular, because of their feeling that religious groups do not understand the purposes and importance of genetic services.¹¹

In the interviews I conducted, this tension was often mentioned, as many Israeli counsellors expressed a lot of resentment towards religious patients and authorities, basically complaining that the rabbis' anti abortion verdicts result in law suits against the hospitals. Furthermore, most counsellors thought of religious people as "primitive", and one even argued that if the religious knowingly choose to have "sick" children, he did not think "people like us" (that is, like him and me) should pay taxes to support those "miserable children".

Yet, I argue that things are not exactly as they seem. Rather, my claim is that despite the discussed resentment, Israeli "secular" counsellors are still much more "Jewish" in their way of reasoning, than they themselves imagine, and that the Jewish religion is more supportive of reproductive genetics than it may seem at a first glance, or in a non-comparative context. Thus, in the following I will argue that religious Jews and genetic counsellors in Israel seem to share the same implicit logic concerning PND, despite their explicit disagreements, a factor which is one of the reasons behind the warm endorsement of reproductive genetics in Israel.

By contrast, in Germany criticism of reproductive genetics is widespread, and religion is clearly only one of the opposing factions. Thus, while in Israel the resentment felt by counsellors is focused on religious authorities, my interviews in Germany revealed that German counsellors perceive themselves to be more in conflict with political parties (such as the Green party) and disability activists, than with religious authorities. Yet, like in the case of their Israeli counterparts, I will argue that German professionals lean on religious cultural understandings while trying to handle the dilemmas put forward by their controversial practice, and that the Christian religion is an important reason behind the cautious endorsement of reproductive genetics in Germany. Moreover, the fact that in Germany religious authorities collaborate in somewhat surprising coalitions with the Green party as well as with the

¹¹ Juan M. Chemke and A. Steinberg, 'Ethics and Medical Genetics in Israel', in Dorothy C. Wertz and John C. Fletcher (eds.), *Ethics and Human Genetics: A Cross Cultural Perspective*, Berlin 1989, pp. 281 f.

disabled and with feminists¹², also explains the cautious adoption of reproductive genetics in Germany.

In the following I will trace how in both societies religious understandings are interwoven with genetic counsellors' moral reasoning, as well as with state laws and the moral reasoning of the disabled themselves. I will demonstrate that Jewish and Christian (mostly Catholic) traditions are fundamentally different in their attitudes towards the practice of eugenics, towards the disabled, towards abortions, and towards the idea of "playing God", and claim that these differences influence the general permissiveness in Israel concerning the uses of prenatal genetic diagnosis, as well as German cautiousness regarding the same technology.

Abortion and the Effect of Religion

Today's reproductive genetics does not enable us to cure genetically "ill" embryos. Consequently, its common "remedy" takes the form of what became known as "selective"¹³ abortions, and thus abortions are inextricably tied to PND.

When discussing abortion and religion in Germany I focus on Catholicism, despite the fact that Catholics make only 34 % of the German population. This is due to the following: firstly, the Protestant position regarding abortion is not uniform¹⁴, and in general, abortion is not a major issue on the Protestant political agenda. Secondly, Catholic doctrine frames the abortion debate in terms of a right to life, serving as a discursive framework for any moral and legal discussion concerning this matter in much of the Christian world. Thus, even opponents of the Catholic view are forced to frame their arguments using terms originated in Catholic discourse, which proclaims that the fetus is a living human being from the moment of conception. According to Catholic dogma, since the soul distinguishes human beings from

¹² Christina P. Schlegel, 'Landmark in German Abortion Law: The German 1995 Compromise Compared with English Law', in *International Journal of Law, Policy and the Family* 11 (1997), pp. 36–62; Kronen and Richter; Hashiloni-Dolev, *What is a life (un)Worthy of Living?*, chap. 3.

¹³ These abortions are also often termed "medical", "therapeutic" or "eugenic". These terms relate to wanted pregnancies which are interrupted due to embryopathic indications.

¹⁴ One can find a spectrum of protestant positions moving from protestant fundamentalists who ban abortions, to more "old-line" Protestants who are far more permissive, and to profeminist liberationists who support women's right to choose. See Beverly Wildung Harrison, 'Abortion, Religious Tradition: Protestant Perspectives', in Warren T. Reich (ed.), *Bioethics: Sex, Genetics and Human Reproduction*, (Macmillan compendium: single volume encyclopedia), New York 1998.

other entities, and since it enters the fetus at conception, under no circumstances should the fetus be hurt. Furthermore, a newly-conceived human being is on a moral par with adults and a temporal boundary cannot be drawn between an unborn fetus and a newborn baby, making the killing of a fetus murder.¹⁵

By contrast, Judaism does not ban abortions. Ancient Jewish law affords the fetus no legal status, since it is deemed an organic part of its mother rather than an independent entity.¹⁶ Jewish principles assert that abortion is not murder, although it may amount to killing, with the difference lying in the circumstances. Killing is allowed in self-defense, when the victim is not innocent, but is considered an “aggressor”. A fetus may be regarded as an aggressor when the mother’s health is endangered. Thus, the woman’s interests, when health considerations are at stake, override those of the fetus.¹⁷ The Jewish fetus has no “right to life”, but a right to be born, and this right is also dependent on the mother’s welfare. In any moral clash, the mother, who is actual, has priority over the fetus who is only potential.¹⁸

So, although Judaism accords life a supreme value¹⁹ it permits abortion under certain circumstances, and while some rabbis would justify abortions only when the woman’s life is in danger, others are willing to extend religious exemptions when continuation of the pregnancy threatens the woman’s physical or psychological wellbeing²⁰, as well as the future wellbeing of the child. In the last few years, Jewish rabbis have issued different rulings regarding the question of abortion in cases of a number of medical conditions affecting the fetus such as Tay Sachs, Downs Syndrome, anencephaly, X-ray exposure during pregnancy, maternal rubella infection during pregnancy, and so on. For each of these conditions some have allowed the termination

¹⁵ John R. Connery, *Abortion: the Development of the Roman Catholic Perspective*, Chicago 1977. However, Catholic teaching on abortion has not always centered on the right to life, as in early times abortions were characterised more as a sexual sin. Early Christian writers believed the fetus to receive a soul only after its body has formed, at about 3 months. See Lisa Sowle Cahill, ‘Abortion, Religious Tradition: Roman Catholic Perspectives’, in Warren T. Reich (ed).

¹⁶ Immanuel Jakobovits, *Jewish Medical Ethics: A Comparative and Historical Study of the Jewish Religious Attitude to Medicine and its Practices*, New York 1967, pp. 153–167.

¹⁷ J.D. Blech, ‘Abortion and the Jewish Law’, in Thomas W. Hilgers, Dennis J. Horan and Mall Frederik David (eds.), *New Perspectives on Human Abortion*, Portsmouth, NH 1981; David M. Feldman, *Health and Medicine in Jewish Tradition*, New York 1986; Yael Yishai, ‘Public Ideas and Public Policy: Abortion Policies in Four Democracies’, in *Comparative Politics* 25 (1993), pp. 207–228.

¹⁸ David M. Feldman, ‘Eugenics and Religious Law: Judaism’, in Warren T. Reich (ed).

¹⁹ Jakobovits, pp. 153–167.

²⁰ Noga Morag-Levine, ‘Abortion in Israel: Community, Rights and the Context of compromise’, in *Law and Social Inquiry* 19 (2 Spring 1994), pp. 313–335.

of pregnancy, while others have not.²¹ Yechiel Barilan explains that according to Jewish law, a child's claim to life begins only upon the thirtieth day after birth, and thus the threshold of viability is postponed.²² Halakhically, in order to claim full rights for the protection of life, the capacity to maintain independent and lasting life must have been established. Thus, Jewish doctrine does not stress biological viability alone, but viability in the sense of the baby acquiring viable attributes of *imago dei*.²³ Due to this postponement of acquiring full protection post-natally, in the case of premature neonates, preventing their future suffering may in the first thirty days prevail over the principle of the right to life. Moreover, in Jewish law, unlike in other western religions, the right to destroy a fetus before birth is entirely unrelated to the question of the entry of the soul before birth, or to the claim to salvation after death.²⁴

To conclude, although Jewish doctrine is not in favour of abortions, it is far more flexible than Catholic doctrine, whose position regarding abortions and understanding of the fetus as having a right to "life" right from conception, has shaped much of the social controversy surrounding abortions in Western countries. This difference is further enforced by the fact that the Catholic Church has made abortion an important issue in its political agenda, while Jewish rabbis have not done so. Israeli counsellors' common understanding of religion to negate their practices is thus limited or wrong. However, from a comparative point of view, this is clearly not the case. It may in fact be the result of the fact that the religious stance's relative caution towards reproductive genetics is conspicuous because of the lack of any other opposing parties in Israel.

Legal Discussion of Abortion

Religious understandings of the relationship between mothers and their unborn babies, and of the moral status of the fetus, deeply affect the formation of civil laws in both Israel and Germany. The legal discussion of abortion in Germany strongly distinguishes between the mother and the fetus, in accordance with Catholic understanding. This is best illustrated by the German Constitutional Court decision of May 1993:

²¹ Abraham Steinberg, *Medical Halakhic Encyclopedia*, vol. 2. Jerusalem 1991, pp. 90 f.

²² Yechiel M. Barilan, 'Biomedical ethics & Halakha (forthcoming); *idem*, 'Abortion', in J. Neusner *et al.* (eds.), *The Encyclopedia of Judaism*, 2nd edn., Leiden (forthcoming).

²³ *Ibid.*

²⁴ Jakobovits, pp. 153–167.

The termination of pregnancy must be regarded fundamentally as wrong (*unrecht*) throughout the entire period of the pregnancy and thereby must be considered illegal. The right to life of the unborn may not be placed, even if just for a limited period of time, in the hands of a free, not legally-bound decision of a third person, even the mother herself.²⁵

The German law also sets a time-limit for all abortions, except those which are performed to protect the physical or mental wellbeing of the mother. Furthermore, the mandatory counselling in Germany for women who wish to abort is required by law to strive for the continuation of pregnancy, and to inform the woman of the fetus' right to life.

On the other hand, the general framework of abortion policy in Israel subscribes to Jewish principles. According to Delila Amir²⁶, Israeli abortion law is actually a Jewish law, especially because of two unique characteristics: first is the law's non-differentiation between the mother and the fetus, thus setting no time-limit for abortions, which is very uncommon among most other western countries, and particularly significant in the case of "late" abortions. The second characteristic is a clause that permits abortion on the grounds of extra-marital sex, which is based on the halakhic fear of women giving birth to what religious law calls a "*mamzer*" (bastard).²⁷ So, in stark opposition to German-Christian perceptions, the Israeli-Jewish fetus is not considered to have a right to life from conception, as it has no rights according to the law. Just like civil laws, counsellors' understanding of the moral status of the fetus also echoes religious thought.

Counsellors' Views concerning Abortions

The findings of this study reveal that German and Israeli counsellors interpret the same scientific facts about the stages of pregnancy in a totally different manner. Although most of the Israeli counsellors I interviewed declared themselves to be secular, their understanding of mothers' and fetuses' rights were revealed not to be as far removed from traditional Jewish thought as they may have thought.²⁸ Actually, Israeli counsellors disregarded the fetus'

²⁵ As quoted in Andrea Wuerth, *Re-Unification and Reproductive Rights: Abortion in the German Public Sphere, 1989–1990*, Chapel Hill, NC 1997 (Working paper, Center for European Studies. University of North Carolina, Chapel Hill).

²⁶ Delila Amir, *Abortions, a Silenced Issue in Israel: Feminist and International Perspectives* (forthcoming).

²⁷ In Judaism a bastard is not a person born out of wedlock but someone who was born as a result of his or her mother's adultery.

²⁸ Somewhat surprisingly, it seems that those traditional attitudes do not affect only Israeli (Jewish) counsellors, but also American Jewish women. In Rapp's study about women from New York who undergo amniocenteses, Jewish (non-orthodox) women

rights and saw the fetus primarily as part of its mother and not as an autonomous being. In Germany, only about a quarter of the counsellors I interviewed belonged to the Catholic Church. In spite of this, and although the religious undercurrent to the abortion debate in Germany is not usually explicitly mentioned²⁹, during the interviews, all of the German counsellors (including the non-religious ones) talked of fetuses using a Christian frame of reference, and described the fetus (even very young ones) as a form of “life” with at least possessing some rights of its own.

A female genetic counsellor with a PhD who worked in one of Israel’s largest hospital genetic institutes said:

I have nothing against abortions. I think they can reduce suffering. In any case I respect the parents’ wish, and if they want to abort, I see it as their full right. Generally I trust the parents that when it’s a wanted pregnancy, as is usually the case when people contact me, they will not rush into abortion for stupid reasons. And I am also not to decide what a major or a minor problem is. Abortion is very hard for women, it involves a lot of grief, and I sympathise with the mother’s pain. But the fetus? It is really nothing to me. Only a potential for life, with no rights.

Similarly, a pediatrician and a genetic counsellor who heads one of Israel’s genetic hospital units did not perceive the fetus as holding autonomous rights, or as being independent from its mother, and thus did not see abortions as a major moral problem, early or late during the pregnancy:

The fetus belongs to the mother. It is her business, and she is allowed to do to it things that I might dislike. I am always there first of all for her. After all, she is the one who would have to raise this child. For me, the fetus is part of the woman’s body, until very late. Of course in the thirtieth week of pregnancy it is harder to see it that way, but I would hardly see the fetus as independent.

Another female counsellor who worked in one of Israel’s major genetic hospital units was very straightforward and displaying no sense of guilt about the connection between prenatal genetic diagnosis and abortions:

The goal of genetic counselling is to prevent the birth of children with birth defects, if that’s what the parents choose to do. How do we do it? By abortions. Right from the start our role is to lead people to abortions. It might sound cruel, but this is our job, by definition. If I objected to abortions, or cared too much about the fetus, I could not do this job. And anyway, I think it is better for the fetus not to be born with a severe disease.

were revealed to be the most prone to abort after a “positive diagnosis”, and to have what Rapp describes as a “user-friendly” attitude towards medical intervention; see Rayna Rapp, *Testing Women, Testing the Fetus: The Social Impact of Amniocentesis in America*, New York 1999, *passim*.

²⁹ Joyce Mushaben, Geoffrey Giles and Sara Lennox, ‘Women, Men and Unification: Gender Politics and the Abortion Struggle Since 1989’, in Konrad H. Jarausch (ed.), *After Unity: Reconfiguring German Identities*, transl. by Alison Brown and Belinda Cooper, Providence, RI 1997, pp. 137–172.

In contrast, German interviewees had a completely different view of the fetus, its status, rights, and relationship with the mother, and of their job definition. For example, a female genetic counsellor and gynaecologist who worked in the private sector told me:

It's hard for me to say what the fetus is. But basically I think life begins at implantation [14 days after fertilization], because before that the baby has not been accepted [by the body of its mother]. But even in IVF treatment, before implantation, there is potential for life. After all, those early cells can be implanted. That's why they should be treated very carefully, like the hope of a baby. ... There is no real point in time when life begins, before which the embryo is just [a cluster of] stem cells or chromosomes.

In a similar vein, a male doctor and clinical geneticist who headed a large genetic institute spoke of the fetus in terms of a "life" and of "late" abortions in terms of feticide, despite accepting the necessity for them in rare circumstances:

Life begins early. But still there is a difference between eight stem cells and a human-shaped embryo, and between prenatal and postnatal life. I think that late abortions are feticide. But if you know that the child will die anyway soon after birth, for example with trisomy 13 or 18, I don't oppose late abortions. But if it is only, for example, a kidney problem, I think abortion at late stages is feticide.

Likewise, a female doctor and human geneticist, who worked in a hospital, placed the 14-day old fetus' rights on par with those of other family members:

I can live with a stages model. After fertilisation and before implantation [the first 14 days after conception], I don't think it is a highly protected human being. It's only a pre-embryo, and therefore I do not oppose stem cell research. But after that, the embryo must be protected. Within the family situation it has rights like anyone else. Not more or less, but like the others. Late abortions after viability, in which the embryo has to be killed before it is aborted, are something I oppose.

As we have seen, the interviewed German counsellors whose profession is closely connected with selective abortions are far more ambivalent about this procedure than their Israeli counterparts. Whereas most Israeli interviewees repeatedly emphasised the supremacy of the mother's rights and wishes over the fetus' non-rights, German counsellors spoke of the fetus in terms of a "life" having autonomous rights, from quite early during pregnancy. These different views cannot be attributed to any scientific education, as medicine obviously has no clear answer to the question of when life begins. Furthermore, while according to Margrit Shildrick and Janet Price³⁰ modern

³⁰ Margrit Shildrick and Janet Price, 'Splitting the Difference: Adventures in the Anatomy and Embodiment of Women', in Gabriele Griffin (ed.), *Stirring It: Challenges for Feminism*, London 1994.

medical technologies, such as ultrasound and its images, which make a distinction between mothers and fetuses, lead to an emphasis on fetuses' rights, my findings suggest that this effect is actually culture-dependent, and not technology-dependent.

Eugenics, "Playing God" and the General Scientific Mentality

Much of the opposition to PND in today's world has to do with the trauma of Nazi eugenic policy which led to the present wish to hold eugenics and its immoral connotations at arm's length.³¹ This sensitivity regarding eugenics obviously characterises contemporary German society³², but it is also common in Israel. Table 5 represents the counsellors' level of agreement or disagreement with a classical eugenic statement, saying reproductive genetics should aim at reducing the number of deleterious genes in the population. It shows that whereas this statement is strongly resented by counsellors in both nations, a small group of genetic counsellors (14.3 % in 1993–5 and 13.3 % in 2000–1) in Israel supports this idea.

Table 5: Responses to the statement: "An important goal of genetic counselling is to reduce the number of deleterious genes in the population."

	1993–5			2000–1			
	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	
Germany	1.6 %	3.8 %	94.5 %	100 %	–	3.6 %	96.4 %
Israel	14.3 %	–	85.7 %	100 %	13.3 %	13.3 %	73.3 %

However, when put in less classical eugenic terms, a similar statement saying that it is socially irresponsible to give birth to a child with a serious genetic disorder in the era of PND, was far more supported by Israeli counsellors. The percentages of people agreeing with this idea were six times higher among the Israeli group as compared to the German group (66.7 % compared to 9.3 % in

³¹ Diane B. Paul, 'Eugenic Anxieties, Social Realities and Political Choices', in *Social Research* 59 (1992), pp. 663–683; Lene Koch, 'The Meaning of Eugenics: Reflections on the Government of Genetic Knowledge in the Past and the Present', in *Science in Context* 17 (3) (2004), pp. 315–331.

³² Irmgard Nippert and Gerhard Wolff, 'Germany', in Wertz and Fletcher (eds.), pp. 223–235; Krones and Richter; Erikson, pp. 1987–2001.

1993–5 and 24.1 % compared to 3.6 % in 2000–1). Percentages of those disagreeing were 4.7 times higher among the German group compared with the Israeli group in 1993–1995, (90.7 % compared to 19 %) and 2.5 times higher (87.8 % compared to 34.4 %) in 2000–2001 (See table 6).

Table 6: Responses to the statement: “It is socially irresponsible knowingly to bring an infant with a serious genetic disorder into the world in an era of prenatal diagnosis.”

	1993–5			2000–1				
	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree		
Germany	9.3 %	–	90.7 %	100 %	3.6 %	8.8 %	87.8 %	100 %
Israel	66.7 %	14.3 %	19 %	100 %	24.1 %	41.4 %	34.4 %	100 %

While not denying the strong effect of the fairly recent Nazi past on German and Israeli counsellors wishing to detach themselves from eugenics and its immoral connotations, in this article I will not discuss the effects of history on the legitimacy of reproductive genetics in our times, but rather focus on how religious tradition is related to eugenics, as well as to contemporary practices and their moral acceptance.

While it is true that most rabbis are cautious concerning selective abortions, they do not oppose preventing affected pregnancies, or the life of disabled people. Immanuel Jakobovitz contends that Jewish law has always been supportive of eugenic ideas (even before modern genetics was founded), as it encouraged individuals to be responsible to society and to the generations yet unborn in a manner which was unknown in any preceding system of religious thought or social medicine.³³ In addition, different provisions in Jewish law from medieval times were clearly motivated by eugenic considerations for the moral excellence of the progeny, which was associated with physical excellence, since they prohibited marriage into families with hereditary disorders.³⁴ By contrast, in his essay about Jewish eugenics, Noam Zohar contends that the conventional views which perceive Jewish tradition to be eugenic and one may even say racist (with its idea of the “chosen people”) involve a one-sided reading of the Jewish tradition and, particularly, the suppression of traditional critiques of lineage and of the notion of a

³³ Jakobovits, pp. 153–167.

³⁴ See also Feldman, ‘Eugenics’.

“Jewish race”.³⁵ Likewise, Yechiel Barilan also disagrees with Jakobowitz on this point.³⁶ Without going into the details of this argument, it is important to draw the links between Jewish attitudes towards the health of offspring, and contemporary Jewish Orthodox practices. The present-day orthodox Jewish community is utilising contemporary genetic knowledge in a unique fashion, running a programme called *Dor Yeshorim* for carrier screening tests prior to prearranged marriages, which is the approved type of marriage in this community.³⁷ The purpose of the programme is to prevent mating of two heterozygotes, and thus to prevent affected pregnancies and the conception of disabled children. Screening is strictly anonymous, and results are provided to the match-makers. If both potential partners are found to be carriers of the same abnormal allele, the engagement arrangements are stopped. Barbara Prainsack and Gil Siegal claim that pressing issues which “secular” genetic screening programmes struggle with, such as the passing on of too much “useless” information to the tested individual is avoided because *Dor Yeshorim* gives no information on individual disease carrier status but only on “genetic compatibility” of prospective partners.³⁸ Moreover, it is demonstrative of the fact that Jewish culture is in favour of preventing disability.³⁹ In contrast to Judaism, according to William Bassett the only Christian laws which have any eugenic significance are those prohibiting consanguineous marriages.⁴⁰ Moreover traditional Christianity, and particularly Catholicism reject a eugenic world view. Even in Germany between 1920 to 1945, although some forms of Catholic eugenics existed, the Catholic church largely opposed eugenics, as well as abortions and sterilisation, on the grounds of the threat to the integrity of the human person.⁴¹ “The Catholic hierarchy and theologians had generally opposed the compulsory negative eugenics policies of the Nazis and their predecessors, interpreting them as intrusions into the private spheres of human relations and as an unnatural interference with God’s creative plans.”⁴²

³⁵ Noam J. Zohar, ‘From Lineage to Sexual Mores: Examining “Jewish Eugenics”’, in *Science in Context*, vol. 11, nos. 3–4 (1998), pp. 575–585.

³⁶ Barilan.

³⁷ The current list of screened diseases includes: Tay-Sachs; cystic fibrosis; Gaucher’s disease type I; Canavan disease; familial dysautonomia; Bloom syndrome; Fanconi anemia; glycogen storage disease type 1A; mucopolidosis type IV; and Niemann-Pick disease type A. See: Barbara Prainsack and Gil Siegal, ‘The Rise of Genetic Couplehood: A comparative View of Pre-marital Genetic Screening’, in *Biosocieties* 1, 2006, pp. 17–36.

³⁸ *Ibid.*

³⁹ Hashiloni-Dolev, *A Life (un)Worthy of Living*, chap. 7.

⁴⁰ William M. Bassett, ‘Eugenics and Religious Law: Christianity’, in Warren T. Reich (ed.).

⁴¹ *Ibid.*, W. R. Inge, ‘Eugenics and Religion’, in *Eugenics Review*, 60 (2) January 1968, pp. 92–98.

⁴² Donald J. Dietrich, ‘Catholic eugenics in Germany, 1920–1945: Hermann Mucker-

In fact, in 1930 with the promulgation of the papal encyclical, *Casti Con-nubii*, compulsory sterilisation for eugenic reasons was forbidden by the church. An example worth mentioning in this context is Cardinal Clemens August von Galen who in 1941 endangered himself by openly condemning the Nazi euthanasia program; Galen remained, however, silent about the fate of the Jews .

According to James Walter theological and moral judgments concerning modern genetics are shaped by theological models such as *imago dei* (human beings created in the image of God) and the tendency of humans to “play God”.⁴³ These models are different in Christianity and Judaism. According to Yechiel Barilan rabbis never ban issues such as stem cell research, cloning or genetic experimentations on humans *a priori*.⁴⁴ Rather, they try to find legal solutions which enable them not only to tolerate such practices, but also to regard them as morally valuable. This is in line with the fact that the Halakhah usually sees its role as removing religious and other impediments to medical practice and progress, and not as its watch-dog.⁴⁵ Furthermore, while most Christian teachings consider humans to be subordinate to God in the process of creation, in Judaism there can be no accusation of “playing God” as human beings are understood to take an active part in God’s creation, which they are obliged to improve. Human dignity is thus understood to manifest itself in the willingness to alleviate suffering, and thus to improve on God’s creation.⁴⁶ While a similar view to the Jewish one which understands humans to have a responsibility to help bring creation to completion exists in Christian doctrine, another dominant perspective understands intervening in the very material that constitutes life as playing God, and thus as exceeding human limits. This understanding emanates from the stewardship model which tends to limit human activity, as it stresses preserving creation.⁴⁷ To conclude, whereas in the Jewish world reproductive genetics is adapted to contemporary Jewish orthodox life, and has the blessing of Jewish religious leaders, it is harder for it to be accepted in the Christian world, which has no religious eugenic heritage, and is more likely to fear the harm associated with science’s transgression into God’s creative plan.

mann, S. J. and Joseph Mayer’ in *Journal of Church and State* 34(3) (1992), pp. 575–601, here p. 576.

⁴³ James J. Walter, ‘Theological Issues in Genetics’, in *Theological Studies* 60 (1) (1999), pp. 124–134.

⁴⁴ Barilan.

⁴⁵ *Ibid.*

⁴⁶ Miryam Z. Wahrman, *Brave New Judaism: When Science and Scripture Collide*, Hanover, NH 2002, *passim*.

⁴⁷ Walter.

Attitudes to Scientific and Technical Progress

It is impossible to understand the cultural logic behind the uses made of medical genetics in both countries without taking into consideration both countries' scientific mentality. Being political, moral and aesthetic, the discourse of scientific and medical-genetic risks is profoundly different in Israel and Germany. Whereas in Germany it is characterised by a proliferation of risk discourse and a suspicious attitude towards science and progress, such discourse is almost completely missing in Israel, where the public-generally has trust in science and "progress".⁴⁸ Attitudes towards prenatal genetics can therefore not be detached from this context.

Different writers have pointed to the extraordinary fear of science in German society, and tried to explain its cultural and historical sources. For example, Uli Linke relates the German preoccupation with scientific and environmental disasters to the German history of the nineteenth and twentieth century.⁴⁹ She claims that after the Second World War Germany had to deal with guilt management, a process in which Nazi values have been inverted, but their themes, represented in the German collective imaginary, were not thoroughly transformed. Linke exemplifies this claim by the fact that the German imaginary, is still shot through with "holocaust" fantasies and fears of massive destruction. The only difference is that now the German obsession with destruction is pointed at nuclear or genetic holocausts, a mass destruction of which this time the German people would become the victim. Furthermore, according to Linke, the German resentment of science is deeply embedded in the German romantic movement of the nineteenth century, and also in the Nazi universe of the 1930s and 1940s.

Another commentator on this issue is Maurie J Cohen,⁵⁰ who claims that there is much in risk society theory, developed by the German sociologist Ulrich Beck⁵¹, which has a distinctly German stamp. Although this theory won international recognition, Cohen suggests that its central contention

⁴⁸ For example, the 2002 survey of the Israeli science, culture and sports ministry, concerning public attitudes towards science in Israel, revealed 73% of the Israeli public to be enthusiastic about science, 5.7% to be indifferent towards science and only 15% to be critical or worried about the outcomes of scientific progress. Moreover, the survey showed that Israelis believe their country has impressive scientific achievements in the field of medicine. Just as well, over eighty per cent among the surveyed believed that scientists contribute to society, and that investment in scientific and technological projects will contribute to Israel's welfare, standard of living and public health. (The survey can be found on the internet site of the science, culture and sports ministry www.most.gov.il).

⁴⁹ Uli Linke, *German Bodies: Race and Representation after Hitler*, New York 1999, *passim*.

⁵⁰ Maurie J. Cohen, 'Science and Society in Historical Perspective: Implications for Social Theories of Risk', in *Environmental Values* 8 (1999), pp. 153–176.

⁵¹ Ulrich Beck, *Risk Society*, London 1992, *passim*.

that public anxieties about high consequence–low probability events undermine the legitimacy of science, best describes German but not modern mentality in general. Her explanation of the specific German “scientific mentality” has to do with German religious doctrine, moral prescripts, historical precedent or simple inertia. Therefore she reads Ulrich Beck’s popular characterisation of the contemporary era as “risk society” as a German-inspired approach whose relevance for other Western societies is not a matter of course. Adopting her point of view I argue that the society in Israel does not fit the theoretical model of a risk society, and that the relationship between science and society are dramatically different in Germany and Israel. Beck’s thesis is that contemporary western society is no longer occupied with the production and distribution of scarce goods, but with the prevention or minimisation of “risks” which are the outcome of modernisation and industrialisation. But Beck tends to downplay the fact that what concerns one contemporary modern society, may not concern another. In contrast to Beck, I do not claim risks are objective,⁵² and hence what I stress is the differences among contemporary societies, and not among pre-modern and modern ones. I would argue that Germans are occupied with probable distant risks which are hard to measure as they are not localised and supposedly have a long-term effect, whereas Israeli worries are far more tangible (actually fearing the next terror attack, or war). In that sense Israel may not have reached the stage of a late modern risk society, which is centred on critical self reflection upon the dangers of modernity. On the other hand, Germany having experienced Nazism, which Zygmunt Bauman⁵³ understands to have been a regime, in which science was uncontestedly expected to create a better, more orderly and healthier society, is now no longer innocent regarding the atrocities of the modern rational-scientific spirit. This can best be demonstrated by the traditional lack of criticism concerning nuclear power in Israel. Whereas the fear of the all-destructive atom bomb was behind the formation of environmental oppositional groups in much of the Western world, and certainly in Germany, Israel seems to be missing from this line of protest, which later on formed a coalition with environmental movements with concern about gene technology in Germany and elsewhere. As a matter of fact, when Green-Peace International opened their office in Israel, they decided to leave aside nuclear power protest, as they estimated it would not gain them sympathy among the Israelis⁵⁴ who basically feel pro-

⁵² Beck himself sometimes seems to claim risks are objective, and other times to be more critical of this claim. Yet, to my mind his overall thesis does treat scientific risks as more real than imaginary.

⁵³ Zygmunt Bauman, *Modernity and Ambivalence*, Cambridge 1993, *passim*.

⁵⁴ Speculating about the reasons for these differences between Germany and Israel is beyond the scope of this article. Yet the immediate line of thought that comes to mind

tected and not endangered by their own nuclear abilities, both because of the Zionist-Arab conflict, and because of their trust in science.

Returning to genetics, all forms of gene technology (in medicine, agriculture or ecology) are viewed sceptically by the German public. In fact, according to a European survey done in 1991, there is no other country in the world where gene technology has encountered resistance as strong as in former West Germany.⁵⁵ Dixon's survey which assessed how genetic engineering scientists in Europe viewed the influence of public attention on their field, found out that in almost every respect, by far, the most negative responses came from scientists in West Germany who felt deeply criticised by the public. German scientists and journalists, who were asked to explain this phenomenon, pointed to three causes for public opposition: one-sided media coverage, sensitivity to the Second World War history of eugenics, and powerful activist opposition. Furthermore, the *Eurobarometer* 1991 and 1993 surveys of the German general public showed that the German scientists' perceptions of the public attitudes were based on reality, as the application of genetic technology in Germany has been continually countered by pointing out the ethical, legal, socio-economic and environmental risks.⁵⁶ However this tendency seems to be changing as recent studies suggest that the German public favours allowing new genetic reproductive technologies to be developed, despite restrictive German laws regarding this issue.⁵⁷

In contrast, writing about the regulation of biotechnology in Israel and its non-controversial status as compared to other parts of the Western world, Barbara Prainsack and Ofer Firestone argue that Israelis generally adopt a positive attitude to scientific practices and technologies that are controversial elsewhere (such as stem cell research, genetic diagnosis, and cloning).⁵⁸ This attitude is explained in terms of cultural, political and religious narratives which construct biotechnology as crucial for the continuity of Jewish existence in the Middle East; indeed, the very survival of Israel in such a hostile environment is seen to be dependent on its modernity, or in other words, on

has to do with the fact that for nearly sixty years Israel has been faced with very concrete risks, whereas Germany is a state, which has lived in relative peace.

⁵⁵ Bernard Dixon, 'Who's who in European Antibiotech', in *Bio/Technology* 11 (1993), p. 45.

⁵⁶ Isaac Rabino, 'German Genetic Engineering Scientists and the German Public: Complementary Perceptions in a Changing European Context', in *Public Understanding of Science*, vol 3, no. 4 (1994), pp. 365–384.

⁵⁷ Tanja Krones, 'Public Expert and Patients' Opinions on Preimplantaion Genetic Diagnosis (PGD) in Germany', in *Reproductive Biomedicine Online*, vol. 10, no. 1, (2005), pp. 116–123, online: www.rbmonline.com/Article/1547 as of 10 November 2004.

⁵⁸ Barbara Prainsack and Ofer Firestone, 'Science for Survival: Biotechnology Regulation in Israel', in *Science and Public Policy*, vol. 33, no. 1 (2006), pp. 33–46.

its scientific and technological superiority.⁵⁹ To get back to the specific interests of this study, let me remark that although the German genetic counsellors whom I interviewed were critical of the fears about science and genetics in their society, those fears and the language and metaphors in which they were couched penetrated their own expert discourse and affected their attitudes towards their expertise. Israeli counsellors on the other hand, were uncritical of science, just like the public they belong to.

The Disabled and Suffering

Concerning the issue of disability and suffering, genetic counsellors were asked three questions: is it fair to a child to bring it into the world with a serious genetic disorder? is it fair to his siblings? And does the existence of people with severe disabilities make society more rich and varied? Table 7 clearly shows that German counsellors perceive the existence of disability to be important for society far more than their Israeli colleagues (42.4 % compared to 10 % in 1993–5 and 61.4 % compared to 40 % in 2000–1) and levels of disagreement with the idea that the disabled are good for society were much higher in Israel in both periods (60 % compared to 17.7 % in 1993–5 and 26.9 % compared to 5.3 % in 2000–1).

Table 7: Response to the statement “The existence of people with severe disabilities makes society more rich and varied.”

	1993–5			2000–1				
	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree		
Germany	42.4 %	40.0 %	17.7 %	100 %	61.4 %	33.3 %	5.3 %	100 %
Israel	10 %	30 %	60 %	100 %	40 %	33.3 %	26.9 %	100 %

Concerning the benevolent effect the disabled individual has on society, Table 8 demonstrates that German counsellors strongly rejected the idea that impaired life is not worth living (47.3 % and 52.6 %), while the majority of Israeli counsellors, in both time periods, supported it (71.4 % and 66.7 %), thus seeming to accept the possibility of what in legal terminology is called a

⁵⁹ *Ibid.*, pp. 33–46.

“wrongful life”. Wrongful life suits permit the infant to sue medical agents and accuse them of negligently failing to detect a fetal anomaly, or to inform the parents of its potentiality. As a consequence, the child (as well as the parents) can demand compensation, on the grounds of the infant’s life being “wrongful”.

Table 8: Response to statement “It is not fair to a child to bring it into the world with a serious genetic disorder.”

	1993–5			2000–1				
	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	100 %	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	100 %
Germany	14.4 %	38.3 %	47.3 %	100 %	5.3 %	42.1 %	52.6 %	100 %
Israel	71.4 %	9.5 %	19 %	100 %	66.7 %	20 %	13.3 %	100 %

Table 9 further demonstrates that also concerning siblings, the majority of Israeli counsellors think it is unfair to a family’s other children knowingly to have a child with a disability, (61.9 % and 44.5 %) while the majority of German counsellors disagree (74.8 % and 56.1 %).

Table 9: Response to the statement: “It is not fair to a family’s other children knowingly to have a child with a disability.”

	1994–6			2000–1				
	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	100 %	Strongly Agree + Agree	Neither Agree nor Disagree	Disagree + Strongly Disagree	100 %
Germany	8.7 %	16.4 %	74.8 %	100 %	8.8 %	31.5 %	56.1 %	100 %
Israel	61.9 %	9.5 %	28.6 %	100 %	44.5 %	34.5 %	20.6 %	100 %

In his book about disability in Jewish law, Zvi Marx states that attitudes to disability evinced in the rabbinic and halakhic literature, are often disturbing to contemporary sensibilities, as halakhic culture is to a large extent a competence-oriented culture of “learners” excluding the disabled who are exempted from the obligation to fulfil many precepts, an exemption which

leads to their devaluation and stigmatisation.⁶⁰ Furthermore, the disabled are not considered to be important for the morality of the community, and marrying for siblings of the disabled is difficult in today's orthodox community, due to eugenic concerns. Despite this, a lot of organisations which support the disabled in contemporary Israeli society are run by the religious community.

On the other hand, Catholic tradition has a two faced attitude towards the disabled, who are simultaneously negatively and positively stereotyped. This religious moral attitude towards disability is exemplified by the attitude towards lepers and their role in Christian society in medieval times. At that time the Church interpreted leprosy as a holy disease, and its victims were believed to be chosen by God in order to grant them salvation in the after-life. Their suffering was understood to be similar to that of Jesus Christ, who suffered for all human kind, and Jesus himself was sometimes believed to have reappeared as a leper. As a result of this understanding of leprosy, the ill were treated by the Christian community with mercy and compassion, and charity for lepers was believed to provide forgiveness for the sins of this world.⁶¹ However, side by side with the described attitude, the lepers were also believed to be sinners who were punished for their sins, and accordingly they were often excluded from their communities.

In Germany today the moral-social status of the genetically abnormal is characterised by positive stereotyping. Their suffering is glorified and their existence is believed to better society, to make it more tolerant and humane. This attitude is not only due to religious sentiment but is also used as a means to rehabilitate the moral status of modern Germany. However, just like negative stereotyping, positive stereotyping does not understand disability to be a non-stereotyped human variant. Rather, both positions perceive the disabled as more or less than human,⁶² and thus the "good society" must either persecute them (in the Nazi past and in medieval times) or cherish and admire them (in medieval times as well as at present) for society's own good. Positive stereotyping was common in the positions expressed by the German counsellors interviewed in this study, who believed genetic diversity, and thus the existence of the disabled, to be socially, morally, and also biologically important.

⁶⁰ Zvi C. Marx, *Disability in Jewish Law*, London 2002, *passim*.

⁶¹ Liora Navon, *Lepers as Figurative Types: A Social Biography of Metaphor*, Tel-Aviv 1991, *passim*.

⁶² Leslie Fiedler, *Tyranny of the Normal: Essays on Bioethics, Theology and Myth*, Boston, MA 1966.

For example, a male gynaecologist, working in the private sector said:

Being around people with disability, you get a stronger sensitivity for the fact that your own life can also change from health to illness, or to poverty, from one minute to the next. The disabled remind us of that. They are a strong reminder of real life, away from the TV screen, where not everybody is young, healthy, rich and funny. They also stop us from becoming more and more uniform, which is dangerous from an evolutionary perspective.

Another counsellor, a woman gynaecologist working in the private sector, in cooperation with an IVF clinic said:

“We only look for money and for a good job, and forget all the rest. Disabled children make you confront the other important things in life. They remind us that there are people around us who need our help.”

While the majority of German counsellors at least paid respect to the idea that the disabled play a positive role in society, the majority of their Israeli counterparts totally mocked and opposed this idea. For example an Israeli woman genetic counsellor said:

Do people with severe disabilities make society more rich and varied? Maybe on the philosophical level. But in reality, I want to see you spend one day with a child with CP or mental retardation, and then you will see what it really means. Then I will ask you again what you think of the high-minded who say it's nice. There are enough things that make our lives diversified without suffering. One should not have disabled children in order to enrich the world or to make one's neighbour more sensitive.

Another female genetic counsellor with an MA qualification working in a hospital said:

I think the idea of diversity is bullshit. It can be supported only by high-minded people who don't really know the situation. It is easy to support until it happens in your own family. You can't say to people with a sick child, that he makes society richer, despite the fact that sometimes the parents of the disabled try to glorify themselves and their children, as a means of coping with this terrible situation as if having a disabled child were some kind of a reward. But it is all about rationalisation, since no one would freely choose a sick or a retarded or a problematic child. And really, why should anyone care about society's diversity, when it comes to one's own private suffering?

However, in Germany, too, some of the counsellors criticised the present German understanding of the importance of the disabled to society. While they did not mock the idea of diversity altogether, some pointed out that this ideology disregards the suffering of the child and that of his or her parents. For example a German human geneticist and hospital genetic unit director said:

I do believe society is richer because of the [presence of] the disabled. But who has to pay the bill for the education society needs? At the end of the day it is the disabled themselves, and their families, who have to deal with all the problems, and I don't see it

as their duty to live in order to educate us. I don't think my patients should suffer, for me to have an educational humanistic experience.

While the group of critical German counsellors who felt uncomfortable about the idea that the disabled are important for "the good society" understood the current German glorification of suffering to be a counter-reaction to Nazi atrocities, my suggestion is that it also resonates with religious understanding of the role of suffering. Likewise Israeli intolerance follows a Jewish logic which sees no point in suffering.

The religious background for such dissimilarities is explained by Avraham Steinberg:

Christianity views pain as the punishment for the original sin, and hence it is a welcomed experience, and it should not be prevented and should be gracefully accepted. Judaism accepts the idea that pain might be a punishment for sins. However, it negates the notion of original sin, and it certainly does not regard it as a virtue or sign of grace. Rather, pain and suffering is an unwanted curse, even if it has a purpose. Hence it should be prevented and treated.⁶³

An attitude which values suffering repeatedly appears in the writings of Christian religious figures discussing the challenges of reproductive genetics in Germany. For example Johannes Gruendel, a Catholic moral theologian at the University of Munich, writing about prenatal diagnosis, argues that in order to prevent the formation of a society which values only healthy life, one should stress the value of every human being. Furthermore acceptance of the handicapped should be promoted, as they should not be devalued but rather seen as a hint and reminder of the suffering of Jesus Christ.⁶⁴ Likewise, Miriam and Ruben Zimmermann in their article entitled "Is one entitled to have a healthy child?" make a link between reproductive genetics and a hedonistic world view which aims to reduce suffering and enlarge happiness at the cost of neglecting the fetus' right to life.⁶⁵ Similarly, a statement issued by the Council of the Protestant Church in Germany expresses the fear that therapies aimed at the human embryo foster the illusion of a world free of suffering.⁶⁶

⁶³ Avraham Steinberg, 'The Meaning of Suffering: A Jewish Perspective', in Edmund D. Pellegrino and Alan I. Faden (eds.), *Jewish and Catholic Bioethics: An Ecumenical Dialogue*, Washington, DC 1999, pp. 80 f.

⁶⁴ Johannes Gruendel, 'Theologisch-ethische Aspekte zur pränatalen Diagnostik', in J. Murken (ed.), *Pränatale Diagnostik und Therapie*, Stuttgart 1987, p. 314.

⁶⁵ Mirjam Zimmermann and Ruben Zimmermann, 'Gibt es ein Recht auf ein gesundes Kind? Eine ethische Anfrage zum "Diskussionsentwurf zu einer Richtlinie zur Präimplantationsdiagnostik" der Bundesärztekammer', in *Deutsches Ärzteblatt* 97, nos. 51–52, December 2000, pp. 51 f.

⁶⁶ Rat der Evangelischen Kirche Deutschlands (EKD), 'Der Schutz menschlicher Embryonen darf nicht eingeschränkt werden', 22 May 2001, <http://www.ekd.de/presse/39/>.

However, the differences in attitude towards disability in Israel and Germany go beyond the notion of what is good for society or for the family; they are also to be found in the meaning the disabled themselves attribute to their condition. Table 4 shows that while in Israel no resistance towards PND comes from advocates of people with disabilities, in Germany the disabled pose the strongest opposition to reproductive genetics.

The position of many of Germany's disability organisations is best demonstrated by cystic fibrosis (CF) which with a carrier rate of about one in thirty is the most common inherited genetic disease in Germany. Despite the fact that CF is not a rare medical condition in Germany, and despite the fact that CF patients usually die in their thirties or forties, and that they usually receive a lot of medical attention,⁶⁷ no screening tests are offered to the German public, in accordance with the stance taken by the CF association. At an international workshop on evaluating cystic fibrosis carrier screening development in Northern Europe, which took place in 1992, the representative of the German CF Association, the late Andreas Kersting-Wilmsmeyer said on behalf of the association:

We see our disease as a challenge which may influence our lives in a positive way, for example towards a greater sensibility for the discriminated and towards a deeper sense of life. Many of us feel their life to be more conscious and desirable than their non-handicapped fellowmen. ... Don't you think that living with trouble and knowing one's own limitations means having a much more intensive life than that of careless so-called non handicapped people? We therefore demand: Gene testing only if personally wanted, no advertising and as a precondition in any case a human genetic consultation!⁶⁸

A striking case exemplifying the fact that the Israeli disabled do not resent the idea of selective abortions, or the idea of a "wrongful life", or even of infanticide, is the story of Yoav Kreim, the present spokesmen of Israel's disabled persons organisation. Kreim was first introduced to the Israeli public as a child, when his father, a well-known literary critic, said in a newspaper interview, in front of his then twelve year old handicapped boy sitting next to him, that he thinks it would have been better to let his child, suffering from CP, die when he was one year old. In an interview Kreim junior, then twenty seven years old, said he was not angry with his father, who had wanted to save him and the rest of the family the tremendous suffering involved in liv-

⁶⁷ David Vardimon and Zion Ben-Rafael, *A Guide to Prenatal Counseling*, Tel-Aviv 1999.

⁶⁸ Andreas Kersting-Wilmsmeyer, 'Views of the German Cystic Fibrosis Association', quoted in 'Country Report from Germany', in Irmgard Nippert *et al.* (eds.), *Evaluating Cystic Fibrosis Carrier Screening Development in Northern Europe: Denmark, The Federal Republic of Germany, the Netherlands, and the United Kingdom*, Münster 1998. pp. 43–70, here pp. 31 f.

ing with CP. Yoav Kreim maintained that his father was right, since it demanded huge efforts to bring him up, and that it had meant a high price being paid by the entire family. Therefore, because the handicapped were mainly their family's concern, and not society's concern (a situation criticised by Kreim), parents should be given the opportunity to choose.

My father said that if he had known in due time that my life would be dependent on life-long medical intervention, he would not have fought to save it. I was born premature. All that was necessary was to take me off medical support. I don't understand this to be killing.⁶⁹

Yoav Kreim, then, believed it to be his parents' moral right to put an end to his life. No opposition to this view was voiced publicly by his fellow citizens after this interview. In contrast, in Germany it would be unthinkable for a spokesman of a disability organisation to express such opinions, as many German disability organisations are fighting very hard against PND and selective abortions. Aviad Raz, who studied the views of leaders of disability rights organisations and support groups for people with genetic conditions in Israel and compared them to the discourse of their North American counterparts, found that unlike the prevalent position of their American fellows, Israeli activists are generally in favour of prenatal diagnosis and selective abortions.⁷⁰ However, these attitudes go hand in hand with their commitment to the support of disabled individuals. Raz explains this as an Israeli two-fold view of disability which separates prenatal preventive testing from postnatal support of disability, and attributes positive connotations to eugenics, which is understood to improve the health of the progeny.

My suggestion is that these different attitudes also echo religious understanding, not only of the difference between postnatal and prenatal life, or of the collective meaning of suffering, but also of the individual meaning of disability and suffering.

Conclusion

In line with theories that challenge the modern assumptions of secularisation, arguing that modern politics is saturated with theological assumptions⁷¹, my findings blur the borders between the "secular" scientific sphere and the religious sphere, as they suggest that moral judgments concerning the legitimate uses of reproductive genetics echo models of religious think-

⁶⁹ Aviva Lori, 'What did Daddy Mean?', in *Haaretz*, 16 April 2003 (my translation).

⁷⁰ Raz.

⁷¹ John Milbank, *Theology and Social Theory: Beyond Secular Reason*, Oxford – Cambridge, MA 1990, *passim*; Shenhav, *passim*.

ing and feeling in both Israel and Germany. However, the influence of religion on the adoption of reproductive genetics is not direct, namely through obeying religious rules, but rather works through supplying mental structures for understanding different issues such as abortion, disability, suffering and eugenics.

My findings seem to indicate that interested parties such as modern scientists (namely genetic counsellors), as well as policy makers and the disabled in both nations, are not indifferent to the influence of religion, whether they perceive themselves to be in conflict with religious authorities or not, and whether they are aware, or unaware, of the religious undercurrents in the logics of their justifications.⁷² Yet, the effect of religion does not work in a predictable manner – it may either hinder the use of innovative medical techniques or facilitate their acceptance. Thus I have specifically argued that differences in religious attitudes towards the moral status of the fetus, towards the question of eugenics, towards the legitimacy of interference with God's creation, as well as towards the social and personal meaning of disability and suffering, all contribute to the diverse understandings of reproductive genetics in Israel and Germany. While Jewish culture stresses the potential blessings of reproductive genetics which may eliminate suffering and contribute to the excellence of the progeny, Christian culture points out its potential moral deficiencies such as “playing God”, lacking respect for the fetus and denying the value of suffering. I have further argued that the absence of fundamental religious opposition to PND in Israel, along with the existence of the implicit religious logic connecting contemporary reproductive genetics and traditional Jewish views, are among the most important factors for prenatal diagnosis having become an unquestionable and unquestioned medical routine in Israel. On the other hand, unusual coalitions formed between religious parties which allied with the green party, feminists and disability activists in Germany, have prevented the adoption of reproductive genetics as an aid to selecting embryos for abortion in Germany.⁷³ Obviously, in both Israel and Germany, the influence of religion may only be fully understood when seen in connection with general attitudes to scientific and technological progress, political legacies, such as the influence of Zionist ideology, as well as with the striving for the moral rehabilitation of contemporary Germany. This task, however, was beyond the scope of this paper.

⁷² Luc Boltanski and Laurent Thévenot, ‘The Sociology of Critical Capacity’, in *European Journal of Social Theory* 2/3 (1999), pp. 359–377; Julia Resnik and Michal Frenkel, ‘From Critical Sociology to the Sociology of Criticism: Comments on the Pragmatic Sociology of Luc Boltanski’, in *Theory and Criticism* 17(2000), pp. 101–122.

⁷³ Kronen and Richter; Hashiloni-Dolev, *A Life (un)Worthy of Living*, chap. 3.

Appendix

The Sample of Genetic Counsellors

The empirical data presented in this paper come from a quantitative study of Israeli and German genetic counsellors' professional practices. The samples are based on data collected through questionnaires (N= 295) which were distributed to genetic counsellors in Israel and Germany in 1993–5 and 2000–1. The first pool of 207 questionnaires comes from data collected by Dorothy Wertz and John Fletcher in 1993–1995 as part of their cross-national study of thirty-seven countries.⁷⁴ Their questionnaire comprised fifty questions dealing with ethical and social issues in genetic counselling. The late Dorothy Wertz allowed me to use their raw data, from which I extracted and re-coded this study's first database. The second database, which corresponds to the first one, constitutes the answers to a questionnaire that replicates parts of the original study and which I distributed and collected in both countries in 2000–2001 (N=88).

The first survey

In Wertz's study, in each of the thirty-seven surveyed nations a local geneticist compiled a list of practicing geneticists and distributed and collected the questionnaires, which were answered anonymously. In Germany, Irmgard Nippert and Gerhard Wolff distributed the questionnaires to professional geneticists based on the membership lists of the German Society of Human Genetics, the Professional Board of Geneticists, and listings from all the genetics clinics and academic departments in Germany. A German translation of the questionnaire was used. In Israel questionnaires were distributed by Zully Kohan, though only to MD geneticists and not to non-MD genetic counsellors. Both Hebrew and English questionnaires were used. The number of Israeli MD counsellors at that time was very small (around 30), and so Zully Kohan could distribute the questionnaires to all of them based on her acquaintance with them. Unlike this study, Wertz's international survey did not focus only on practices of prenatal diagnosis, but rather on a broader scope of genetics and ethics. Additionally, it also included non-counselling geneticists among its research population. In order to prepare the data for use in this study, only those questions relevant to the specific concerns of the current research were analyzed (15 out of the 50 original questions). Moreover, in order to learn specifically about practices of counsellors who advise patients, only practitioners of genetic counselling were

⁷⁴ Wertz and Fletcher (eds.).

included in the survey. 27 Israelis were invited to participate in the original study, of whom 23 (85 %) responded. I used only 22, on the basis that they counselled at least 1–5 patients per week. In Germany, 418 geneticists were invited to participate, and 255 (61 %) responded. Of these I used only 185, again on the basis of each individual concerned seeing at least 1–5 patients per week.

The second survey

In 2000–1, I replicated parts of Wertz's study and redistributed partial follow-up questionnaires based on the former study, thereby collecting new data focused on reproductive genetics. Respondents of the second survey might have also responded to the first one, but the two populations do not overlap. The completion of the new questionnaire took up to one hour. In Israel the questionnaires were distributed in English; in Germany, German version was used. In Israel, the anonymous questionnaires were distributed in several ways: some were handed out at professional meetings in which I participated, and others were distributed by mail according to the lists of two organisations: the Israeli Association of Medical Geneticists, and the Israeli Association of Clinical Geneticists. The rest were sent to employees of genetic hospital units, after receiving permission from the head of the unit. 44 Israeli genetic counsellors (this time including non-MDs) were invited to participate in the study. 31 (70 %) responded. After handing out the questionnaires participants were contacted by telephone and asked to return them. In Germany, 161 questionnaires were mailed (in double envelopes) all over the country to counsellors belonging to the German Professional Board of Geneticists (*Berufsverband Medizinische Genetik*). Only a few – those whose email address appeared on the list – were contacted a few weeks later by email and reminded to fill in the questionnaire. Four addressees returned empty questionnaires, explaining that they could not answer it for various reasons, such as having left the field of counselling in favour of laboratory work. Fifty-seven questionnaires (35 %) were returned. I cannot estimate how many people might not have received the questionnaire, or found them to be irrelevant to their line of work, since no contact was made other than through the above-mentioned list, which is unfortunately updated only infrequently. Counsellors who moved without leaving a forwarding address, died, or left the field of counselling, might thus have reduced the original sample considerably, in both the first and second surveys.

Possible biases of the second wave

In Israel, most of the unreturned questionnaires were from two hospital genetic institutes. I have some reason to believe these institutions are very permissive in their attitudes towards the selection of embryos. This stance could be a possible explanation for their unwillingness to participate in a study inquiring into ethical practices. For this reason, the Israeli sample might suffer from some underestimation of the phenomenon, as I assume that were I to receive these questionnaires, the Israeli results might have pointed to a more permissive attitude towards the detection and selection of abnormal fetuses. All German counsellors contacted were aware of the fact this study was conducted by an Israeli (probably Jewish) sociologist. As the topic of embryo selection is perceived by professional and public opinion in Germany as being firmly linked to the Nazi eugenic programs the fact that the individuals in question had been approached by an Israeli, might have affected their answers as well as their willingness to participate in the survey. This might have led to the overestimation of the phenomenon in the German case, as it might have caused German counsellors to wish to appear more cautious regarding the practice of PND and its outcomes than they really were.

Interviews

In the years 2000–1, I conducted thirty-two in-depth interviews with Israeli and German genetic counsellors: eighteen in Israel and fourteen in Germany. I first approached Israeli counsellors in a meeting of their organisation (clinical rounds), while others were contacted through membership lists of their organisations (the Israeli Organisation of Medical Geneticists and the Israeli Organisation of Clinical Geneticists), or following a referral from a colleague (snowball sample). In Israel interviews took place in eight out of the eleven hospital genetic institutes. Among the interviewees were seven heads of such institutes. Most of the interviewees were M.D. geneticists who specialised in diverse medical fields such as pediatrics, gynaecology and internal medicine. Six of the interviewees were non-M.D. counsellors. All interviews were conducted in Hebrew.

Due to the large size of the country and because of budget limitations, interviews in Germany were mostly conducted in the federal state of North Rhine-Westphalia (Nordrhein-Westfalen). Using the list of the German professional board of geneticists *Berufsverband Medizinische Genetik*, (BV) I contacted all counsellors who were working within two hours driving distance from Cologne. Among my German interviewees were counsellors with various educational backgrounds, holding diverse positions: among those interviewed were genetic counsellors who were gynaecologists and

paediatricians, four hospital unit directors, a counsellor working in a Catholic hospital, a former president of the German Society for Human Genetics, a university professor in the field of genetics who also practised counselling, and specialists who had formulated guidelines in the field of human genetics. The interviews took place in hospital units, university departments or university-based hospital institutes, as well as in private practices and homes.

The interviews were conducted in order to explore the complex logic of justification genetic counsellors use in their field of work, or, in other words, to look for the “value worlds” that were historically constructed by their community, and served them in forming their attitudes, justifying their own actions, and criticising others.⁷⁵

When setting out to interview I had prepared a number of set questions about opinions concerning different issues such as the standards required for entry into the human community⁷⁶, the good of society, the legal and moral standing of the fetus and its parents, disability, the goals of genetic counselling, science and progress, and the history and consequences of medical genetics. However, in practice the conversations were open-ended. I set out with one set of questions but enlarged and transformed them as during the interviews I became more knowledgeable about my field of study and its dilemmas. Interviews in both countries lasted from 1.5 to 4 hours. All interviews were tape-recorded, as well as summarised in writing, and all interviewees were promised anonymity. The interviews in Germany were conducted in English. Wherever a language problem appeared I was assisted by a native speaker.

Possible biases

In Israel, my request for an interview was turned down by two genetic institute managers, the same ones who also had failed to return the questionnaire. For this reason, the Israeli sample might suffer from some underestimation of the counsellors' support for the detection and selection of “abnormal” fetuses. In Germany, the fact that I was interviewing only in one federal state might have caused a slight regional bias. However, North Rhine-Westphalia is not known to be extremely liberal like Hamburg, or conservative, like Bavaria.

⁷⁵ Boltanski and Thévenot.

⁷⁶ Rapp.

The Texts

Apart from collecting quantitative data and interviewing, this study is also based on textual analysis. The majority of texts dealt with in the study, are legal ones such as abortion laws, embryo protection law, and court decisions concerning “wrongful life” suits. In addition, newspaper materials were collected. In Germany the majority of newspaper articles collected for this study, were texts published in the *Frankfurter Allgemeine Zeitung* 2000 (FAZ), English edition, 2000–2001. In Israel, the collection of texts was undertaken in a more eclectic fashion. In the years of this study, I collected many texts related to genetics from diverse media sources, such as newspapers and television programmes which dealt with the topic of this article. Another group of analysed texts consisted of the professional writings by medical geneticists in both countries such as professional guidelines, conference lectures, written summaries of discussions, and policy recommendations. Additionally, views of disability organisations concerning prenatal genetics were collected.

IV. Anti-Semitism in Academia

Pragmatic and Dogmatic Physics: Antisemitism in Nature, 1938

Aharon Loewenstein

It is well known that antisemitism was an important factor in the course of scientific research, in particular during the Second World War period. The expulsion of Jewish scientists from Nazi Germany had an adverse effect on German science and greatly promoted the scientific research of the Allies. The contribution of Jewish émigré scientists to the development of the atomic bomb and the Radar cannot be underestimated.¹ Antisemitism also infiltrated the non-German scientific publication media and the present study examines such a case.

The British weekly *Nature* is one of the most important scientific journals in the world. Since its establishment it has served as the medium for the announcement of many important scientific discoveries.² Apart from the scientific letters and articles, the journal devotes considerable space to matters that are of general interest to the scientific community. These range from comments on current economical, social and political issues to articles concerned with the history and philosophy of science. As an example of many, one may cite the editorial from 8 October 1938 ('The Promotion of Peace'), which enthusiastically supports the Munich accord between Neville Chamberlain, Edouard Daladier, Benito Mussolini and Adolf Hitler.³ The journal also contains important book reviews, obituaries, and so on. This essay is con-

¹ I am thankful to Professor Andreas Kleinert of the Martin-Luther-University at Halle-Wittenberg and Dr. Ute Deichmann of the Leo Baeck Institute, London, for reading the manuscript and offering some important comments.

There exists a vast literature concerned with the contributions of Jewish émigré scientists to the scientific and technological developments during and after the Second World War. Some material can be found in Richard Rhodes, *The Making of the Atomic Bomb*, Simon and Schuster, N.Y. 1986; Jean Medawar and David Pyke, *Hitler's Gift: The True Story of the Scientists Expelled by the Nazi Regime*, New York 2001; Ute Deichmann, *Biologists Under Hitler*, Cambridge, MA 1996.

² The first issue of *Nature* was published on 4 November 1869.

³ It should be noted that the corresponding American journal, *Science*, also welcomed the Munich accord. Frederic John Moulton, Secretary of the American Association for the Advancement of Science (which publishes *Science*), wrote an article to that effect in the *Science* issue of 7 October 1938.

cerned with the analysis of one particular article that a prominent German physicist published in *Nature* in 1938, the background of its publication and the response to it.

An article entitled 'The Pragmatic and the Dogmatic Spirit in Physics' by Professor Johannes Stark,⁴ president of the *Physikalisch-Technische Reichsanstalt* (Imperial Institute of Physics and Technology) in Berlin-Charlottenburg, appeared in the 30 April 1938 issue of *Nature*.⁵ Before presenting the contents of this article, it is important to give a short outline of the biography of its author and a description of the circumstances that led to its publication.

Johannes Stark was born on 15 April 1874 in Schickenhof, Bavaria. He received his doctorate in physics from the University of Munich in 1897. In 1913 he discovered what came to be known as the "Stark Effect", the splitting of the spectral lines in an electric field. He was awarded the Nobel Prize in Physics in 1919 in recognition of his work on electromagnetism. Stark resigned his physics chair in 1922 after angry polemics against Albert Einstein and his theory of relativity. Stark also rejected the Bohr-Sommerfeld quantum theory as "dogmatic", though it should be noted that the "Stark Effect" is in fact a very good demonstration of the success of Niels Bohr's early quantum theory. In 1922 Stark was driven out of German academic life and in 1924 declared his allegiance to Hitler. In April 1930 he joined the Nazi Party and together with Philipp Lenard (1862–1947; Nobel Laureate in Physics, 1905) formulated what would come to be known as "Aryan physics". The rise of the Nazis brought Stark back into Academia and he became president of the Imperial Institute of Physics and Technology from 1933 to 1939 and of the German Science Foundation (*Deutsche Forschungsgemeinschaft*) till 1936. Stark published his books *Nationalsozialismus und Wissenschaft* (National Socialism and Science) in 1934 and *Jüdische und Deutsche Physik* (Jewish and German Physics) in 1941. Stark was an ardent racist and antisemite. In July 1947, after the war, he was sentenced to four years of hard labour but this sentence was later suspended. Stark died in Traunstein on 21 June 1957.

The 1938 article was not Stark's only antisemitic contribution to *Nature*. In 1933, Professor Archibald Vivian Hill⁶, in his Huxley Memorial Lecture,

⁴ Some biographic details of Stark can be found in Alan D. Beyerchen, *Scientists under Hitler*, New Haven, CT 1977, and Mark Walker, *Nazi Science*, New York-London 1995. For a more detailed account see the works of Andreas Kleinert such as 'Der Briefwechsel zwischen Philipp Lenard und Johannes Stark' in *Leopoldina Jahrbuch*, vol. 46 (2000), p. 243.

⁵ Johannes Stark, 'The Pragmatic and the Dogmatic Spirit in Physics', in *Nature*, vol. 141 (30 April 1938), pp. 770–772.

⁶ A[rchibald] V[ivian] Hill, 1886–1977, Nobel Laureate in 1922 (with Otto Meyerhof) in Physiology or Medicine for his discoveries concerning the production of heat in muscles, was an important and active member of the British Academic Assistance Council (AAC, later the Society for the Protection of Science and Learning, SPSL). The AAC

had described the plight of Jewish scholars and professionals in Germany under Hitler. An extract of this lecture was published in *Nature* on 23 December 1933. Stark responded to Hill in *Nature* in February 1934. Stark claimed that Hill's statements were "not in accordance with the truth" and that all the measures of the German Government were an "attempt to curtail the unjustifiable great influence exercised by the Jews":

Jews had created a monopoly for themselves and in which they had taken possession of almost all academic posts. ... Jews who had come after the war [i.e. the First World War] from the east ... had been tolerated and encouraged by the *Marxist* Government of Germany. Only a small part of the 600,000 Jews ... has been affected by the National Socialist measures. ... Only half of the number that Hill gives (over a thousand) have been dismissed and among these are many Jewish and slightly fewer non-Jewish scientists who have *voluntarily* given up their jobs.⁷

Examples of the latter given by Stark were Albert Einstein, James Franck, Max Born, Erwin Schrödinger, Lev (Davidovich) Landau, Yacov (Il'ich) Frenkel and others. Stark continued to state that there were not even 10,000 people in concentration camps (Hill wrote 100,000) and that they were there "not because of their desire for freedom and of thought and speech (as Hill wrote) but because they have been guilty of high treason and actions directed against the community". Stark ended his reply thus: "It would be a good thing to keep political agitation and scientific research apart."

Hill responded briefly to Stark's letter writing as "an Englishman without any Hebrew ancestry or Marxist allegiance". He refuted Stark's claims and stated that they were nonsense and not true continuing: "as regards 'high treason' and 'concentration camps', in England we do not call liberalism or even socialism by that name". Hill sarcastically assumed that after his reply "my works in the *Journal of Physiology* and elsewhere will be burned [in Germany]" and ended his reply by calling for contributions to the Academic Assistance Council that helped dismissed scholars and scientists.

On 15 July 1937 *Das Schwarze Korps* (The Black Corps), the weekly publication of the SS, published an article entitled "'Weisse Juden"⁸ in der Wissenschaft' ("White Jews" in Science).⁹ The article was written partly by the edi-

was founded by Lord Beveridge (William Henry Beveridge, 1879–1963), Director of the London School of Economics. The AAC and SPSL assisted over two thousand Jewish (and other) academic refugees to obtain positions in the United Kingdom. A description of the AAC can be found in Jean Medawar and David Pyke, *Hitler's Gift: The True Story of the Scientists Expelled by the Nazi Regime*, New York 2001.

⁷ Emphasis added in this and all subsequent quotations.

⁸ The expression "Weisser Jude" (white Jew) seems to have been an already existing pejorative term in south Germany for non-Jews who were deemed to possess all the allegedly bad characteristics widely attributed to Jews. (Ofra Yeshua Lyth, private communication).

⁹ An English translation of this article can be found in Klaus Hentschel (ed.), *Physics*

tor of *Das Schwarze Korps*, Gunter d'Alquen, under the guidance of Stark and partly by Stark himself. The main theme in the article was that it is not sufficient to exclude all Jews from sharing in the political, cultural and economic life of the German nation, but to exterminate the Jewish spirit, clearly recognisable in physics through its most pronounced representative, Albert Einstein. "There is one sphere in particular", the article claimed, "where we meet the spirit of the 'White Jews' in its most intensive form and where what is common between the outlook of the 'White Jews' and Jewish teaching and tradition, can be directly proved, namely in science. To purge science from this Jewish spirit is our most urgent task. For science represents the key position from which intellectual Judaism can always regain a significant influence on all spheres of national life." Several gentile scientists of international reputation such as Max Planck and Arnold Sommerfeld were named in the article as followers of Judaism in German intellectual life and it was remarked that "they must be got rid of as much as the Jews themselves". It should be noted that the same journal published another article on 26 August 1938 entitled "*Wirtschaft Ohne Dogma*" (Economy without Dogma) which was closely related in its stance to the above mentioned article on Jews in science.

Foremost among those "Aryan German" theoretical physicists who were attacked by Stark in this *Schwarze Korps* article was Werner Heisenberg whom Stark described as a "White Jew" and as the "Ossietzky of Physics".¹⁰ Stark stated that the award of the Nobel Prize to Heisenberg in 1933 was "a demonstration of the Jewish influence on the Nobel committee against German National Socialism. ... Heisenberg is one example of many others". One of Stark's motives in his attack on Heisenberg was his wish to sabotage Heisenberg's effort to obtain the chair of theoretical physics at the University of Munich from Sommerfeld who was about to retire. Stark won this battle and the Munich chair was given to Wilhelm Müller. After this publication in *Das Schwarze Korps*, Stark was asked by the editor of *Nature*, Sir Richard Gregory¹¹, if its contents represented his considered views on the relative

and *National Socialism: An Anthology of Primary Sources*, transl. by Ann M Hentschel, Basel – Boston – Berlin 1996.

¹⁰ Carl von Ossietzky, 1889–1938, German pacifist, journalist and writer who was a leader of the peace movement in Germany after the First World War. He wrote against German rearmament. The Nazis imprisoned Ossietzky after the burning of the Reichstag in 1933. He was awarded the Nobel Prize for Peace in 1936. Ossietzky died of tuberculosis in a Berlin Hospital in 1938. By Hitler's orders the German government decreed that in the future no German could receive any Nobel Prize (cf. Walker, p. 131.).

¹¹ Sir Richard Arman Gregory 1864–1952; for biographical details see Walter Harry Green Armytage, *Sir Richard Gregory: His Life and Work*, London 1957; see also Frederic John Marrian Stratton's contribution in Royal Society (ed.), *Obituary Notices of Fellows of the Royal Society*, vol. 8, no. 22 (November 1953), p.410.

values of experimental and theoretical physics and whether he would care to make them known to other men of science through the columns of *Nature*. Stark responded positively to Gregory's request and agreed to contribute an article to *Nature* that was published on 30 April 1938.¹²

Stark's article opened with a general statement about research in physics:

The aim of physical science is the investigation of the laws which govern the properties and processes observed with objects of inanimate Nature. These inherent laws are independent of human existence, action and thought, and are the same all over the world. ... But the manner in which physical research is carried out and described depends on the spirit and character of the men of science engaged upon it, and this spirit and character differ individually, as do men, nations and *races*.

We note that already in the first paragraph of the article the combination of race and character is presented. Stark then continues to describe "two principal types of mentality in physics" or "two types of mental attitude" of physicists:

The first is the pragmatic spirit which is "directed towards reality". The aim is "to discover new phenomena and bodies as yet unknown". Though they "form a conception as to what the body or process to be investigated may be like in reality", such conception "is solely the means to the end of devising experimental arrangements for the empirical formulation of their question in reality itself". ... "Their final goal is always to establish reality. ... The mathematically formulated theory is to physicists of the pragmatic spirit not an end in itself."

The second type is the physicist of the dogmatic school "He [the dogmatic physicist] starts out from ideas that have arisen primarily in his own brain or from arbitrary definitions of relationships between symbols to which a general and so also a physical significance can be ascribed". The dogmatic physicist seeks to give his mathematical formulae a physical meaning by applying them to the results of experience. If his theory is in accord with the experiment he ascribes it to the virtue of his theory. Otherwise he doubts the validity of the experiments. "Dogmatic physicists present things as though their theories and formulae exhaustively covered the whole range of phenomena treated by them." Stark then claimed: "The aim of the pragmatic spirit is reality ... the goal of the dogmatic spirit is the formula." In this way Stark continued to analyse the two types of physicists not hiding which of them he favours: "The pragmatic spirit advances continuously to new discoveries and new knowledge; the dogmatic spirit leads to crippling of experimental research and to a literature which is as effusive as it is unfruitful and tedious, intrinsically akin to the *theological dogmatism* of the Middle Ages."

¹² Cf. footnote 5.

Next Stark presented two of his favourite “pragmatic” physicists, Philipp Lenard and Ernest Rutherford, and then went on to analyse their scientific work. Prominent examples for “dogmatic” physicists, in Stark’s opinion, are Albert Einstein and Erwin Schrödinger. He claims that Einstein’s “relativistic theories are based on arbitrary definition of space and time coordinates” while Schrödinger “by an amazing feat of physico-mathematical acrobatics obtains ... a differential equation. He [Schrödinger] then asks what sort of physical significance the function ... may have. ... [T]he electron is arbitrarily smeared in a large region round about the atom”. Other examples of “dogmatic” physicists mentioned are Max Born (a Jew), Pascual Jordan, Werner Heisenberg and Arnold Sommerfeld (who is associated with the creation of the “old quantum theory”). All four laid the foundations to quantum mechanics, a revolution in physics, though it might be noted that Jordan was a member of the Nazi party and that Heisenberg ultimately cooperated willingly with the Nazi regime.

Stark further pointed out another difference between the two types of physicists: “The pragmatic spirit does not conduct propaganda for the results of his research ... he finds his satisfaction in obtaining new knowledge ... and that it will serve as a step towards new advances”. On the other hand, “almost before they [the “dogmatic” physicists] have published, a flood of propaganda ... is started by articles in journals, by textbooks and by lecture tours”. As examples for this attitude Stark cites again the behaviour of Einstein as compared to that of Lenard and Rutherford. According to Stark the “dogmatic spirit” has gained in the last three decades “a dominating influence in Germany” through “their collective action and their connection with early [Weimar] Ministries, they were able to acquire numerous chairs in physics, above all in Theoretical Physics”. Stark then takes upon himself the mission to save Germany from “Einstein and his dogmatic imitators”.

Finally there appears the crucial issue in Stark’s arguments: “I have also directed my efforts against the damaging influence of *Jews* in German science, because I regard them as the *chief exponents and propagandists of the dogmatic spirit*.” The question immediately arises why are the Jews the propagandists of the “dogmatic spirit”? Stark states that “the great discoverers, from Galileo and Newton to the physical pioneers of our age were almost exclusively Aryans, predominantly of the Nordic race”. Stark asks why “propagandists of modern dogmatic theories are men of Jewish descent”. The answer is “that Jews played a decisive part in the foundation of theological dogmatism and that the authors and propagandists of Marxism and communistic dogmas are for the most part Jews”. Stark admitted that there are some Aryan men of science who follow the “dogmatic spirit” (for instance Heisenberg, the “white Jew”) and conceded that some Jews “produced valuable experimental work carried out in the pragmatic spirit”. Stark concluded by

stating that he “combats the harmful influence of the dogmatic spirit in physics ... regardless whether the culprit is a Jew or not” and that he had already started his battle as early as 1922 with a paper entitled ‘The Present Crisis in German Physics’.

Stark totally miscomprehended the creative development of science in general and modern physics in particular, Stark used his article to propagate his very strong antisemitic attitude. One might have expected such an article to provoke a strong response from members of the scientific community most of whom were readers of *Nature*. This, however, was not the case.

The *only* response to Stark’s article in *Nature* appeared in its 12 November 1938 issue (about six months after Stark’s article) and was written by Professor Arthur Stewart Eve¹³ who entitled it: “Foundations of Physics”.¹⁴

Eve was a close friend of Rutherford and was involved with him in research on radioactivity; later he also wrote a biography of Rutherford. Rutherford was a founder and supporter of the Academic Assistance Committee and chaired its important meeting in the Albert Hall, London in October 1933 in which Einstein also participated. In Stark’s article Rutherford is named as an example of a “pragmatic” physicist and I believe that this may have triggered Eve to respond. It should be borne in mind that Rutherford had died about six months before Stark’s article appeared.

Eve’s article started with the statement that “Professor J. Stark attempted to divide physics into two groups or tendencies and at the same time made

¹³ Arthur Stewart Eve, F.R.S., (1862–1948) was born in England. He studied in Cambridge and in 1903 became lecturer in mathematics at McGill University Montreal, Canada. He was the director of physics at McGill from 1919 to 1935. Eve served in the First World War and retired as a colonel. He was president of the Royal Society of Canada from 1929–1930. Between 1898 and 1907 Ernest Rutherford (1871–1937; Nobel Prize in Chemistry 1908) stayed at McGill University.

¹⁴ Arthur Stewart Eve, ‘Foundations of Physics’, in *Nature*, vol. 142 (12 November 1938), pp. 857–859.

In its 29 May 1938 issue *The New York Times* published a short editorial entitled ‘Nordic Science’ concerning Stark’s article in *Nature*. It stated that Stark himself was a “dogmatist” because of his thesis that most “dogmatic” scientists were non-Nordic (non-Aryan). “Pragmatic anthropologists long ago exploded the racial myth to which he [Stark] clings. There is no pure race anywhere on earth” Furthermore, “[e]ven on the relative merits of dogmatism and empiricism [note the difference in terminology!] Professor Stark is both illogical and obscure.”... “Also Stark forgets to mention the deadening influence of ‘Nordic’ metaphysicians Hegel, Schelling and Fichte.”... “Professor Stark prefers to dogmatize in [*sic*] behalf of pragmatism with Hitler and Streicher.” In many respects (mostly concerning Stark’s racial arguments) this editorial uses much stronger language than Eve’s response. The editorial is unsigned, but I believe that Franz Boas (1858–1942) may have been its author. I am indebted to Professor Andreas Kleinert for drawing my attention to this editorial. Professor Kleinert pointed out to me that Philipp Lenard in a letter to his friend Stark, criticized the latter’s decision to publish his article in *Nature* because (in his opinion) it had become a “*Judenblatt*” (a Jewish paper).

an unpardonable attack on the Jewish people in general and Einstein in particular". Eve wrote that the "article has been met with cold disfavour by the generality of physicists, who have made no reply to it". Eve believed that the reason for this silence was because all deemed "that the statements carried with them their own refutation so that no answer was required". However, Eve did not seem to be happy with this reasoning and added: "Men fear to pour oil, not on troubled water, but on a blazing furnace, which if left undisturbed might reach exhaustion by its own violence." This kind of reasoning was quite popular, also among German Jewry, until the "*Kristallnacht*" events in November 1938 violently disproved it.

Eve's article presented a review of the development of modern physics, from Jean Baptiste Joseph Fourier to Paul Adrian Maurice Dirac. He showed that in many instances, theory and experiment complemented each other irrespective of who preceded whom. He quoted Rutherford who was willing to abandon the theory of radioactive decay if a single experimental result were to contradict it and showed that Rutherford could not be termed a pragmatist or a dogmatist. Other examples Eve mentioned are the electromagnetic theory of James Clerk Maxwell that supplemented Michael Faraday's work; Planck's quantum hypothesis; Bohr's atomic model and others. "Here, as in many cases, ideas which might be termed 'dogmatic' by some have led directly to the 'pragmatic'."

Eve commented on the use of scientific discoveries for "propaganda" purposes, a practice which according to Stark was only carried out by the 'dogmatists'. Eve claimed that the big scientific discoveries, from Copernicus, Galileo and Newton to Bohr and Einstein, never needed any advertisement. He quoted Rutherford who "believed that it was one of his duties to interpret and spread the good news of scientific discovery and progress. He would be a rash man who dared to use the word 'advertising' in this connexion and no fair-minded man would connect the word with Einstein." It should be noted that Eve replaced the term "propaganda" with "advertisement". Eve possibly did not comprehend the importance of propaganda in the Nazi regime.

It is interesting to note that only *one* paragraph in the article is concerned with Stark's racist, antisemitic views: "The fact that physical interpretation lags far behind the mathematical calculation ... in no way detracts from the work of these men of genius, who belong to various nationalities. If these men are deemed to be dogmatic, then it would indeed be an honour to be included in their ranks. But the whole theory of pragmatics and dogmatics is pure moonshine and to link such discoveries mainly with the Jewish people is a poor compliment to the rest of mankind."

The division between experimental and theoretical scientists has existed throughout the history of science though many scientists had "mixed" ca-

reers devoting their time to both theory and experiment. It has always been generally accepted that theorists and experimentalists complement each other and that this symbiosis constitutes the essence of the scientific method (a theory must conform to known experimental facts and be able to predict new phenomena). The uniqueness of Stark's paper is not his division between "pragmatists" and "dogmatists" but his total rejection of the "dogmatists" and his assertion that most "dogmatists" are Jewish or possess a "Jewish mentality" ("white Jews"). According to Stark the "dogmatic" elements of science should be completely eradicated.

Two questions remain to be considered. The first is: why did *Nature* agree to publish Stark's article which was essentially a refined version of his publication in *Das Schwarze Korps*? In the 'News and Views' section of the 30 April 1938 *Nature* issue, Richard Gregory, the editor, stated:

At the moment we make no comments upon the views expressed by Prof. Stark and we gladly give him the opportunity of making them known to the scientific world. We should, however, be surprised if the limitations which these new principles impose on the scientific truth are generally accepted as the highest or best means of promoting the advancement of natural knowledge¹⁵.

The second question is why was the only response in *Nature* to Stark's article published so late and why was it relatively mild?

Concerning the first question: one possible answer is that Gregory agreed to the publication because he held the view that international science is the key to a solution of many of the world's problems. It is known that he was

¹⁵ Attempts made by the author to obtain any remaining correspondence between Professor Johannes Stark and Sir Richard Gregory failed. Both the present editor of *Nature* Dr. Philip Campbell, and its former editor Sir John Maddox stated that *Nature* has no archives for the period in question and therefore such possible correspondence no longer exists. Brenda Maddox in her book *Rosalind Franklin: The Dark Lady of DNA*, London 2002, writes (p. 211): "The voluminous and unsorted *Nature* archive was thrown out during a move to the new offices in 1963." This could explain the lack of documentation. Inquiries at the *Staatsbibliothek* in Berlin, where some of Stark's correspondence is held, produced negative results. Stark's article was not the only German antisemitic material published in *Nature* without comment. In 1935 A. V. Hill drew Gregory's attention to a note by Lenard published in the students' magazine of the University of Heidelberg. Lenard addressed students who had congratulated him on the occasion of renaming the Physics Institute in Heidelberg as the "Philipp Lenard Institute". Gregory published Lenard's note in the "News and Views" section of the 1 June 1935 issue of *Nature*. It reads as follows: "I am very grateful to the students of the University of Heidelberg for their congratulations. ... I hope that the Institute may stand as a battle flag against the Asiatic Spirit in Science. Our Leader has eliminated the same spirit in politics and national economy – where it is known as Marxism. In natural science, however, with the over-emphasis of Einstein, it still holds sway. We must recognize that it is unworthy of a German – and indeed only harmful to him – to be the intellectual follower of a Jew. Natural science properly so called is of completely Aryan origin. ... Heil Hitler!" Gregory added, "We prefer to make no comment upon it."

convinced that political conflicts between nations could be remedied through international scientific cooperation since “science has no frontiers”. Furthermore, Stark, as other Nobel Laureates, was held in special esteem by the scientific community. We may also find the answer in a more profane matter: Gregory’s reaction to the prohibition of *Nature* in Germany. In the 22 January 1938 issue of *Nature* Gregory quoted a document, issued by the German Ministry of Culture, saying that *Nature* published “unprecedented and base attacks against German science and the National socialistic State. ... Therefore this journal must be excluded from general use in scientific libraries.” In his response Gregory countered: “It is untrue that *Nature* has ever attacked German contributions to scientific knowledge”. He continued: “We welcome the opportunity of recording worthy additions to the literature of science or to natural knowledge from any country or any race; but we should be false to the traditions of science if we failed to condemn any influence which would make scientific research subservient to political or theological domination.” ... “We regret that the penalty involved in the withdrawal of *Nature* from libraries ... will be felt more by some of our readers in Germany than by ourselves.” After such statements Gregory probably had little choice but to accept Stark’s article for publication. On the other hand it is also possible that Gregory maintained relatively tolerant views towards the Nazi regime as is evident from *Nature*’s endorsement of the Munich accord and the citation from Lenard’s speech in 1935.¹⁶ It is obvious that a scientific journal such as *Nature* which also has political, social and economic aspirations is liable to stumble and make grave historical misjudgements.

It is difficult to answer the second question. It could be that some readers of *Nature* simply thought that it would not be worthwhile to waste time responding to the absurd ideas expressed in Stark’s article. Still, the article with all its antisemitic connotations should have drawn the attention of at least some Jewish German émigré scientists in Britain or elsewhere (who certainly were *Nature* readers and also contributors of scientific articles). It is surprising that none of them responded. This may reflect their feelings of insecurity in their new environment, but there was also no response from their

¹⁶ Cf. preceding footnote. Richard Gregory, in a letter addressed to A. V. Hill, dated 21 May 1935, concerning Lenard’s note, wrote: “How sane or scientific people could be associated with such expressions of opinion as those given by Lenard *passes the comprehension of any reasonable being. I think I must print the extract practically without comment and let it speak for itself to the scientific world.*” Also, in another letter to Hill dated 27 November 1935 concerning Hill’s decline of an invitation to attend a Congress in Berlin during the Olympics, he writes: “I am glad you have stated so definitely why you are unable to be associated with any such movement while the *Germans are behaving disgracefully to members of the Jewish people.*” Courtesy of the Churchill Archives Centre, Churchill College Cambridge UK, A. V. Hill papers, AVHL 13/53. I wish to thank them for providing this material.

British colleagues. The political atmosphere in Britain, dominated by the wish to appease the Germans and avoid war, might also have contributed to the lack of response. Furthermore, it is not unreasonable to speculate that Gregory would not have been too enthusiastic about publishing a response to Stark's article that would anger his German readers. A plausible guess is that the trigger to Eve's response was the description of Rutherford in Stark's article as a "pragmatic physicist". Eve must have been very annoyed by this statement. Gregory could not refuse publishing Eve's article since he was well acquainted with him.

It should be mentioned that in Nazi Germany Stark eventually fell from grace with the authorities (Ministry of Science, Education and Culture and the SS) possibly because of his fanatic attitude or because he had the wrong ally. His patron, Alfred Rosenberg, did not belong to the 'correct' top Nazi hierarchy and could not help him. Heisenberg, a 'white Jew' and a 'dogmatic physicist', held the leadership of the German atomic project during the war.

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NATURE

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The Pragmatic and the Dogmatic Spirit in Physics

By Prof. J. Stark President of the Physikalisch-Technischen
Reichanstalt, Berlin-Charlottenburg

The aim of physical science is the investigation and formulation of the laws which govern the properties and processes observed with objects of inanimate Nature. These inherent laws are independent of human existence, action, and thought, and are the same all over the world. For this reason, the object of physical science is international. But the manner in which physical research is carried out and described depends on the spirit and character of the men of science engaged upon it, and this spirit and character differ individually, as do men, nations and races.

When in what follows I speak of two principal types of mentality in physics, my observations are founded on experience. I have inquired into the mental characteristics that have led the great physicists of the past to their discoveries, and in the course of the forty years of my

scientific life I have observed very many more or less successful contemporary physicists and authors of theories and of books, in an endeavour to discern the mainspring of their work. On the basis of this wide experience I have come to recognize that there are two main types of mental attitude among workers in the field of physics.

The pragmatic spirit, from which have sprung the creations of successful discoverers both past and present, is directed towards reality; its aim is to ascertain the laws governing already known phenomena and to discover new phenomena and bodies as yet unknown. Even before they tackle a particular problem, physicists of this school of thought have acquired a certain feeling of the reality of the phenomena to be investigated, by giving careful attention to all previously ascertained facts connected with their prob-

lem. On the basis of this feeling they form a conception as to what the body or process to be investigated may be like in reality. For them, however, such a conception is solely the means to the end of devising experimental arrangements for the empirical formulation of their question to reality itself. If the observations made with the apparatus chosen do not confirm the initial conception, as very frequently happens, they reject it with out hesitation and seek stimulation from experience for a new conception for the purpose of new experiments. Their final goal is always to establish reality, whether they gain new knowledge or are led to obscure and still unexplored features of the phenomena investigated. The mathematically formulated theory is to physicists of the pragmatic spirit not an end in itself, but solely a method for the purpose either of presenting the knowledge gained from experience in a quantitative manner and as briefly and simply as possible, or of deriving mathematically for special cases results which follow from general laws obtained from experiment.

The physicist of the dogmatic school operates in quite a different manner in the field of physics. He starts out from ideas that have arisen primarily in his own brain, or from arbitrary definitions of relationships between symbols to which a general and so also a physical significance can be ascribed. By logical and mathematical operations he combines them and so derives results in the form of mathematical formulae. He then seeks to give these a physical meaning by applying them to the results of experience. In so far as they are found to be in accord with experience, he underlines this agreement with the greatest of emphasis, and makes it appear as though the results of experience have been established and have gained scientific importance only by virtue of his theory. If there are any experimental results available

that are not embraced by this theory or which stand in contradiction to it, he doubts their validity or considers them so unimportant that he does not deign to mention them. Dogmatic physicists further present things as though their theories and formulae exhaustively covered the whole range of phenomena treated by them; they can see no further problems in this field, and thought and inquiry are ice-bound in their formulae.

The aim of the pragmatic spirit is reality, and his way to this goal is appropriate and careful observation; the goal of the dogmatic spirit is the dogmatic formula, and his way is one of logical mathematical construction. For the pragmatic spirit physical research is a process of evolution from what has been established to new experimental knowledge; for him there is no such thing as classical physics or modern physics, but only physics. For the dogmatic spirit physics is a field for his logical formalistic activity towards revolution against existing principles and towards the accomplishment of general acceptance of his theories or, indeed, of his new 'world-picture' (*Weltbild*). The pragmatic spirit advances continuously to new discoveries and new knowledge; the dogmatic spirit leads to the crippling of experimental research, and to a literature which is as effusive as it is unfruitful and tedious, intrinsically akin to the theological dogmatism of the Middle Ages, which was opposed to the introduction of pragmatic natural science.

The researches of Lenard and of Rutherford present us with obvious recent examples of the manner in which the pragmatic spirit works in physics. By his experimental investigations on cathode rays, Lenard paved the way for the greatest discovery of the last fifty years, that of the electron, and furthermore, in the photo-electric effect, he revealed by careful measurements the connexion between the electron and light. From his intuitive

sense of reality and by convincing experiments and measurements, Rutherford derived our knowledge of the radioactive transformation of chemical atoms and of their nuclear structure, knowledge which could never have been derived by dogmatic methods. The relativistic theories of Einstein, which are based on an arbitrary definition of space and time co-ordinates or their differentials, constitute an equally obvious example of a product of the dogmatic spirit. Another example of this kind is the wave-mechanical theory of Schrödinger. By an amazing feat of physico-mathematical acrobatics he obtains as a final result first a differential equation. He then asks what sort of physical significance the function that occurs in his equation may have, and for this he makes a suggestion, according to which the electron is arbitrarily smeared in a large spatial region round about the atom. In characteristic fashion, however, other dogmatic physicists (Born, Jordan, Heisenberg, Sommerfeld) give to the Schrödinger function an other dogmatic significance, contrary to fundamental laws of experience. They make the electron dance round the atom in an irregular manner, and allow it to act externally as though it were simultaneously present at every point round about the atom with a charge corresponding to the statistical duration of its sojourn at each point.

There is still another important difference between the pragmatist and the dogmatist in physics, which has to do more with the characters of these two types. The physicist of the pragmatic spirit does not conduct propaganda for the results of his research in order to gain authority and influence; he finds his satisfaction in obtaining new knowledge and trusts that it will receive recognition from the expert as a representation of reality, and that it will serve as a step towards new advances. How different are the protagonists of the dogmatic spirit! They do not first wait

for at least five years to see whether their revolutionary fashioned theories may perhaps prove to be inadequate or erroneous when examined in the light of experience. On the contrary, almost before they have been published, a flood of propaganda for them is started by articles in journals and newspapers, by text-books and by lecture tours, if possible right round the world. So far as I am aware, Rutherford never undertook lecture tours to make known the results of his researches. Of Lenard I know that he detested speaking about his researches before a wide public, and that he only twice took part in the German Congress of Natural Science (*Naturforscherversammlung*). On the other hand, older physicists will probably still remember with what pertinacity propaganda was carried on all over the world and before the widest public for Einstein's theories of relativity. Matters have not been quite so bad with the newer dogmatic theories which have been advertised under such terms as quantum theories, quantum mechanics, and so on; nevertheless, for the purpose of propaganda on their behalf, innumerable lectures have been held throughout the world, and very many text-books have been written about them.

In so far as the task of physics is the investigation of bodies and of laws concerning the reality of Nature, only the pragmatic attitude of men of science is qualified to solve them, and hence also alone entitled to do so. When the dogmatic spirit does not confine itself to theology and sociology, but also chooses physics as an arena for its intellectual gymnastics, one might tolerate this, but only under the condition that physical research of the pragmatic school of thought does not suffer in consequence. But for about three decades this condition has not been satisfied, at any rate not in Germany, where during this time the representatives of the dogmatic spirit have

gained a dominating influence. By their collective action and their connexion with earlier Ministries they were able to acquire numerous chairs in physics, and above all in theoretical physics. In consequence of this, and because of the lively propaganda for modern dogmatic theories, academic youth was predominantly educated in the scientific ideal of the dogmatic spirit. Not men like Lenard and Rutherford, but Einstein and his dogmatic imitators were held up to them as models for scientific thought and work. I have taken the field against the dogmatic spirit in Germany because I have been able to observe repeatedly its crippling and damaging effect on the development of physical research in this country. In this conflict I have also directed my efforts against the damaging influence of Jews in German science, because I regard them as the chief exponents and propagandists of the dogmatic spirit.

This reference brings me to the national aspects of the mental outlook of men of science in research. It can be adduced from the history of physics that the founders of research in physics, and the great discoverers from Galileo and Newton to the physical pioneers of our own time, were almost exclusively Aryans, predominantly of the Nordic race. From this we may conclude that the predisposition towards pragmatic thinking occurs most frequently in men of the Nordic race. If we examine the originators, representatives and propagandists of modern dogmatic theories, we find amongst them a preponderance of men of Jewish

descent. If we remember, in addition, that Jews played a decisive part in the foundation of theological dogmatism, and that the authors and propagandists of Marxian and communistic dogmas are for the most part Jews, we must establish and recognize the fact that the natural inclination to dogmatic thought appears with especial frequency in people of Jewish origin.

In establishing these facts, of course, I do not maintain that there are no Aryan men of science who are actively engaged in the dogmatic spirit in the realm of science; nor do I maintain that Jews cannot produce valuable experimental work carried out in the pragmatic spirit. I wish solely to make a statement on the frequency of occurrence of the natural tendency to pragmatic or to dogmatic ways of thinking. It must also be taken into consideration that, by training and practice, Aryans can become accustomed to the dogmatic and Jews to the pragmatic habits of thought. I acknowledge scientific achievement in new discoveries irrespective of the nationality of the discoverer, and I combat the harmful influence of the dogmatic spirit in physics whenever I encounter it in my scientific work, and regardless of whether the culprit is a Jew or not. Moreover, I have been engaged in this fight not only since 1933, for as long ago as the year 1922 I denounced in the strongest terms the formalism and dogmatism in German physics in one of my publications entitled :

“The Present Crisis in German Physics”.

No Return: Jewish Emigrés and German Scientists after the Second World War

Ruth Lewin Sime

After the end of the Second World War an intense discussion took place between several prominent Jewish émigrés and two equally prominent German scientists who had been their colleagues and close friends. The émigrés were convinced that Germany had undergone a moral catastrophe. Albert Einstein believed this moral failure was irreversible and wanted to have nothing to do with Germany again. But others took a more differentiated view. Some, such as the physicist Lise Meitner and the biochemist Otto Meyerhof, considered returning to Germany and their former positions after the war, and many more wanted to support the rebuilding process, to help restore those aspects of Germany they had once known and loved. These émigrés urgently appealed to their former colleagues in Germany to examine their past, reform their society, and try to make amends for the crimes committed in their name.

These issues dominated the post-war correspondence of Albert Einstein, Lise Meitner, and Otto Meyerhof with Otto Hahn and Max von Laue. The émigrés considered Hahn and Laue to be among the very few German scientists who had come through the National-Socialist period with their integrity intact. Einstein, for example, praised Laue for having “cut himself off, step by step, from the traditions of the herd, under the influence of a strong sense of justice”¹, while Meyerhof described Hahn and Laue as the only Germans whom colleagues abroad could trust. Indeed, Laue had spoken out publicly against the Nazi regime² and both were known for their loyalty to Jewish friends, for helping colleagues with their emigration, and for doing what they could for those who did not leave Germany in time.³ They were,

¹ Albert Einstein to Max Born, 7 September 1944, in Max Born, *The Born-Einstein Letters: Correspondence between Albert Einstein and Max and Hedwig Born from 1916 to 1955, with commentaries by Max Born*, transl. by Irene Born, New York 1971, p. 114.

² Dieter Hoffmann, ‘Between Autonomy and Accommodation: The German Physical Society during the Third Reich’, in *Physics in Perspective* 7 (2005), pp. 293–329, here pp. 298 f.

³ Peter Paul Ewald, ‘Max von Laue 1879–1960’, in *Biographical Memoirs of Fellows of*

as Meitner put it, among Germany's "best and intellectually most prominent people", and it was for this reason that she and other émigrés called on them for moral leadership in the post-war period. As this article will show, however, that was never what Laue and Hahn had in mind. In positions of leadership in the post-war scientific community, they expressed solidarity with Germans of nearly every degree of culpability and distanced themselves from their émigré friends. In the end very few refugees returned to Germany, while the majority of the scientists who stayed, like many Germans in every walk of life, engaged in a collective silencing of their recent past.

Rescuing German Science

In 1945 Otto Hahn (1879–1968) and Max von Laue (1879–1960) were both prominent senior members of the scientific community. Hahn, a radiochemist and director of the Kaiser Wilhelm Institute (KWI) for Chemistry, was best known for the discovery of nuclear fission, for which he would soon be awarded a Nobel Prize. Laue, a theoretical physicist who had received his Nobel award in 1914 for the discovery of x-ray diffraction in crystals, was retired from the KWI for Physics. Personally the men were quite different: Hahn was sociable and charming, Laue an introverted, somewhat nervous intellectual, but during the National-Socialist period their shared political outlook drew them together and they became close friends.

As the war neared its end, both men were in southern Germany, where their institutes had been relocated to escape the bombing in Berlin. In April 1945 Laue wrote to his son Theodor in America: "Insofar as I come through the catastrophe, my main task for the rest of my life will be to help with the intellectual reconstruction of Germany. In the relevant countries of the world there are colleagues everywhere who have a good opinion of me; I will try to put this capital to use for German science."⁴

By the end of April, Laue, Hahn and several physicists were taken into custody by the Alsos mission, a scientific intelligence unit of the American army. Their institutes had been devoted to military-sponsored research on nuclear fission throughout the war and were rated at the highest level of

the Royal Society of London 6 (1960), pp. 135–156, here pp. 147 ff.; James Franck, 'Max von Laue: 1879–1960', in *American Philosophical Society Yearbook* (1960), pp. 155–159, here pp. 158 f.

⁴ Max von Laue to Theodor von Laue, 7 April 1945. I am grateful to the late Hildegard Hunt von Laue for access to the Max von Laue-Theodor von Laue correspondence 1937–1960, now in the archive of the Max-Planck-Gesellschaft (MPG-Archiv), Abt. III, Rep. 50, Nachlass Max von Laue.

Kriegswichtigkeit (importance to the war effort) until the end.⁵ Of the captured scientists, all except Laue had been involved in the fission project. Since they were treated well and since the Americans seemed very interested in their research, the scientists concluded that they were ahead of the Allies. “This might be significant for rescuing German nuclear physics research, physics overall, and perhaps even more”, Laue wrote to Theo after their capture. Hahn added: “We hope that we can perhaps rescue something for German science. Then it would be worthwhile to have been abducted like this.”⁶ Laue was sure that his friends in America shared his priorities. “Tell friends about this letter!” he instructed Theo. “They, above all Einstein and [Peter] Debye, should exert *all their influence* on behalf of the Kaiser Wilhelm Institutes. We want to keep working; they must help us to do that.”⁷

The men’s outlook in this period displays a mixture of continuity and compartmentalisation. As with top-level scientists everywhere, their first thoughts are for their work. Their emphasis on *German* physics, *German* science, and “perhaps even more”, by which Laue surely meant Germany as a whole, reflects a mindset that goes back to the Weimar period and before, when scientific achievement was expected to enhance German prestige, not just for practical benefits but because of its international validation and connections, especially at a time of military defeat or economic difficulty.⁸ In his letter, moreover, Laue assumed that the international norms of scientific collegiality were still intact, and could still be called on to benefit German scientists and their institutions. It is difficult to know if Hahn and Laue were fully aware of the revulsion and anger directed against Germany at that moment, when the war that Germany had begun was barely over and the full extent of German atrocities was coming to light. What is evident is their intense identification with their country, their concern for their work, and their avoidance of problematic connections. They see the scientific enterprise – even military research – as transcending politics and war, yet serving the national interest. Laue knew that his reputation abroad was based on his opposition to Hitler, but he intends to use it as “capital” to help all Germans,

⁵ Mark Walker, *German National Socialism and the Quest for Nuclear Power 1939–1949*, Cambridge 1989; David C. Cassidy, *Uncertainty: The Life and Science of Werner Heisenberg*, New York 1992, chaps. 22–25; Ruth Lewin Sime, ‘„Die ‘Uranspaltung’ hat da die ganze Situation gerettet”. Otto Hahn und das Kaiser-Wilhelm-Institut für Chemie während des Zweiten Weltkrieges’, in Helmut Maier (ed.), *Gemeinschaftsforschung, Bevollmächtigte und der Wissenstransfer. Die Organisation kriegsrelevanter Forschung und die Kaiser-Wilhelm-Gesellschaft im NS-System*, Göttingen (forthcoming 2007).

⁶ Max von Laue/Otto Hahn to Theodor von Laue, 28 April 1945, MPG-Archiv, Abt. III, Rep. 50, Nachlass Max von Laue.

⁷ Max von Laue to Theodor von Laue, 25 April 1945 (emphasis in original), *ibid.*

⁸ Paul Forman, ‘Scientific Internationalism and the Weimar Physicists: The Ideology and its Manipulation in Germany after World War I’, in *Isis* 64 (1973), pp. 151–180.

including those who supported the regime. For both men, as for other Germans, the end of the war seems to represent a *Stunde Null* (zero-hour). They have turned away from the past, as if National Socialism had been a temporary aberration that had already vanished without a trace.

In Farm Hall

Hahn, Laue, and eight other scientists, including Werner Heisenberg, the director of the KWI for Physics, were turned over to the British and remained in custody for over eight months, most of it at Farm Hall, a country estate near Cambridge. There the men were physically comfortable but prisoners, with their outside contacts tightly controlled and their conversations secretly recorded. All were convinced that their knowledge of fission science was the key to their future. Although the ten scientists had differed considerably in their degree of enthusiasm for National Socialism, in Farm Hall such matters receded and political differences were mostly set aside.⁹

They had time to write and think. Laue, deeply interested in German history, felt a need to record events he had observed and he did so in long, meticulously detailed letters. Throughout the war he had written regularly to Lise Meitner in neutral Sweden, finding ways, despite the censor, to describe the fate of Jewish friends and colleagues.¹⁰ In the summer of 1945 Laue continued the process in letters to his son. In page after page of carefully typed, single-spaced letters Laue set down what he remembered of family members, friends, and neighbours who had suffered in ways “characteristic of the Third Reich”¹¹: elderly Jewish parents who were deported or committed suicide, mixed marriages with spouses or children forced into hard labour, some people who barely survived and others, good friends, who did not. Although the letters were addressed to Theo, the writing process was clearly a necessity for Laue, permitting him to bear witness to events for the sake of memory and history.

⁹ Charles Frank (ed.), *Operation Epsilon: The Farm Hall Transcripts*, Berkeley, CA 1993, Jeremy Bernstein, *Hitler's Uranium Club: The Secret Recordings at Farm Hall*, Woodbury 1996.

¹⁰ Jost Lemmerich, *Lise Meitner–Max von Laue. Briefwechsel 1938–1948*, Berlin 1998; Ruth Lewin Sime, *Lise Meitner: A Life in Physics*, Berkeley, CA 1996, pp. 295–298.

¹¹ Max von Laue to Theodor von Laue, 21 June 1945. Laue's letters from Farm Hall are mostly in the archive of the Deutsches Museum (ADM), Max von Laue papers. See also Jost Lemmerich, ‘Max von Laue. Sein Wirken in der Dahlemer „Kaiser-Wilhelm-Gesellschaft” bzw. späteren „Max-Planck-Gesellschaft” aus Anlaß der Sonderausstellung „Dahlem- ein deutsches Oxford”’, in *Domäne Dahlem* 16 (1992), pp. 3–18.

In Farm Hall Hahn wrote a short memoir of his career, from his early days in radioactivity research to his more recent work during the war.¹² Written entirely from memory, Hahn's narrative is uneven. Not surprisingly, Lise Meitner, his closest colleague in Berlin for over thirty years, is a recurrent figure. Hahn recalls their first meeting in 1907, their early work together, and her harrowing escape from Germany in July 1938. But he says almost nothing of their long collaboration that led to the discovery of nuclear fission in December 1938, nor does he credit her with any part in the discovery itself.¹³ That is consistent with his position in early 1939, when he was afraid to admit that he had continued to collaborate with Meitner in Swedish exile, through their correspondence, until the discovery took place. Another significant omission in the memoir is Hahn's description of the war-time work in his institute. Here he constructs a scientific *Alltagsgeschichte*: the research went on as before, always "purely scientific" and openly published. Nowhere does Hahn mention that he committed his institute to secret military research on nuclear fission at the very start of the war, nor does he describe the network of government, military, and industrial support that he and his institute enjoyed until the war's end.¹⁴ Hahn's memory is very fresh for the occasions when he was accused of "political unreliability"¹⁵, but he is essentially silent about the Jewish persecution that he witnessed. Except for Meitner and Fritz Haber, Hahn writes almost nothing of the dismissals and forced emigrations of his colleagues, nor does he describe the fate of Jewish friends who could not leave. In this respect his chronicle is as empty as Laue's is full.

The one exception to Hahn's silence is his separately written account of the murder of his friend Wilhelm Traube in Berlin. In Farm Hall Hahn decided to set down "this tragic story exactly as it took place, to show a new generation of youth how things were during the war and after 1933 in Germany."¹⁶ The story is indeed tragic. Traube, an organic chemist who was the first to synthesise caffeine, was dismissed from the University of Berlin in 1933 at age seventy; he had a pension and stayed in Germany. Later, when the deportations began, Hahn made great efforts to obtain an exemption for Traube by claiming that his knowledge of caffeine chemistry was vital to the war effort, but in September 1942 the Gestapo came for Traube and when he resisted they beat him so severely that he died. Hahn was on his way to see him that day and vividly remembered the circumstances. But he never pub-

¹² Otto Hahn, 'Erinnerungen 1901–1945', in Dietrich Hahn (ed.), *Otto Hahn. Erlebnisse und Erkenntnisse*, Düsseldorf 1975, pp. 15–73.

¹³ Sime, *Meitner*, chaps. 7, 9–11.

¹⁴ *idem*, 'Die Uranspaltung'.

¹⁵ Hahn, 'Erinnerungen', p. 63.

¹⁶ Otto Hahn, *Aufzeichnungen 1945*, MPG-Archiv, Abt. III, Rep. 14, Nr. 4395.

lished his account later, nor did he ever mention Traube or the circumstances of his death in his many later autobiographical writings. At one point in the 1950s, Hahn thought of writing a proper obituary for his friend, but it does not appear that he or any of Wilhelm Traube's former colleagues or students ever did so.¹⁷ It suggests that, for Hahn, these memories were not forgotten but somehow compartmentalised away so as not to disrupt the story he wanted to tell of his life and work.

Solidarity

As is known from the secret recordings, the Farm Hall scientists reacted to the news of Hiroshima with shock and disbelief, but quickly began to reformulate their position: although they were far behind scientifically they realised that they had gained a certain moral edge precisely because they had not come close to building a nuclear weapon. On 8 August 1945, two days after Hiroshima, the group agreed on a joint memorandum that described the German fission project as never having been directed towards a nuclear weapon but only towards an energy-producing reactor for peaceful purposes. The memorandum was signed by all, including Laue, who had no direct knowledge of the fission research but went along with the others.¹⁸ With its portrayal of German nuclear science as "pure research" and German scientists as uninvolved with the military or National Socialism, the memorandum marks the genesis of what has been described as the German version of the "myth of the German atomic bomb."¹⁹ The story was readily accepted by the post-war generation of German scientists and is still alive today, as shown, for example, by the portrayal of Heisenberg in Michael Frayn's highly successful play *Copenhagen*.²⁰

Hahn and his work lent credibility to the group's position and the memorandum highlighted his role. He was the discoverer of nuclear fission, the result of "purely scientific" research, and his wartime work was similarly "pure"; it went without saying that his politics during National Socialism was as pure as his science. To cover all contingencies, Hahn prepared a state-

¹⁷ Ruth Lewin Sime, *Otto Hahn und die Max-Planck-Gesellschaft. Zwischen Vergangenheit und Erinnerung* (Ergebnisse 14, Forschungsprogramm "Geschichte der Kaiser-Wilhelm-Gesellschaft im Nationalsozialismus"), Berlin 2004, pp. 24–28; Sime, 'The Politics of Memory: Otto Hahn and the Third Reich', in *Physics in Perspective* 8 (2006), pp. 3–51, here pp. 19–22.

¹⁸ Frank (ed.), pp. 70–106; Bernstein, pp. 117–163; Cassidy, p. 507.

¹⁹ Walker, chap. 7.

²⁰ Michael Frayn, *Copenhagen*, London 1998; Matthias Dörries (ed.), *Kopenhagen. Stück in zwei Akten. Mit zwölf wissenschaftsgeschichtlichen Kommentaren*, 3rd edn., Göttingen 2003.

ment separate from the joint memorandum in which he emphasised that Lise Meitner had not participated in the discovery. With this, the discovery was not only purely scientific but purely German, with no ugly reminders of Nazi persecution to spoil the story. This is one of the clearest instances in which the integrity of research, in this case the integrity of scientific attribution, was compromised by overtly political considerations. Hahn's exclusion of Meitner was endorsed by the Nobel award, announced in November 1945, of the 1944 prize in chemistry to Hahn alone.²¹

Taken together, the closeted existence at Farm Hall fostered solidarity among the scientists and provided them with an attractive platform that would serve them well on their return to Germany. As a group they created a synchronised narrative of their wartime research as scientifically excellent and politically untouched: they were worthy, innocent, even in some respects morally superior to their Allied counterparts. Deeply worried about the dire conditions in Germany, they saw themselves and other Germans as innocent victims of the Nazis, and the war. Hahn admitted that he had hoped for Germany's defeat but never imagined it would bring such "terrible tragedy" to his country;²² he wrote to Meitner that Germany had been "bled dry."²³ Laue concluded from newspaper reports that the policies of the occupation powers were ultra-nationalistic and unjust. "Nazi barbarism is obviously not confined to Germany," he wrote to Theo in November 1945. "The Nazi mentality can now be found everywhere in the world."²⁴ Such statements suggest that Laue's and Hahn's memory of actual Nazi aggression and atrocities was already dim. Major T. H. Rittner, the British officer in charge of the Farm Hall group, concluded that his "guests" had forgotten who had started the war and in general seemed to think that the Allies "should all be largely concerned to set Germany on her feet again."²⁵ This was Hahn's and Laue's frame of mind when they were released from custody and returned to Germany in early January 1946.

²¹ Sime, *Meitner*, p. 323; *idem*, *Otto Hahn und die Max-Planck-Gesellschaft*, pp. 32–41, 52; *idem*, 'The Politics of Memory', pp. 24–30.

²² Frank (ed.), p. 82 f.

²³ Otto Hahn to Lise Meitner, October 1945 (exact date unknown), CAC, Meitner Collection.

²⁴ Max von Laue to Theodor von Laue, 25 November 1945, ADM, Laue Papers.

²⁵ Frank (ed.), p. 230; Bernstein, p. 302.

Starting again

Hahn and Laue settled in Göttingen, which the British had designated as the site for the Kaiser Wilhelm Society administration and several scientific institutes. Hahn was named president of the Kaiser Wilhelm Society (soon to be reconstituted as the Max Planck Society), a position he would hold until he retired in 1960. The KWI for Physics was re-established with Heisenberg as director and Laue as deputy director. Laue also accepted a position on the physics faculty at the university in Göttingen.²⁶ Laue, in particular, was singled out by colleagues in Britain and the United States; in the summer of 1946 he was the only German invited to an international meeting of British crystallographers in London, a demonstration of their admiration for him and their aversion to other Germans. In 1948 Laue spent much of the year in the United States, where he was celebrated by American colleagues for his personal stature.²⁷

Relationships with émigré colleagues were always more complex: the attachments had been stronger and the refugees were more wounded and angry. Laue's friendship with Einstein dated back to the early days of relativity, they had been close during Einstein's years in Berlin, and had stayed in contact after Einstein's emigration in 1933. In 1937, when Laue sent his son Theo, then twenty-one years old, to study in America and to get him out of Germany, he chose Princeton primarily because Einstein was there. After the war Einstein began his first letter to Laue by praising his friend: "I realise that you acted wonderfully in those unspeakably difficult years and that you did not compromise but remained true to your friends ... as very few others did. I find it right and just that people abroad value this and even admire it. Because everyone knows that this was not easy."²⁸ Einstein's letter crossed one from Laue, who was asking American colleagues for money to help Josef Mattauch, a physicist who was ill with tuberculosis.²⁹ Mattauch was a prin-

²⁶ Otto Gerhard Oexle, *The British Roots of the Max-Planck-Gesellschaft*, London 1995; *idem*, 'Wie in Göttingen die Max-Planck-Gesellschaft entstand', in *Max-Planck-Gesellschaft Jahrbuch 1994*, Göttingen 1994, pp. 43–60; Klaus Hentschel and Gerhard Rammer, 'Physicists at the University of Göttingen, 1945–1955', in *Physics in Perspective* 3 (2001) pp. 189–209, here pp. 193, 198.

²⁷ Max von Laue to Theodor von Laue, 10 July 1946, p. 1, ADM, Laue Papers; Max von Laue, 'Mein physikalischer Werdegang: Eine Selbstdarstellung', in *Gesamellte Schriften und Vorträge*, Braunschweig 1961, pp. v–xxxiv, here pp. xxxii–xxxiii; Correspondence Otto Hahn and Max von Laue 1948, MPG-Archiv, Abt. III, Rep. 14, Nr. 2463–2467.

²⁸ Albert Einstein to Max von Laue, 9 August 1946, ADM, Laue Papers 1964–6/16a. Albert Einstein Archives, Hebrew University, Jerusalem, Folder 16–118

²⁹ Max von Laue to Albert Einstein, 13 August 1946, ADM, Laue Papers; Albert Einstein Archives; Folder 16–119.

cipled non-Nazi who had found a haven in Hahn's institute as Meitner's successor. Einstein's reply:

Now just imagine the following vividly: Imagine that Jews had massacred 35 million Germans, for no reason other than an inner need to do so. Imagine further that those who survived were robbed of everything and left in misery, and then imagine that you were requested to give money to a Jew.

After you have vividly imagined all this you will recognise how right the following saying is: There is no greater difference in the world than that between 'I' and 'you' (one could also say: between 'we' and 'you').³⁰

Laue responded with a page-long citation from Lessing's play *Nathan der Weise*: Nathan's wife and seven sons have been murdered by Christians yet he has faith in God and is grateful that one child has survived. Einstein's reply: "I thank you for your pleasant little letter. ... Obviously, self-deception arises in situations that would otherwise be unbearable."³¹ It is not clear if Einstein's remark about the character of Nathan was intended for Laue as well.

With few exceptions, Einstein was rejecting everything German. In 1948, when Hahn wrote to him with the offer of foreign membership in the newly formed Max Planck Society, Einstein replied:

I find it painful that I must send my refusal to you, one of the few who remained upright and did their best during those terrible years. But it cannot be otherwise. The crimes of the Germans are truly the most loathsome that the history of the so-called civilised nations has produced. German intellectuals – considered as a group – did not behave better than the rabble. There does not even appear to be remorse and the honest effort to make good what little can be made good after the immense murders. Under these circumstances I feel an irrefutable aversion to participating in anything that represents a piece of German public life, simply out of a need for cleanliness.³²

Einstein had never felt a kinship for things German, but other émigrés had been deeply attached to Germany. Lise Meitner had come to Berlin from her native Vienna as a young woman without prospects; she believed she owed her remarkable career in physics to the friendship and support she had found in Berlin. Otto Meyerhof, who had been director of the Physiology Institute of the KWI for Medical Research in Heidelberg until he, like Meitner, was

³⁰ Einstein to Laue, 15 September 1946, ADM, Laue Papers 1964–6/15: 20; Albert Einstein Archives, Folder 16–120.

³¹ Laue to Einstein, 15 October 1946, ADM, Laue Papers; Einstein to Laue, 9 January 1947, ADM, Laue Papers, 1964–6/12: 21; Albert Einstein Archives, Folder 16–122, 16–129.

³² Otto Hahn to Albert Einstein, 18 December 1948; Einstein to Hahn, 28 January 1949; MPG-Archiv, Abt II, Rep. 1A, Blatt 4 (Personalakte Einstein). According to Hahn's secretary, Hahn did not wish Einstein's letter to be made public. Marie-Luise Rehder to Ursula Ringmann, 15 July 1976, MPG-Archiv, Abt II, Rep. 1A, Blatt 31 (Personalakte Einstein).

forced out in 1938, remembered his years there as a “lost paradise.”³³ The physicist James Franck had resigned his Göttingen professorship in 1933 to protest the impending dismissals of Jews but he did not forget “that earlier Germany” or “the many dear people” to whom he still felt bonds of friendship.³⁴ These émigrés and many like them were ready to contribute to the rehabilitation process, but they believed it was essential that Germans begin by openly examining the National-Socialist period and taking responsibility for their part in it.

Meitner had broached these issues with Hahn and Laue when they visited Stockholm during the war. The discussions had not gone well: Hahn and Laue thought Meitner’s position was unjust. In March 1945, Meitner wrote to a Swedish friend,

The letters from German friends sound very depressed, yet I do not think they comprehend just what sort of fate has befallen Germany through their passivity. And they understand even less that they share responsibility for the horrible crimes Germany has committed. These thoughts make me terribly unhappy. How shall the world trust a new Germany when its best and intellectually most prominent people do not have the insight to understand this and do not have a burning desire to make whatever amends are possible? Not only must they feel this strongly, but at the proper time they must state this openly. But I fear they are far from it. For this reason I do not believe that for the most part they had a strong inner resistance.³⁵

Soon after the surrender, Meitner wrote an anguished, angry letter to Hahn urging him and others “to deliver an open declaration that you are aware that through your passivity you share responsibility for what has taken place”, and she accused him and other Germans of having “all lost your standards of justice and fairness.”³⁶ That letter never reached Hahn in Farm Hall, and later Meitner tried again: “If the best Germans do not now understand what has happened and must never happen again, who shall instruct the youth that the path that was tried was a misfortune for the world and also for Germany?”³⁷

³³ Otto Meyerhof to Otto Hahn, 25 June 1946; MPG-Archiv, Abt. III, Rep. 14, Nr. 2937:2.

³⁴ Jost Lemmerich, *Max Born, James Franck. Physiker in ihrer Zeit. Der Luxus des Gewissens*, Ausstellungskatalog 17, Staatsbibliothek Preussischer Kulturbesitz, Berlin 1982, p. 144.

³⁵ Meitner to Eva von Bahr-Bergius, 30 March 1945, Churchill Archives Centre (CAC), Meitner Collection as quoted in Sime, *Meitner*, p. 308.

³⁶ Meitner to Hahn, 27 June 1945, CAC, Meitner Collection as quoted *ibid.*, pp. 309–311, and Ute Deichmann, *Biologen Unter Hitler. Vertreibung, Karrieren, Forschung*, Frankfurt am Main 1992, pp. 316–318.

³⁷ Meitner to Hahn, 20 October 1946, CAC, Meitner Collection as quoted in Sime, *Meitner*, p. 338.

Meyerhof's message was essentially the same. In his first post-war letter to Hahn in 1946 he congratulated him on his Nobel Prize and the presidency of the Kaiser Wilhelm Society and assured him,

Your scientific and moral reputation has remained highly regarded all over the world, and everyone knows that you did not 'howl with the wolves.' ... Except for you and von Laue there is no one that enjoys such trust among the colleagues abroad, and it seems to me that is the most decisive factor for the reconstruction effort. ... As you can see from this I am very interested in the fortunes of German science and the K[aiser] W[ilhelm] S[ociety].³⁸

Meyerhof made it clear that he and like-minded colleagues in America and England were working to reestablish collegial connections with Germans who were non-Nazis and anti-Nazis, helping with equipment, journals, and food packages. But like Meitner, Meyerhof expected something in return:

Germany is not only defeated, that is the least of it, it has gone through a moral catastrophe without precedent in history. I consider it completely essential for the recovery of intellectual life in Germany that this be made entirely clear to everyone, so that students will not continue growing up in the same morass. ... What I want from you and all resolute non-Nazis is that you work to change this situation, even during the current state of hunger, in return for the work we are doing here to promote sensible politics with respect to German science.³⁹

Blanket Amnesty

Meitner and Meyerhof were calling for remorse, introspection, and reform. It does not appear that Hahn or Laue ever thought in those terms. They saw their role solely as advocates for German science, and for Germany as a whole. Accordingly, Laue and Hahn complained with righteous indignation about every hardship, the shortages of food, fuel, and housing, and they bitterly resented the intrusions of foreign occupation. At one point in 1946 Hahn wrote to Meitner: "I would almost doubt that the behaviour of the occupation forces today is so much more generous than that of the Germans in parts of the occupied countries. Of course we did nothing different in Poland and Russia, but ... today the war is over. Why then should the war methods be continued?"⁴⁰ By creating a moral equation between Allied occupation and German crimes, Hahn was suggesting that Germans were no worse than others, denying the reality of the Holocaust, and excusing it as a

³⁸ Meyerhof to Hahn, 25 June 1946, MPG-Archiv, Abt. III, Rep.14, Nr. 2937:2.

³⁹ Meyerhof to Hahn, 8 November 1946, MPG-Archiv, Abt. III, Rep. 14, Nr. 2937:5, 5a, 6.

⁴⁰ Hahn to Meitner, 19 August 1946, CAC, Meitner Collection as quoted in Sime, *Meitner*, p 337.

byproduct of war – all prevalent notions at the time. When Meitner sharply protested, “In Poland 2 million people were killed, not as casualties of war, but intentionally killed”⁴¹, he did not respond.

When the Allies initiated denazification proceedings in 1946 Laue and Hahn regarded the dismissals of former Nazi party members from university positions as completely unjust. The situation was “immeasurably wretched,” Laue wrote to Theo⁴²; to Meyerhof, Laue complained that the Allies were using “Hitler methods” worse than those of the Third Reich.⁴³ In fact, Meitner and others abroad also disapproved of the denazification process because they believed that externally imposed political reform could not work: it was Meitner’s point all along that leadership for reform must come from within. But Laue and Hahn were calling for blanket amnesty for all Germans except the worst Nazi criminals,⁴⁴ and since they were also opposed in principle to the Nuremberg tribunals it does not appear that they were in favour of any form of accountability or justice. Theodor von Laue, who had by then finished his doctorate in history at Princeton, was troubled by the resurgence of nationalism in his father and Hahn. “Now they probably find the distance between [A]llied mentality and their own attitude still more impassable than that between the Nazis and themselves.”⁴⁵

In Stockholm, in December 1946, Hahn used the Nobel ceremonies to appeal for sympathy for Germany:

I stand here as a member of a country that through its regime and a nearly six-year-long war has surely become the most unfortunate country in the world. It stands alone and has no friends. ... It really is not true that in the last 13 years all Germans, and especially all German scientists, subscribed to the Hitler-regime with flying colours. ... Surely not many people outside Germany fully realise just how much pressure most [Germans] lived under during the last 10 or 12 years; and I must say again, how many of my German colleagues, despite all external restrictions, made the effort to do pure scientific research, as much as possible, during the war.

Laue read the speech before Hahn left for Sweden and approved of it,⁴⁶ and Hahn himself was so proud of it that he reprinted it in his autobiography twenty years later, citing it as his “small effort to rescue the honour of the German name.”⁴⁷ Meitner, who attended the Nobel ceremonies, was ap-

⁴¹ Meitner to Hahn, 20 October 1946; CAC, Meitner Collection as quoted in Sime, *Meitner*, p. 338. (The current estimate is three million).

⁴² Max von Laue to Theodor von Laue, 19 May 1946, ADM, Laue Papers.

⁴³ Ute Deichmann, *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker in der NS-Zeit*, Weinheim-New York 2001, pp. 458 f.

⁴⁴ Max von Laue to Theodor von Laue, 16 July 1946, ADM, Laue Papers.

⁴⁵ Theodor von Laue to Lise Meitner, 8 March 1946, CAC, Meitner Collection.

⁴⁶ Max von Laue to Otto Hahn, 28 November 1946, MPG-Archiv, Abt. III, Rep. 14, Nr. 2462: 18.

⁴⁷ Otto Hahn, *Mein Leben*, München 1986, pp. 208–210.

palled. Later she summarised Hahn's attitude for James Franck: "Just forget the past and stress the injustice now happening in Germany." She added, "Laue is naturally better able to reflect on things than Hahn and does respond to one objection or another that one puts to him, but his basic position is not very different from Hahn's."⁴⁸ By then she was aware of just how thoroughly Hahn had written her out of the fission discovery. "He suppresses the past with all his might. ... As I am part of that suppressed past, Hahn never, in any of his [Nobel] interviews about his life work, mentioned our long years of work together, nor did he even mention my name."⁴⁹

Negating Reality

That suppression of the past is acutely evident in Hahn's testimonials for several men on trial in Nuremberg. One of these was Ernst Freiherr von Weizsäcker, who had been secretary of state (*Staatssekretär*) under foreign minister Joachim von Ribbentrop; Hahn defended him as a thoroughly upright man who had defended "objective science" against Nazi interference in his capacity as a member of the senate of the Kaiser Wilhelm Society. Weizsäcker was convicted and sentenced to seven years' imprisonment for waging aggressive war and for crimes against humanity – he had been responsible for deporting Jews from occupied countries throughout Europe – but Hahn's opinion of him did not change: he thought Weizsäcker was "splendid" ("*grossartig*").⁵⁰

Equally remarkable was Hahn's involvement in the Nuremberg proceedings against Fritz ter Meer and Heinrich Hörlein, directors of the giant chemical concern *IG Farben*, which had used slave labour and concentration camp inmates in the *IG Farben* plant at Auschwitz-Monowitz. Hahn was well acquainted with Hörlein and ter Meer as officers of the *Emil-Fischer-Gesellschaft*, which oversaw the financing of his institute, and he wrote a strong testimonial for each of the men, again citing their defence of "objective science." Privately Hahn wrote to Hörlein,

An ordinary mortal can hardly imagine that one is sent to the prisoner's dock simply because one has held an elevated position in an industrial enterprise. ... Therefore I do not think that the men of the I.G. – perhaps with a few exceptions – can really be blamed for anything that was not also done by other leading industrialists in all countries, namely to take their work to the highest level.⁵¹

⁴⁸ Lise Meitner to James Franck, 16 January 1947 (incorrectly dated 1946), CAC, Meitner Collection 5/5 as quoted in Sime, *Meitner*, p. 344.

⁴⁹ *ibid.*, pp. 344 f.

⁵⁰ Sime, *Otto Hahn und die Max-Planck-Gesellschaft*, pp. 46–48.

⁵¹ *ibid.*, pp. 48 f.

Hörlein was acquitted, ter Meer and twelve others were convicted and sent to prison. As for Hahn, it seems he considered the activities of *IG Farben* at Auschwitz to be normal, even praiseworthy. Such negation of reality can be found as well in the official protest registered by the German Chemical Society after the *IG Farben* convictions: in its view these were honourable men, the Nuremberg trials were flawed, and had failed to consider the context of total war by a terrorist state. As Ute Deichmann notes, the chemists refused to recognise that what *IG Farben* had done at Auschwitz was criminal, nor would they consider the possibility that *IG Farben's* highest officers were responsible for those crimes.⁵²

Even as Hahn came close to allying himself with Holocaust perpetrators, he and Laue distanced themselves from the victims of Nazi persecution. Meyerhof, for example, wrote in his first post-war letter to Hahn that he and his immediate family were safe in the United States but that he had lost “countless relatives and friends to the Polish gas chambers and concentration camps.” He had been asked whether he would return to his former position in Heidelberg but, as he wrote, he could not go back to a country that had become “a graveyard” for people close to him.⁵³ Hahn responded to this with a single line: “I can understand that after what happened to your relatives and close friends here in Germany you don’t feel like coming back here” before launching into a lengthy defence against “unjust” suggestions from abroad that most Germans were responsible for what had taken place in the previous twelve years, and a list of complaints about the inequities of occupation.⁵⁴ In her analysis of the Meyerhof – Hahn correspondence, which also includes Laue, Deichmann has pointed to Hahn’s lack of sympathy for his friend’s losses, his rejection of Meyerhof’s overtures of collegiality, and the fact that he regarded Meyerhof as an unwelcome critic from the outside.⁵⁵ Meyerhof’s response was blunt:

Now I must openly say, that even the best and most tried and true of my friends over there, such as yourself, have so far not been able to free themselves from the constricted perspective created by the Nazis, so as to understand the true roots of the resultant situation in Germany and Europe. ... My interpretation is that what Germany is now experiencing it entirely “owes to its Führer,” and it owes its Führer to itself.⁵⁶

To the extent that even the “best” Germans were so self-absorbed that they lacked fundamental sympathy for victims of Nazi persecution, it appears that

⁵² Deichmann, *Flüchten, Mitmachen, Vergessen*, pp. 484–488.

⁵³ Otto Meyerhof to Otto Hahn, 25 June 1946, MPG-Archiv, Abt. III, Rep. 14, Nr. 2937:2.

⁵⁴ Otto Hahn to Otto Meyerhof, 5 August 1946, *ibid.*, Nr. 2937:3.

⁵⁵ Deichmann, *Flüchten, Mitmachen, Vergessen*, pp. 455–459.

⁵⁶ Meyerhof to Hahn, 8 November 1946, MPG-Archiv, Abt. III, Rep. 14, Nr. 2937:5, 6.

the National-Socialist perspective indeed persisted into the post-war years. This climate appears to have resulted in the emigration of at least one Jewish scientist from Germany after 1945. Hartmut Kallmann had been a physicist in Fritz Haber's KWI for Physical Chemistry and Electrochemistry when he was dismissed for racial reasons in 1933. He, his non-Jewish wife, and their children remained in Germany and survived, but his parents were killed and his wife was conscripted into forced labour. In 1945 Kallmann returned to his former institute in Berlin with high hopes but, as he later wrote, "it was very difficult for me to live in Germany after everything that I had experienced and seen"; he believed the National-Socialist mentality was still present.⁵⁷ Kallmann and his family left for the United States in 1948. He found a position at New York University and in 1954, with the help of a restitution lawyer, he petitioned the Max Planck Society for compensation for his disrupted career. The MPS strongly resisted⁵⁸ and Laue, then director of the Fritz Haber Institute for Physical Chemistry, reacted coldly: "Kallmann complains that the National Socialists have robbed him of his fortune. Well, the Allies have robbed us of ours, which in practice amounts to the same thing."⁵⁹ Quite possibly Laue's failure to see any difference between Kallmann's experience and his own is an example of the mentality that made it so difficult for Kallmann to remain in Germany after the war.⁶⁰

With similar misgivings, Lise Meitner decided not to return to Germany. In 1947 she was asked if she would consider taking the position of director of the KWI for Chemistry, Hahn's former position, as well as head of the physics section, the position she had held until 1938. The offer came, with Hahn's approval, from Fritz Strassmann, whom Meitner knew well and trusted from their years of work together on the investigation that led to the discovery of nuclear fission. Meitner was tempted, as her professional situation in Sweden was poor. But she could not do it. "Judging by what I see in letters from my German friends, and by other things I hear about Germany, the Germans still do not comprehend what has happened, and they have completely forgotten all the horrors that did not personally happen to them. I think I would

⁵⁷ Hartmut Kallmann to Otto Hahn, 8 March 1946, *ibid.*, Nr. 1985:11; Kallmann to Bundespräsident Theodor Heuss, 1 April 1954, MPG-Archiv, Personalakte Kallmann; Deichmann, *Flüchten, Mitmachen, Vergessen*, p. 102; Stefan L. Wolff, 'Frederick Lindemanns Rolle bei der Emigration der aus Deutschland vertriebenen Physiker', in Anthony Grenville (ed.), *German-speaking Exiles in Great Britain*, The Yearbook of the Research Centre for German and Austrian Exile Studies, 2 (2000), pp. 25–58, here pp. 41 f.

⁵⁸ Michael Schüring, *Minervas verstoßene Kinder. Vertriebene Wissenschaftler und die Vergangenheitspolitik der Max-Planck-Gesellschaft*, Göttingen 2006, pp. 214–217.

⁵⁹ Max von Laue to Otto Hahn, 8 June 1954, MPG-Archiv, Personalakte Kallmann.

⁶⁰ Klaus Hentschel, *Die Mentalität deutscher Physiker in der frühen Nachkriegszeit (1945–1949)*, Heidelberg 2005, pp. 9, 129.

not be able to breathe in such an atmosphere.”⁶¹ She refused the offer, and neither Hahn nor Laue tried to persuade her to change her mind. By then it was 1948, and the emotional underpinning for the discussion between the Germans and the émigré scientists was exhausted.

Conclusion

This article focuses on a relatively short period just after the war when Hahn and Laue were intensely focused on rebuilding the German scientific community and Germany itself. Their commitment was absolute: nothing mattered to them except Germany, and in that respect there was continuity, as Meyerhof observed, between the “constricted perspective created by the Nazis” and their own. In the process, Hahn and Laue expected, asked, even at times demanded help from those who had suffered from German aggression and persecution, but they offered nothing in return. Their advocacy for Germany required dishonesty of nearly every kind. Hahn and other nuclear scientists constructed a fabricated account of their wartime work in order to conceal their military involvement and excuse their lack of scientific achievement. They regarded Germans as victims, although they knew from their own experience that there had been many perpetrators and many more bystanders. They called for a blanket amnesty for everyone except Nazi criminals, but then refused to recognise who those criminals were, so that Hahn could still defend, even admire, powerful men who were part of the genocide. Their negation of reality had the hallmarks of a willed amnesia. They did not differentiate between Nazi genocide and Allied occupation, and even Laue, with his awareness of history, did not see the connection between Germany’s aggression and its eventual defeat. In the end they walled themselves off intellectually and emotionally, with a diminished capacity for sympathy or understanding of any situation but their own.

Certainly Hahn and Laue were not unique. In almost every study of German institutions and individuals of this period, one finds the desire, as Norbert Frei has called it, to seek the “healing power of a ‘collective silencing’ of the past.”⁶² What makes Hahn’s and Laue’s story especially difficult to un-

⁶¹ Meitner to Eva von Bahr-Bergius, 10 January 1948, CAC, Meitner Collection as quoted in Sime, *Meitner*, pp. 353–357.

⁶² Norbert Frei, ‘Vergangenheitspolitik in den fünfziger Jahren’, in Wilfried Loth and Bernd-A. Rusinek (eds.), *Verwandlungspolitik. NS-Eliten in der westdeutschen Nachkriegsgesellschaft*, Frankfurt am Main 1998, pp. 79–82, here p. 79; Hentschel, *Die Mentalität deutscher Physiker*, pp. 18 f., lists „Amnesie, Verdrängen [amnesia, suppression] ... Totschweigen und Täuschen [hushing up and deception]” as well as „Selbstmitleid, Sentimentalität und Selbstsüchtigkeit [self-pity, sentimentality and selfishness]” as characteristic of the postwar mentality among physicists.

derstand, however, is the apparent discontinuity between their conduct under National Socialism and their post-war attitudes and behaviour. Here we note some similarities in an example from Vienna, where the physicist Berta Karlik was known for her antipathy to the Nazis. When her mentor, Stefan Meyer, was forced out as director of the Radium Institute in 1938, she remained intensely loyal, helping him when he went into hiding during the war and on his return to the institute afterwards. Karlik also maintained a warm correspondence with émigré friends, including the physicist Marietta Blau, before and after the war. Eventually Karlik was appointed *Ordinaria* (full professor), the first woman physicist with this title in Vienna, and she formed strong collegial relationships within the physics community, which included a number of blatantly unrepentant Nazis. When Marietta Blau retired and returned to Vienna in 1960, she was kept at arm's length, even though she was an internationally prominent particle physicist. To her bitter disappointment, she realised that the pioneering work she had done in Vienna before she emigrated was generally attributed to her non-Jewish collaborator and not to her, and that Karlik went along with it. Their friendship was over, and when Marietta Blau died in 1970, neither Karlik nor any other Austrian physicist saw fit to write an obituary notice for her.⁶³

The similarities suggest that individuals who were nonconformists during National Socialism may have placed an exceptional priority on rejoining the mainstream once the need for nonconformity was lifted. For Hahn and Laue the twelve years of National Socialism meant loss, trauma, and – perhaps most difficult for people who regarded themselves as apolitical – an extended period of political alienation. In this respect, Hannah Arendt has noted that members of the French Resistance were “the first who failed to remember” their experiences under German occupation because, Arendt reasons, their role as political challengers was so alien to them that they later “could not name it” or remember it.⁶⁴ The analogy is, of course, imperfect but it allows us to situate Hahn and Laue in a more general context of alienation and forgetting. On the other hand, it is important to note that while Laue and Hahn were nonconformists during the Hitler period they were never outsiders – in particular Hahn and his institute thrived during the war. In the end it is ironic, or tragic, to realise that Hahn and Laue, the exemplary “decent Ger-

⁶³ Ruth Lewin Sime, ‘Science, “Race”, and Gender: The Forced Emigration of Lise Meitner and Marietta Blau’, in *Simon Dubnow Institute Yearbook 3* (2004), pp. 290–312; *idem*, ‘Twice Removed: The Emigration of Lise Meitner and Marietta Blau’, in Friedrich Stadler (ed.), *Österreichs Umgang mit dem Nationalsozialismus. Die Folgen für die naturwissenschaftliche und humanistische Lehre*, Vienna 2004, pp. 153–170; Brigitte Strohmeier and Robert Rosner, ‘Biographischer Abriss’, in Robert Rosner and Brigitte Strohmeier (eds.), *Marietta Blau. Sterne der Zertrümmerung*, Vienna 2003, pp. 21–89, here pp. 65–73.

⁶⁴ Hannah Arendt, *Between Past and Future: Eight Exercises in Political Thought*, New York 1961 (reissued 1968), p. 6.

mans,” played a part in perpetuating the National-Socialist perspective: a hyper-nationalism that suppressed an honest evaluation of the past, gave primacy to all things German, and permanently excluded the Jewish émigrés who had once been among their closest colleagues and friends.

V. Prosopographical Data

Jewish Scientists in German-Speaking Academia: An Overview

Simone Wenkel

German-Jewish scientists in the nineteenth and twentieth centuries were represented in nearly all fields of natural sciences, in mathematics and in medicine. Nonetheless, there were significant differences in the proportion of Jewish¹ scientists in different disciplines. The present article's first objective is to analyse the representation of Jewish scientists in the nineteenth and twentieth centuries quantitatively for various disciplines. The analysis is based on the data of two comprehensive German biographical encyclopaedias, the General German Biography, henceforth ADB and the New German Biography, henceforth NDB. Abbreviated entries of both encyclopaedias are published online in the *Digitales Gesamtregister der Neuen Deutschen Biographie und der Allgemeinen Deutschen Biographie* (Comprehensive Digital Registers of the New German Biography and the General German Biography), henceforth ADB/NDB².

The article's second part consists of an extensive list of the names and some biographical data of German-speaking Jews in science and medicine in the nineteenth and twentieth centuries with special regard to their scientific fields. In order to include as many names as possible, various other sources have been used in addition to the ADB/NDB (see below).

In 1911 Bernhard Breslauer published a memorandum about the discrimination of Jews at German universities on behalf of the *Verband deutscher Juden*.³ In his study Breslauer examined the number of Jewish scientists and scholars at universities in the German empire in three specific terms between 1874 and 1910.

¹ The term Jewish, if not stated otherwise, is used here as defined by the editors of this volume (see introduction and footnote 9).

² Historische Kommission der Bayerischen Akademie der Wissenschaften and Bayerische Staatsbibliothek (eds.), *Digitales Gesamtregister zur ADB und NDB*, version October 2003, <http://mdz1.bib-bvb.de/~ndb/ndbmaske.html>.

³ Bernhard Breslauer, *Die Zurücksetzung der Juden an den Universitäten Deutschlands. Denkschrift im Auftrage des Verbandes der Deutschen Juden*, Berlin 1911. This reference is a special reproduction of Breslauer's article published by the Association of German Jews.

Year	Full professors [Ordinarien]			Associate professors [Extraordinarien]			Private lecturers [Privatdozenten]		
	total	Jewish	conv.	total	Jewish	conv.	total	Jewish	conv.
1874/75	397	3	9	172	9	6	130	11	5
1889/90	476	9	15	217	19	10	306	25	10
1909/10	613	15	21	323	25	24	480	44	35

Table 1: Numbers of Jewish faculty members and private lecturers at German universities (without the University of Leipzig) in three different academic terms from 1874 to 1910 (changed from B. Breslauer, 1911, p. 16). The number of converted Jewish scientists (conv.) is not included in the number of Jewish scientists.

While in Breslauer's study the percentage of Jewish full professors more than doubles from 1 % in 1874/75 to 2.5 % in 1909 (total numbers see Table 1), the number of associate professors only shows an increase from 5 % to 8 % and the percentage of private lecturers stays nearly constant at about 8.5 %. These findings change when the numbers of baptised Jewish persons in the examined time period are looked at. The percentage of baptised or converted full professors slightly increases from 2.5 % in 1874/75 to 3.5 % in 1909 (total numbers see Table 1), while the number of associate professors and the number of private lecturers shows a steeper increase from about 3.5 % to 7 %. When Breslauer examined the number of Jewish scientists at German universities in natural sciences and mathematics he found two full professors in these disciplines in 1874/75, five in 1889/90 and eight in 1909/1910. For the associate professors he found four in 1874/75, nine in 1889/90 and fifteen in 1909/1910.⁴

Unlike Breslauer's data the ADB/NDB provides no possibility of dividing scientists into their status at the universities, but the range of the ADB/NDB extends the examined number of individuals to a much larger time period and includes the whole of German-speaking academia.

The *Allgemeine Deutsche Biographie*, the general German biography, is one of the world's largest historical-biographical encyclopaedias. From 1875 to 1912 the Historical Commission at the Bavarian Academy of Sciences published fifty-six volumes with more than 26,500 entries. The ADB was planned for scientific and general use and was intended to broadly inform about important persons from the German-speaking regions who died before 1900.

⁴ Breslauer, p. 21, Table 5c.

The ADB covers all areas of public life such as the arts, culture, science, medicine, law and politics. An expert commission made the selection of the individuals and families included in the ADB entries. The commission excluded persons with solely regional importance and Germans who emigrated and stayed abroad most of their working life.⁵ The New German Biography (*Neue Deutsche Biographie*) was produced to supplement the ADB and continue it beyond 1900. The NDB gives information in short articles about (in most cases) already deceased persons who significantly affected political, economical, social, scientific, technical or artistic developments with their achievements. The covered time period ranges from early mediaeval times until the present. From 1953 until 2005, twenty-two volumes were published with entries in alphabetical order, the last name so far (11/2005) is Schinkel. The last main entry in the digital version of ADB/NDB is Rohlf. In the digital version of the NDB we also find short entries of persons briefly mentioned in other entries. For the NDB a group of six editors selects the considered personalities and allocates articles to expert authors.⁶

The mentioned features make clear that ADB and the partly published NDB provide only an incomplete list of scientists of the nineteenth and twentieth centuries, it is especially incomplete concerning émigré and twentieth century scientists and in some cases conceals conversion by only mentioning one religious affiliation. The following comparisons with other references of the prosopographical overview confirm that impression. In Hans Kalmus' article about Jewish scientists in zoology and animal physiology⁷ he mentions 33 German-Jewish scientists; 18 of these scientists have no entry in the ADB/NDB, one third (11) of the scientists in Kalmus' article are listed as Jewish, two have no religious affiliation and for two scientists only their religion after conversion is mentioned in the ADB/NDB. In a comparison of twentieth century scientists we get another impression for the completeness of ADB/NDB. Of the twenty German-Jewish full professors in chemistry in the 1920s listed in Ute Deichmann's book about chemistry and biochemistry during the Nazi era⁸, fourteen persons are not listed in ADB or NDB main entries, three names are listed as Jewish, one scientist is listed without mentioning his religious affiliation and the final two entries only give the religious affiliation after conversion. Nonetheless, the great extent

⁵ Rochus Freiherr von Liliencron and Franz Xaver Wegele, 'Vorrede', in *Allgemeine Deutsche Biographie*, vol. I, Leipzig 1875 (reprinted Berlin 1967), pp. V-XVII.

⁶ Otto Graf zu Stolberg-Wernigerode, 'Einleitung', in *NDB*, vol. I, Berlin 1953, pp. VII-XI.

⁷ Hans Kalmus, 'Zoologie und Tierphysiologie', in Siegmund Kaznelson (ed.), *Juden im Deutschen Kulturbereich. Ein Sammelwerk*, 2nd edn., Berlin 1959, pp. 455-460.

⁸ Ute Deichmann, *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker in der NS-Zeit*, Weinheim-New York 2001, p. 115.

of the ADB/NDB makes it still possible to use the database as sample for empirical analysis to show tendencies in the participation of Jewish scientists in German speaking academia.

The digitised version of NDB and ADB provides a biographical database with more than 5,300 German-speaking individuals listed in natural sciences and mathematics and more than 3,400 in medicine (including practising physicians). These data give us the possibility to examine the proportion of German-speaking Jewish scientists quantitatively on the basis of the provided articles. The following data from ADB and NDB includes scientists who were born after 1750 and died after 1800.

Discipline	All scientists listed	Scientists with religious affiliation		Jewish ⁹		
	total	total	%	total	converts	%
Astronomy	169	71	42	3	1	4.2
Biology	898	548	61	21	3	3.8
Chemistry	929	593	63.8	56	10	9.4
Geo sciences	973	593	60.9	14	5	2.4
Mathematics	570	392	68.8	39	14	10
Medicine ¹⁰	988	577	58.4	73	7	12.7
Other natural sciences	169	71	42	4	0	5.6
Pharmacy ¹	48	33	68.8	0	0	0
Physics	652	401	61.5	42	10	10.5
Veterinary medicine ¹	18	9	50	0	0	0
Total	5414	3288	60.7	252	50	7.7

Table 2: Statistical overview of scientists listed in the ADB/NDB who died after 1800, sorted according to their discipline. The proportion of scientists with known religious affiliation and the proportion of Jewish scientists are listed in total numbers and in per cent. The number of Jewish scientists known to be converted (converts) is included in the total number of Jewish scientists.

⁹ The category “Jewish” includes all scientists, who were indicated to be Jewish or have Jewish first-grade relatives or were in all probability Jewish according to the articles in the ADB/NDB. The number of Jewish scientists, who are known to be converted (converts) is included in the total number. Per cent Jewish is relative to “Scientists with religious affiliation”.

¹⁰ The categories medicine, veterinary medicine and pharmacy in Table 2 and partly in Table 4 include only scientists, no practising physicians and chemists.

About 60 % of the included individuals are affiliated religiously. Jewish scientists in the fields of mathematics, physics, chemistry and medical research constitute around 10 % of the group of religiously affiliated scientists (Table 2). According to this data the fraction of Jewish scientists was up to four times lower in the fields of geo sciences, biology and astronomy; no Jewish scientists appear in veterinary medicine and pharmaceutical research. Scientists who converted from Judaism to Christianity were indicated in the ADB/NDB with both religions. With an average of 25 % of converts to Christianity in chemistry, mathematics and physics the number is significantly higher than in medicine with about 10 % converts (Table 2).

Medical sub-disciplines	Scientists with religious affiliation	Jewish scientists as part of religiously affiliated scientists	
	total	total	%
Anatomy	100	3	3
Bacteriology	38	8	21.1
Neurology	23	9	39.1
Pathology	64	13	20.3
Physiology	115	16	13.9
Surgery	141	10	7.1

Table 3: Number and proportion of Jewish scientists listed in ADB/NDB, who were active in different areas of medical research. The total number of Jewish scientists includes converts.

In the sub-disciplines of medical research (Table 3) we see great differences in the representation of Jewish scientists. While one fifth of the bacteriologists and pathologists were Jewish, this is the case only with 3 % of the anatomists and 7 % of the surgeons. The large Jewish participation in neurology with 40 % can be in part explained by its close relationship to psychiatry, where the high Jewish participation has been widely discussed elsewhere. (Table 4, see next page)

The proportion of scientists with known religious affiliation in medical research and in physics steadily grew from the early nineteenth century onwards. The development of the proportion of Jewish scientists in physics (Table 5, see next page) shows specific differences from that in medical research (Table 4). At the end of the nineteenth century until the early twentieth century the number and percentage of Jewish scientists in medical research rose strongly and remained high until the mid-twentieth century. This rise coincided with the beginning of experimental medical research. The decreasing figures at the end of the twentieth century can be explained

Medicine (died between)	All scientists listed	Scientists with religious affiliation		Jewish scientists	
		%	total	%	
1801–1825	51	21	41.2	0	0
1826–1850	60	27	45	0	0
1851–1875	78	39	50	1	2.6
1876–1900	141	69	48.9	10	14.5
1901–1925	192	117	60.9	19	16.2
1926–1950	248	164	66.1	25	15.2
1951–1975	119	81	68.1	10	12.3
1975–2005 or alive	61	35	57.4	3	8.6
not specified	35	24	68.6	5	20.8

Table 4: Development of the representation of Jewish scientists in medical research from 1801–2005 as listed in ADB/NDB. The data is sorted according to the year of death of the scientists to avoid an incomplete or mixed list of eighteenth and nineteenth century scientists. The proportion of scientists with known religious affiliations and the proportion of Jewish scientists are listed in total number and in per cent. The percentage of Jewish scientists is listed as part of religiously affiliated scientists. The total number of Jewish scientists includes converts.

in part with the expulsion of scientists from Nazi Germany. Except for the émigrés there were few German-Jewish scientists. With the largest percentage in the mid-twentieth century in physics the increase in the number of Jewish scientists in physics from the end of the nineteenth century onwards was much smaller and occurred later than in medicine.

The second part of this article is an appended list of Jewish scientists. In addition to ADB/NDB the data come from the following sources, which I shortly introduce here. Carl Pinn wrote two articles about Jewish lecturers at the University of Berlin, which were published in 1910 in the illustrated German-Jewish monthly periodical for modern Judaism *Ost und West*.¹¹ These articles with many portraits shortly introduce Jewish scientists and their scientific disciplines, but only a few include biographical data. In 1934 Siegmund Kaznelson published the first edition of the collective volume about Jews in German culture, *Juden im Deutschen Kulturbereich*. The second edition, published in 1959, had a foreword by Richard Willstätter. Both edi-

¹¹ Carl Pinn, 'Jüdische Dozenten an der Berliner Universität I', in *Ost und West*, vol. X, no. 10 (October 1910), pp. 639–654; *idem*, 'Jüdische Dozenten an der Berliner Universität II' *ibid.*, no. 11 (November 1910), pp. 739–752; both articles are digitised in the internet archive for Jewish periodica at www.compactmemory.de.

Physics (died)	Listed scientists	Scientists with religious affiliation		Jewish scientists	
		total	%	total	%
1801–1825	12	8	66.6	0	0
1826–1850	14	3	21.4	0	0
1851–1875	36	18	50	3	16.6
1876–1900	57	28	49.1	2	7.1
1901–1925	94	66	70.2	5	7.6
1926–1950	145	101	69.7	10	9.9
1951–1975	166	104	62.7	15	14.4
1975–2005 or alive	104	68	65.4	6	8.8
not specified	27	13	48.1	1	7.7

Table 5: Development of the representation of Jewish scientists in physics from 1801–2005 as listed in ADB/NDB. The data is sorted according to the year of death of the scientists to avoid an incomplete or mixed list of eighteenth and nineteenth century scientists. The proportion of scientists with known religious affiliation and the proportion of Jewish scientists are listed in total number and in per cent. The total number of Jewish scientists includes converts.

tions include essays about Jewish scientists sorted according to their disciplines and sub-disciplines. The list in this paper refers to the articles about natural sciences and medicine published in the second edition.¹² Ernst Lustig's unpublished collection (1985) about emigration of German-speaking natural scientists between 1933 and 1945 is a list of biographical data. As it was usual in publications at that time Lustig did not include information about religious affiliation.¹³ In his article from 1998 about dismissals at the medical faculty of the University of Vienna during the Nazi era the un-

¹² Felix A. Theilhaber, 'Geographie', in Kaznelson (ed.), 2nd edn., pp. 383–385; Paul Kuhn, 'Mathematik', *ibid.*, pp. 386–398; *idem*, 'Astronomie', *ibid.*, pp. 399–400; Hadrian Stahl, 'Physik', *ibid.*, pp. 401–419; Georg Alter, 'Geophysik', *ibid.*, pp. 420–423; Reuben Thieberger, 'Atomwissenschaft', *ibid.*, pp. 424–428; Charlotte Politzer, 'Chemie', *ibid.*, pp. 429–450; Rudolf Keller, 'Botanik und Pflanzenphysiologie', *ibid.*, pp. 451–454; Kalmus, 'Zoologie und Tierphysiologie', *ibid.*, pp. 455–460;—Martin Gumpert and Alfred Joseph, 'Medizin', *ibid.*, pp. 461–526; Richard Kantorowicz, 'Tierheilkunde', *ibid.*, pp. 527–530.

¹³ Ernst Lustig, *Freiwillige und zwangsweise Emigration deutschsprachiger Naturwissenschaftler von 1933 bis 1945. Eine Auslese – Kurze Bearbeitung*. [typescript, 1985 unpublished, private correspondence from Ernst Lustig to Ute Deichmann], B.1,1 – B.1,7 (page numbers according to author).

named author specially mentioned cancellation of work contracts for racial reasons and also included biographical information.¹⁴

The two books by Ute Deichmann concerning the development of biological and chemical sciences in the Nazi era in Germany include lists of scientists who were dismissed or emigrated because they were of Jewish origin.¹⁵ Biographical data are contained in the appendices of these volumes.

The following list is sorted in alphabetical order. It includes data collected from the books and articles mentioned above. The names of individuals of whom no personal data except a scientific discipline is listed, originated from Carl Pinn's articles or Kaznelson's collected edition and were mentioned there in the context of nineteenth and twentieth century research. I use the following abbreviations for countries: A – Austria; CH – Switzerland; G – Germany; GB – Great Britain; HU – Hungary.

- Abel, Emil (1875 Vienna, A – 1950 London, GB); physical chemistry
 Abels, Hans (b. 1873 Vienna, A); paediatrics
 Abelsdorf, Georg; ophthalmology
 Abraham, Max (1875 Danzig, G – 1922 Munich, G) ; physics
 Adler, Leo; zoology
 Adler, Ludwig (Louis) (1876 Vienna, A – 1958 New Milford, USA); gynaecology
 Albu, Albert (1867–1921); internal medicine
 Alexander, Ernst (1902 Berlin, G – 1980 Jerusalem, I); physics
 Allers, Rudolf (1883 Vienna, A – 1963 Hyattsville, USA); psychiatry
 Altmann, Rudolf; zoology
 Archenhold, F. Simon (1861–1939); astronomy
 Arco, Georg Graf von (b. 1869 Großgörschütz bei Ratibor); physics
 Arndt, Fritz (1885 Hamburg, G – 1969 Hamburg, G); organic chemistry
 Aron, Hermann (1845–1913); electrophysics, industrialist
 Arons, Leo (1860–1919); physics
 Aronson, H.; bacteriology
 Asch, Robert (1859–1929); gynaecology
 Ascherson, Paul (1834–1913); botany
 Aschheim, Selmar ; gynaecology
 Aschner, Bernhard (1883 Vienna, A – 1955 New York, USA); gynaecology, internal medicine
 Askanazy, Max (1865–1940); pathology
 Askenasy, Eugen (1845–1903); botany
 Auerbach, Charlotte (1899 Krefeld, G – 1985 Edinburgh, GB); biology
 Auerbach, Felix (1856–1933); physics
 Auerbach, Friedrich (1870–1925); chemistry
 Auerbach, Leopold (1828–1897); anatomy, zoology, neurology

¹⁴ anon. 'Enthebungen an der medizinischen Fakultät 1938 – 1945', in *Wiener Klinische Wochenschrift*, vol.110, issue 4–5, pp. 115–120, Vienna, 1998.

¹⁵ Ute Deichmann, *Biologists under Hitler*, Cambridge, MA 1996, pp. 16–17; *idem*, *Flüchten, Mitmachen, Vergessen*, pp. 118–125.

- Auerbach, Sigmund; neurology, neurosurgery
Auspitz, Heinrich (1835–1888); dermatology
- Bacher, Robert Fox (b. 1905); nuclear physics
Baeyer, Adolf von (1835–1917); chemistry
Baeyer, Hans Ritter von; surgery
Baginsky, Adolf (1845–1918); paediatrics
Baginsky, Benno; otology
Bamberger, Eugen (1857–1932); chemistry, Professor in Munich
Bamberger, Heinrich (1822–1888); internal medicine; pathology
Bárány, Robert (1876–1936); otorhinolaryngology
Basch, Karl Ritter von (1837–1905); pathology in Vienna
Bauer, Julius (1887 Nachod in Böhmen, A – 1979 Beverly Hills, USA); internal medicine
Bauer, Richard (1879 Vienna, A – 1959 Vienna, A); internal medicine
Bauer, Theodor (b. 1885 Vienna, A); pathology, anatomy
Bechhold, Heinrich (1866–1937); physical chemistry, biochemistry, colloid chemistry
Beer, Theodor; zoology
Beer, Wilhelm (1797–1850); astronomy, banker
Behrend, Friedrich Jakob (1803–1889); dermatology
Beit, Ferdinand (1817–1870) chemistry
Benda, Carl (b. 1857); anatomy
Bendavid, Lazarus (1762–1832); mathematics, philosophy
Bendix, Bernhard; paediatrics
Benedikt, Heinrich (1871–1928); internal medicine
Benedikt, Moritz (1835–1920); neuropathology
Bergel, Fritz (b. 1900); organic chemistry
Bergel, Salo (b. 1868); bacteriology
Bergmann, Ernst D. (1903–1975); organic chemistry
Bergmann, Max (1886 Fürth, G – 1944 New York); organic chemistry
Berl, Ernst (1877 Freudenthal, A – 1946 Pittsburgh, USA); technical chemistry
Berliner, Arnold (1862–1942); physics
Berliner, Arnold; neurology
Bernay, Paul (1888 London, GB – 1977 Zürich, CH); mathematics
Berndt, Gottlieb Michael (1836–1920); geophysics
Bernhardt, M.; neurology
Bernstein, Felix (1878 Halle, G – 1956 Zürich, CH); mathematics
Bernstein, Julius (1839 Berlin, G – 1917); physiology
Berson, Arthur (1859 Galizien – 1942); geophysics, Prussian Aeronautic Observatory
Bertheim, Alfred (1879–1914); bacteriology, chemistry
Berwald, Ludwig (1883 Prague – 1942 Ghetto Lodz); mathematics
Bessels, Emil (1847–1888); polar research, North Pole explorer, naturalist
Bethe, Hans (1906 Straßburg, G – 2005 Ithaca, USA); physics, Nobel Prize in Physics 1967
Bettelheim, Karl (1840–1895); internal medicine
Bettmann, Siegfried (1869–1939); dermatology, Professor of Medicine in Berlin
Beutler, Hans (1896–1942); physical chemistry
Biedl, Arthur (d. 1933); internal medicine, hormone research

- Bielschowsky, Alfred (1871–1940); ophthalmology
Bielschowsky, Max (1869–1940); neurology
Bikerman, Jacob J. (1898–1978); physical chemistry
Bing, Albert (b. 1844); otorhinolaryngology
Bing, Rudolf; neurology
Binswanger, Otto (1852–1929); neurology, physiology, anatomy
Blaschko, Alfred (1858–1922); dermatology
Blaschko, Hermann (1900 Berlin, G – 1993 Oxford, GB); medical biochemistry
Blatt, Paul (b. 1889 Vienna, A); urology
Blau, Albert (b. 1874 Vienna, A); gynaecology
Blau, Fritz (1865–1929); chemistry
Bloch, Bruno (1878–1932); dermatology
Bloch, Felix (1905–1983); physics
Bloch, Iwan (1872–1922); dermatology
Bloch, Konrad (1912 Neisse – 2000 Burlington, USA); organic chemistry, Nobel Prize in Medicine 1964
Bloch, Moshe R. (1902 Aussig, A – 1985 Ksar Saba, I); chemistry
Blochner, Salomon (1899 Krakau, A – 1982 Houston, USA); mathematics
Blum, Viktor (1877 Vienna, A – 1953 Chicago, USA); urology
Blumenreich, Ludwig; gynaecology
Blumenthal, Ferdinand (b. 1870); cancer research, Director of the Institute for Cancer research in Berlin
Blumenthal, Ludwig O. v. (1876 Frankfurt, G – 1944 Theresienstadt); mathematics
Blumenthal, Otto (1876–1944); mathematics
Boas, Franz (1858 Minden, G – 1942); anthropology
Boas, Ismar (1858–1938); internal medicine
Bodenheimer, Fritz S. (b. 1897); zoology
Bodenstein, Dietrich (1908 Corwigen, G – 1984 Char'vle, USA); zoology
Bondi, Alfred Aron (1906 Vienna, A – 1985 Rehovot, I); biochemistry
Bondi, Samuel (1878 Mainz, G – 1959); internal medicine
Bondy, Gustav (1870 Unterstadt, Böhmen, A – 1954 Australia); otology
Borchardt, Carl Wilhelm (1817–1880); mathematics
Borchardt, Moritz; surgery
Born, Gustav Jakob (b. 1851); embryology
Born, Max (1882 Breslau, G – 1970 Göttingen, G); physics, Nobel Prize in Physics 1954
Brasch, A.; physics
Brauner, Leo (1898–1974); botany
Bredig, Georg (1868 Glogau, G – 1944 New York, USA); physical chemistry
Breßlau, Ernst (1877–1935); zoology
Brieger, Friedrich (1900–1985); botany, genetics
Brieger, Ludwig (1849–1919); physiology, pathology
Bronn, Jegor (1870–1932); technology
Bruck, Carl (b. 1879); dermatology
Brühl, Julius Wilhelm (1850–1911); chemistry
Brünauer, Stefan Robert (1887 Vienna, A – 1968 Chicago, USA); dermatology
Brunner, Hans (1893 Zwittau, Mähren, A); otology
Brunner, Jakob; zoology

- Bucky, Gustav; internal medicine
Buschke, Abraham (1868–1943); dermatology
- Calmann, Adolf; gynaecology
Cantor, Georg (1845–1918); mathematics
Cantor, Moritz (1829–1920); mathematics
Caro, Heinrich (1834–1910); chemistry, dye chemistry
Caro, Nikodem (1871–1935); chemistry, industrialist
Caspari, Ernst W. (1909 Berlin, G – 1985 Rochester, USA); biology
Caspari, Wilhelm (b. 1872); physiology
Casper, Leopold (b. 1859); urology
Cassel, Hans (b. 1891); physical chemistry
Cassirer, Richard (1868–1925); neurology
Chain, Ernst B. (1906 Berlin, G – 1979 Mulranny, Ireland); organic chemistry, Nobel Prize in Medicine 1945
Chargaff, Erwin (1905 Czernowitz, A – 2002 New York, USA); organic chemistry
Christeller, Erwin; pathology
Citron, Julius (b. 1881); internal medicine
Cohen, Emil Wilhelm (1842–1903); geophysics
Cohn, Bernhard (1827–1864); internal medicine
Cohn, Ferdinand (1828–1898); plant physiology, bacteriology, botany
Cohn, Hermann (1838–1906); ophthalmology
Cohn, Konrad; dentistry
Cohn, Lassar: see Lassar-Cohn, Ernst
Cohn, Theodor (b.1867); urology
Cohn, Toby; neurology
Cohn, Fritz (1866–1922); astronomy
Cohnheim, Julius (1839–1884); pathology, student of Virchow
Cohnstein, Isidor (1841–1894); gynaecology
Cohn-Vossen, Stefan (1902 Breslau, G – 1936 Moskau, Sowjetunion); mathematics
Constam, Emil (1858–1917); chemistry
Courant, Richard (1888 Lublinitz, G – 1972 New Rochelle, USA); mathematics
Czempin, Alex; gynaecology
- de Haas, W.; physics
Dehn, Max W. (1978 Hamburg, G – 1952 Bl. Mountain, USA); mathematics
Delbanco, Ernst (b. 1869) veterinary medicine, bacteriology, dermatology
Dember, Harry; physics
Detmold, Ludwig Wilhelm (1808–1894); military surgery, Professor of Military Surgery, US-army physician
Deutsch, Felix (1884 Vienna, A – 1964 Cambridge, USA); internal medicine
Deutschmann, Heinrich (b. 1852); ophthalmology
Diamant, Moritz (1830–1884); chemistry, paper fabricant
Dische, Zacharias (1895 Sambor, A – 1985 New York, USA); biology
Donath, Julius (1870 Vienna, A – 1950 Vienna, A); internal medicine
Drachfeld, H.; physics
Dreyfus, G.L.; neurology
Drucker, Carl (1876–1959); physical chemistry

- Ebstein, Wilhelm (1836–1912); internal medicine
Eckstein, O.; botany
Edinger, Ludwig (1855–1918); pathology, neurology
Edinger, Tilly (Johanna Gabriele Ottilie), (1897 Frankfurt am Main, G – 1967 Cambridge, USA); palaeontology, University of Frankfurt
Ehrenberg, Werner (1901 Berlin, G – 1975 Wembley, GB); physics
Ehrenfest, Paul (b. 1880 Vienna, A); physics
Ehrenhaft, Felix (1879 Vienna, A – 1952 Vienna, A); physics
Ehrenstein, Maximilian (1899 Munich, G – 1968 Philadelphia, USA); biochemistry
Ehrlich, Felix (1877–1942); agrobiocchemistry
Ehrlich, Paul (1854 Strehlen – 1915 Bad Homburg); medicine, bacteriology, serology, Nobel Prize in Medicine 1908
Ehrmann, Rudolf; internal medicine
Ehrmann, Salomon (1854–1926); dermatology
Einhorn, Max (1862–1953); internal medicine
Einstein, Albert (1879 Ulm, G – 1955 Princeton, USA); physics, Nobel Prize in Physics 1921
Eirich, Frederick R. (b. 1905 Vienna, A); physical chemistry
Eisenschitz, Robert K. (1898 Vienna, A – 1968 London, GB); physics
Eisenstein, Ferdinand Gotthold Max (1823–1852); mathematics
Eisinger, Karl (1895 Vienna, A – 1956 London, GB); otorhinolaryngology
Eisner, Hans (1892–1983); technical chemistry
Elias, Herbert (1885 Vienna, A – 1975 New York, USA); internal medicine
Eliasberg, Helene; paediatrics
Ellinger, Alexander (1870–1923); pharmacology
Elsässer, Walter M. (1904 Mannheim, G – 1985 Baltimore, USA); physics
Embden, Gustav (1874–1933); physiology, biochemistry, medical biochemistry
Emin Pascha (1840–1892); Africa research, African official
Engelmann, Guido (1876 Olmütz – 1959 California, USA); surgery
Ephraim, Fritz (1876–1935); chemistry
Eppenstein, Otto (1876–1942); optical physics
Epstein, Alois (1849–1918); paediatrics
Epstein, Berthold (b. 1890); paediatrics
Epstein, Friedrich; physical chemistry
Erdheim, Sigmund (1868 Sombor, Galizia – 1945 Vienna, A); surgery
Estermann, Immanuel (1900 Berlin, G – 1973 or 1979 Haifa, I); physical chemistry, high energy physics, nuclear physics
Ettisch, Georg (b. 1890); medical biochemistry
Eulenberg, Albert (1840–1917); neurology
- Fajans, Kasimir (1887 Warsaw, PL – 1975 Ann Harbor, USA); physical chemistry
Falck, Richard (1873–1955); mycology
Farkas, Ladislaus (1904 Dunaszerdah, HU – 1948 Jerusalem, I);
physical chemistry
Feigl, Fritz (1891 Vienna, A – 1971 Rio de Janeiro, Brasil); inorganic chemistrybiochemistry
Fein, Johann (1864–1923); laryngology
Fejer, Leopold (b. 1880); mathematics

- Fekete, Michael (1886–1957); mathematics
Felix, Arthur; bacteriology
Filehne, Wilhelm Oskar Friedrich (1844–1927); pharmacology
Finkelstein, Heinrich (1865–1942); pediatrics
Fischel, Alfred (1868–1938); zoology, embryology
Flatau, Theodor Simon (1860–1937); otorhinolaryngology, vocal physiology
Fleischer, Emil (1843–1928); chemistry
Fleischer, Maximilian (1812–1871); chemistry
Fleischl, Edler von Marxow Ernst (1846–1891); physiology
Fleischmann, Walter (b. 1896 Vienna, A); physiology
Fleischner, Felix (1893 Vienna, A – 1960); medical radiology
Fliess, Wilhelm; gynaecology
Fodor, Andor (Halle, G – Jerusalem, I); biochemistry
Fraenkel (Fraenken), Karl (1861–1916); bacteriology
Fraenkel, Abraham H. (1891 Munich, G – 1965 Jerusalem, I); mathematics
Fraenkel, Adolf (1891 Munich, G); mathematics
Fraenkel, Bernhard (1836–1911); otorhinolaryngology
Fraenkel, Ernst (b. 1844); gynaecology
Fraenkel, Gottfried (b. 1901); zoology
Fraenkel, Ludwig; gynaecology
Fraenkel, Walter (1879–1945); physical chemistry
Fraenkel-Conrat, Heinz L. (1910 Breslau, G – 1999 Berkeley, USA); biochemistry
Franck, James (1882 Hamburg, G – 1964 Göttingen, G); physics, Nobel Prize in Physics 1925
Frank, Adolph (1834–1916); chemistry
Frank, Erich (d. 1957); internal medicine
Frank, Fritz (1868–1949); chemistry, Professor for Chemistry
Frank, Philipp; mathematics, successor of Albert Einstein in Prague
Fränkel, Albert (1848–1916); internal medicine
Fränkel, Eugen (1853–1925); anatomy
Fränkel, Ludwig (1806–1872); internal medicine
Fränkel, P.; forensic medicine
Fränkel, Sigismund (1968–1939); medical biochemistry
Frankenheim, Moritz Ludwig (1801–1869); physics, crystallography
Frankl, Oskar (1873 Kremsier, A – 1938); gynaecology
Frei, Ephraim H. (1912 Vienna, A, died in Rehovot, I); physics
Freund, Ernst (1863 Vienna, A – 1946 London, GB); medical biochemistry, serology
Freund, Ernst (1876 Karbitz near Aussig, A – 1942 USA); internal medicine
Freund, Leopold (1868 Miskowitz – 1943 Bruxelles, Belgium); medical radiology
Freund, Ludwig (1878–1953); zoology
Freund, Martin (d. 1920); chemistry; University of Frankfurt
Freund, Wilhelm Alexander; surgery
Freundlich, Erwin F. (1885 Biebrich a. Rhein, G – 1964); physics, astronomy
Freundlich, Herbert Max F. (1880–1941); physical chemistry, biochemistry
Frey, Hugo (1873 Vienna, A – 1951 London, GB); otology
Friedberger, Ernst (b. 1875); epidemiology
Friedemann, Ulrich (1877–1949); bacteriology, serology
Friedenthal, Hans (1870–1942); physiology, anthropology, biochemistry

Friedländer, Benno; zoology
Friedländer, Erich (b. 1901); physical chemistry
Friedländer, Karl (1847–1887); pathology, anatomy, medicine
Friedländer, Paul (1857–1923); chemistry, dye chemistry
Friedmann, Friedrich Franz (b. 1876); bacteriology
Frisch, Alfred Viktor (1890 Vienna, A – 1960 Vienna, A); internal medicine
Frisch, Otto R. (1904 Vienna, A – 1979 Cambridge, GB); physics, nephew of Lise Meitner
Fröhlich, Alfred (1871 Vienna, A – 1953 Cincinnati, USA); pharmacology
Fröhlich, Herbert (1905 Rexingen, G – 1991 Liverpool, GB); physics, biophysics
Fröhlich, Hermann (b. 1907); organic chemistry
Frommer, Leopold (b. 1894); physical chemistry
Fröschels, Emil (1884 Vienna, A – 1972 New York, USA); otology
Fuchs, Lazarus (1833–1902); mathematics
Fuchs, Walter (1881–1957); technical chemistry
Fürth, Otto Ritter von (1867 Strakonwitz – 1938 Vienna, A); medical chemistry
Fürth, Reinhold; physics

Gabriel, Max; chemistry, head of Emil Fischer's laboratory
Gabriel, Siegmund (1851–1924); chemistry
Gaertner, Gustav (1855–1937); physiology
Galewsky, E.; dermatology
Gans, Leo (1843–1935); chemistry, industrial magnate
Gans, Oskar (b. 1888); dermatology, histology
Gärtner, August (1848–1934); hygiene
Gatscher, Siegfried (1873 Spital am Pyhrn – 1942 Vienna, A); otology
Georgi, Felix (b. 1890 or 1893); serology
Gerngroß, Otto (1882–1966); organic chemistry
Gerson, Max; internal medicine
Gerstmann, Josef (1887 Lemberg, A – 1969 New York, USA); neurology, psychiatry
Glaessner, Karl (1876 Prague – 1944 New York, USA); internal medicine
Glas, Emil (1877 Vienna, A – 1958 New York, USA); rhinology
Glaser, Eduard (1855–1908); explorer
Gluecksohn-Waelsch, Salome (1907 Danzig, G – 1971 New York, USA); biology
Gold, Ernst (1891 Vienna, A – 1967); surgery
Goldberg, Emanuel (1881 Prague – 1971 Tel Aviv, I); physics
Goldfinger, Paul (1905–1970); physical chemistry
Goldscheider, Alfred; internal medicine
Goldschmidt, Guido (1850–1915); chemistry, professor in Vienna and Prague
Goldschmidt, Hans (1861–1923); chemistry
Goldschmidt, Heinrich J. (1857 Prague – 1937 Oslo, Norway); chemistry
Goldschmidt, Moritz (1863–1916); botany
Goldschmidt, Richard B. (1878–1958); zoology, genetics
Goldschmidt, Stefan (1889–1971); organic chemistry
Goldschmidt, Theodor (1817–1875); chemistry, textile dye producer in Berlin
Goldschmidt, Victor (1853–1933); mineralogy
Goldschmidt, Victor Moritz (1888 Zürich, CH – 1947 Vestre Akar, Norway); mineralogy

- Goldschmidt, Waldemar (b. 1886 Bukarest); surgery
Goldstein, Eugen (1850 Gleiwitz, G – 1928 Berlin, G); physics
Goldstein, Kurt; neurology
Goldzieher, Wilhelm (b. 1849); ophthalmology
Gomperz, Benjamin (1861–1935); medicine, professor of otology in Vienna
Gordon, Walter (1893 Apolda, G – 1939 Stockholm, Sweden); physics
Gottlieb, Bernhard (1885 Kutý – 1950 Dallas, USA); dentistry
Gottstein, Adolf (1857–1941); epidemiology, leader of the Prussian Health Care
Gottstein, Jacob (1832–1895); anatomy
Götzl, Alfred (1873 Vienna, A – 1945 San Francisco, USA); internal medicine
Graefenberg, Ernst; gynaecology
Graetz, Leo (1856–1941); physics
Groedel, Franz (1881–1951); internal medicine
Groß, Fabius (1906–1950); zoology, genetics
Groß, Philipp (1889–1974); physical chemistry
Grosz, Karl (1879 Budapest, HU); neurology, psychiatry
Grün, Adolf (1877 Zürich, CH); chemistry
Grün, Dionys Ritter von (1819–1896); geography
Grünhut, Leo (1863–1921); food chemistry
Grunmach; x-ray research
Guggenheimer, Kurt; physical chemistry
Gundelfinger, Siegmund (1846–1910); mathematics
Gutenberg, Benno (1889 Darmstadt, G – 1960); geophysics
Guttmann, Arthur (b. 1881); chemistry
Guttmann, Ludwig; neurology
Guttmann, Paul (1834–1893); physiology, pathology
- Haas, Erwin (b. 1906); biochemistry
Haber, Fritz (1868 Breslau, G – 1934 Basel, CH); physical chemistry, Nobel Prize in Chemistry 1918
Hahn, Eduard Moritz (1781–1840); mathematics, professor of mathematics and physics in Breslau
Hahn, Friedrich (1888–1975); inorganic chemistry
Hahn, Martin (1865–1934); hygiene, professor of hygiene
Hajek, Max; otorhinolaryngology
Halban, Hans H. (1905 or 1908–1964); nuclear physics
Halban, Josef (1870–1937); gynaecology
Halban, Leon von (1838–1897); medicine, professor of forensic medicine in Krakau
Halberstaedter, Ludwig (1876–1949); nuclear medicine
Halle, Max; otorhinolaryngology
Hallgarten, Friedrich (1865–1925); chemistry
Halphén, George Henri (1844–1889); mathematics, 1882 Steiner Prize
Hamburger, Carl (1870–1944); ophthalmology, social medicine
Hamburger, Clara; zoology
Hamburger, Meyer (1838–1903); mathematics
Hamburger, Victor (1900–2001); zoology
Hammerschlag, Viktor (1870 Leipnik -1943 KZ Theresienstadt); otology

- Handovsky, Hans (1888 Vienna, A – 1959 Remscheid, G); pharmacology, toxicology
- Hannes, Walther; gynaecology
- Hass, Julius (1883 Vienna, A – 1959 New York, USA); surgery
- Hatschek, Berthold (1854–1941); zoology
- Haurowitz, Felix (1896–1987); medical biochemistry
- Hausmann, Walther (1877 Meran – 1938 Vienna, A); pharmacology
- Hausdorff, Felix (1868 Breslau, G – 1942); mathematics
- Hecht, Adolf Franz (1876 Vienna, A – 1938 Vienna, A); paediatrics
- Heidenhain, Martin (1864–1949); zoology, physiology
- Heidenhain, Rudolf (1834–1897); zoology, physiology
- Heidler, Hans (1889 Gmünden – 1955 Vienna, A); gynaecology
- Heilbronn, Alfred (1885–1961); botany
- Heimann, Fritz; gynaecology
- Heims-Heymann, Paul (1849–1931); laryngology, medicine
- Heine, Eduard (1821–1881); mathematics
- Heitler, Walter A. (1904 Karlsruhe, G – 1981 Zürich, CH); physics
- Heitz, Emil (1892–1965); botany, genetics
- Heller, Julius (1864–1932); histology, dermatology
- Heller, Wilfried (b. 1903); physical chemistry
- Hellinger, Ernst D. (1883 Striegau, G – 1950 Chicago, USA); mathematics
- Henle, F.I.G.; zoology
- Henle, Friedrich Jakob (1809–1885); medicine, pathology, professor of anatomy in Göttingen
- Henoch, Eduard Heinrich (1839–1910); paediatrics
- Hensel, Kurt (1861–1941); mathematics, theory of algebraic numbers
- Hermann, Ludimar (1838–1914); physiology
- Hermann, Siegwart (1886–1956); bacteriology
- Herrmann, Albert (1859–1921); chemistry
- Hertz, Gustav (1887–1975); physics, Nobel Prize in Physics 1925
- Hertz, Heinrich (1857 Hamburg, G – 1894 Bonn, G); physics
- Hertz, Mathilde (1891–1975); zoology
- Herxheimer, Carl (1861–1942); dermatology
- Herxheimer, Gotthold (1872–1936); anatomy, pathology
- Herxheimer, Herbert (b. 1894); internal medicine
- Herz, Albert (1876 Freudenthal – 1950 Amsterdam, NL); internal medicine
- Herz, Jacob; internal medicine
- Herz, Richard (1867–1936); industrial chemistry
- Herzberg, Gerhard (1904 Hamburg, G – 1999 Ontario, Canada); physics, atomic and molecular spectroscopy, Nobel Prize in Chemistry 1971
- Herzig, Josef (1853–1924); chemistry
- Herzog, Reginald (or Richard) Oliver (1878–1935); organic chemistry
- Hess, Leo (1879 Vienna, A – 1963 USA); internal medicine
- Hevesy, Georg Karl von (1885 Budapest, Hungary – 1966); physical chemistry, Nobel Prize in Chemistry 1943
- Heymann, Bruno (1871–1943); hygiene
- Heymann, Erich (b. 1901); physical chemistry
- Hilzheimer, Max (1877–1946); zoology

Hirsch Emil (b. 1870); chemistry, metal industrial, company associate 'Aron Hirsch and Son'

Hirsch, Adolf (1830 Halberstadt – 1901 Neuchatel, CH); astronomy, geodesy

Hirsch, August (1817–1894); medical history, hygiene, Professor of Medicine in Berlin

Hirsch, Max (1877–1948); gynaecology, internal medicine, public health

Hirsch, Meier (1770 or 1765–1851); mathematics

Hirsch, Oskar (1877 Prerau – 1965 Boston, USA); rhinolaryngology

Hirsch, Rahel (1870–1953); internal medicine

Hirschberg, Julius; ophthalmology

Hirschfeld, Felix; internal medicine

Hirschfeld, Hans (b. 1879); histology, haematology

Hirschfeld, Hermann (1825–1885); internal medicine

Hirschfeld, Magnus (1868–1935); sexual research, sexual reformer

Hirschland, Franz Herbert (b. 1880); electro chemistry, President of the Metal Thermit Corporation in New York

Hitzenberger, Karl (1893 Laakirchen – 1941 Vienna, A); internal medicine

Hitzig, Eduard (1838–1907); neurology, Director of the neurological clinic of the University of Halle

Höber, Rudolf (1873–1953); biochemistry

Hofbauer, Ludwig (1873 Vienna, A – 1951); internal medicine

Hoff, Hans (1897 Vienna, A – 1969 Vienna, A); psychiatry, neurology

Hoffa, Albert (1859–1907); surgery

Hoffer, Max (b. 1906); organic chemistry

Holde, David (1864–1938); technical chemistry

Holländer, Eugen (b. 1832); surgery

Holländer, Ludwig H. (1833–1897); dentistry, pathology

Hopf, Ludwig (1884 Nuremberg, G – 1939 Dublin, Ireland); aeronautics, physics

Hurwitz, Adolf (1859 or 1855 1919); mathematics

Igersheimer, Joseph (b. 1879); ophthalmology

Iltis, H. Hugh Hellmut (1882 Brünn, A – 1952 St. Louis, USA); biology

Infeld, Leopold (1898 Krakau – d. in the USSR); physics

Isaac, Simon (b. 1881); internal medicine diabetes research

Israel, Arthur (1883–1969); surgery Professor of surgery; head of a department at the Israeli Clinic Hamburg

Israel, James (1848–1926); urology

Israel, Wilhelm (b. 1881); urology, surgery, private lecturer of urology and surgery in Berlin

Isserlin, Max (b. 1879); neurology

Jacob, Alfons; neurology

Jacobi, Carl Gustav Jacob (1804–1851); mathematics, astronomy

Jacobi, Moritz Hermann von (1801–1874); physics, electrical engineering

Jacobsohn, Kurt; medical biochemistry

Jacobsohn, Max; surgery

Jacobsohn-Lask, Louis (around 1860–1940); neurology

Jacobson, Heinrich (1826–1892 or 1890); pathology, professor of medicine

- Jacobson, Julius (1828–1889); ophthalmology
 Jacobson, Louis (1852–1905); otology, professor in Berlin
 Jacobson, Paul (1859–1923); chemistry
 Jacobsthal, E.W.; serology, bacteriology
 Jacoby, Martin; biochemistry
 Jadassohn, Josef (1863–1936); dermatology
 Jaffé, George Cecil (1880 Gießen, G – 1965 Göppingen, G); physics
 Jaffé, Max (1840 or 1841–1911); pharmacology, biochemistry, University of Königsberg; professor of medical chemistry
 Jaffé, Rudolf; physiology
 Jakob, A.; botany
 Jakob, Max (1879–1955); physics
 Jakob, Salomon; ophthalmology
 Japha, Arnold (1877–1943); zoology
 Jellinek, Stefan (1871 Prerau, Mähren – 1968 Edinburgh, GB); electro pathology
 Jeßner, Max (1887–after 1933); dermatology, professor of dermatology in Breslau
 Joachimovits, Robert (1892 Vienna, A – 1970 Brazil); gynaecology
 Joachimsthal, Ferdinand (1818–1861); mathematics
 Joachimsthal, Georg (1863–1914); surgery
 Jolles, Stanislaus (b. 1857); mathematics
 Jollos, Viktor (1887–1941); zoology, genetics
 Joseph, Eugen (1879–1933); urology
 Joseph, Heinrich; zoology
 Joseph, Jacques (1865–1934); surgery
 Jossmann, Paul; neurology
- Kafka, Gustav (1883–1953); zoology
 Kafka, Victor (b. 1881); serology
 Kahler, Hermann (1891 Vienna, A – 1951 Mondsee); internal medicine
 Kahns, Fritz (b. 1888); zoology
 Kallmann, Hartmut (b. 1896); physical chemistry, physics
 Kalmus, Hans (b. 1906); zoology genetics
 Kaposi, Moriz (1837 or 1827–1902); dermatology, professor of dermatology in Vienna
 Kármán, Theodor von (1881–1963); aerodynamics, aerospace engineering
 Kassowitz, Max (1842–1913); paediatrics, zoology
 Katz (Kahr), Heinrich (1888 Linz, A – 1947 Vienna, A); gynaecology
 Katz, J. R.; chemistry
 Katzenstein, J.; laryngology
 Katzenstein, Moritz; surgery
 Kauffmann, Walter (b. in Königsberg); physics
 Kaznelson, Paul; internal medicine
 Keller, Rudolf; zoology
 Kerl, Wilhelm (1880 Vienna, A – 1945 Vienna, A); dermatology
 Kestner, Otto (1873–1953); physiology
 Kirchberger, Margarete (1882–1953); geography
 Kisch, Bruno (1890–1966); physiology, cardiology, medical biochemistry
 Kisch, Enoch H. (1841–1914); internal medicine

- Klaften, Emanuel (1892 Brody – 1971 New York, USA); gynaecology
 Klein, Bruno (1879 Raycza near Bielitz, A – 1954 Vienna, A); dentistry
 Klemperer, Felix (1866–1932); medicine, internal medicine
 Klemperer, Georg (1865–1946); metabolic pathology
 Klopstock, Alfred (1896–1968); serology
 Knöpfelmacher, Wilhelm (1866 Boskowitz – 1938 Vienna, A); paediatrics
 Köbner, Heinrich (1838–1904); dermatology
 Kochmann, Martin (1878–1936); pharmacology
 Koenigsberger, Leo (1837–1921); mathematics
 Köhler, Robert (1884 Vienna, A – 1955 New York, USA); gynaecology
 Kohn, Albert (1857–1926); social hygiene, Pioneer of Public Health
 Kohn, Alfred (b. 1867); zoology, histology, Professor at the German University in Prague
 Kohn, Gustav; mathematics
 Kohn, Hans (b. 1866); internal medicine, pathology, anatomy
 Kohn, Moritz (b. 1878); organic chemistry
 Koller, Carl (1857 Schüttenhofen, Böhmen – 1944); pharmacology
 Königsberger, Leo (1837–1922); mathematics
 Königstein, Hans (b. 1878 Vienna, A); dermatology
 Koppel, Ivan (b. 1873 or 1867); organic chemistry
 Korn, Arthur (1870–1945); physics
 Kornfeld, Gertrud (1891 Prague – 1955 Rochester, USA); physical chemistry
 Krasso, Hugo (b. 1893 Toplecz); internal medicine
 Kraus, Rudolf (1868 Böhmen – 1931); bacteriology, zoology
 Krebs, Hans (1900 Hildesheim, G – 1981 Oxford, GB); medical biochemistry, Nobel Prize in Medicine 1953
 Kristeller, Samuel (1820–1900); gynaecology
 Kronecker, Hugo (1839–1914); zoology, physiology
 Kronecker, Leopold (1823–1891); mathematics
 Kröpelin, Hans (1901–1993); physical chemistry
 Kuczynski, Max H. (b. 1890); virology, bacteriology
 Kuczynski, Robert René (1876–1947); statistics
 Kurtenacker, Albin (1886–1942); organic chemistry
 Kuttner, Leopold (b. 1866); internal medicine
- Lachmann; internal medicine
 Ladenburg, Albert (1842–1911); chemistry
 Ladenburg, Erich (1878–1908); physics
 Ladenburg, Rudolf (1882–1952); physics
 Landau, Edmund (1871 Berlin, G – 1938 Berlin, G); mathematics
 Landau, Leopold (1848–1920); gynaecology, professor of gynaecology in Berlin
 Landau, Theodor (1861–1937); gynaecology, professor of gynaecology in Breslau
 Landsberger, Richard (1864–after 1936); dentistry, pathology
 Landsteiner, Karl (1868 Vienna, A – 1943 New York, USA); biochemistry, medicine, Nobel Prize in Medicine 1930
 Lange, E.; physics
 Langer, Erich; dermatology
 Langstein, Leo; 1876–1933 paediatrics

- Laqueur, August (b. 1875); internal medicine
Laser, Hans (1899–1980); medical biochemistry
Lassar, Oscar (1849–1907); pathology
Lassar-Cohn, Ernst (1858–1922); chemistry
Laub, Jakob (1882–1962); physics
Lazarus, Adolf (b. 1867); internal medicine
Lazarus, Julius (b. 1847); internal medicine
Lazarus, Paul (b. 1873); internal medicine
Lebert, Hermann (1813–1878); internal medicine, pathology
Lederer, Edgar (b. 1908); organic chemistry
Lederer, Richard (b. 1885 Karlsbad); paediatrics
Lehmann, Hermann; medical biochemistry
Lehndorff, Heinrich (1877 Vienna, A – 1965 New York, USA); paediatrics
Leidler, Rudolf (1880 Prague – 1938 Vienna, A); otology
Leimdorfer, Alfred (1885 Hohenau – 1956); internal medicine
Lemberg, Rudolf (1896–1975); organic chemistry
Lenel, Fritz Victor (b. 1907); materials science, professor of materials science in Trocy, New York
Lenk, Robert (1885 Weinberge near Prague); medical radiology
Less, Emil; meteorology
Lesser, Edmund (1852–1918); dermatology
Lesser, Ernst Joseph (1879–1928); internal medicine
Lesser, Ludwig (b. 1869); botany
Levi, Friedrich (1888 Mühlhausen, G – 1966 Freiburg, G); mathematics
Levi, Hilde; physical chemistry
Levinsohn, Georg (b. 1867); ophthalmology
Levinstein, Eduard (1831–1882); neurology
Levinthal, Walter; bacteriology
Levy-Dorn, Max (1863–1929); internal medicine
Lewald, Friedrich (1796–1858); statistics, economy, politician, city councillor in Breslau
Lewandowsky, Max (b. 1876); neurology
Lewin, Georg (1820–1896); otorhinolaryngology
Lewin, Louis (1850–1929); toxicology, pharmacology
Lewy, F.H.; neurology
Lichtenberg, Alexander (born around 1880); urology
Lichtenstein, Leon (1878–1933); mathematics
Lichtheim, Ludwig (1845–1928); bacteriology, internal medicine
Lichtwitz, Leopold (b. 1876); internal medicine
Lieben, Adolf (1836–1914); chemistry
Lieben, Fritz (1890 Vienna, A – 1966 Vienna, A); medical chemistry
Lieben, Robert von (1878 Vienna, A – 1913 Vienna, A); physics, inventor
Liebermann, Hans (1876–1939); chemistry, organic chemistry, professor of chemistry at the Technical University Berlin
Liebermann, Karl (1842–1914); chemistry, dye chemistry
Liebesny, Paul (1881 Vienna, A – 1962 Washington, USA); physiology
Liebreich, Matthias Eugen Oscar (1839–1908); pharmacology, University of Berlin
Liebreich, Oscar (1839–1908); chemistry, veterinary medicine, pharmacology

- Liebreich, Richard (1830–1917); ophthalmology
 Liepmann, Hugo Karl; neurology
 Liepmann, Wilhelm (b. 1878); gynaecology
 Lipmann, Fritz (1899–1986); medical biochemistry
 Lippay, Franz (b. 1897 Vienna, A); physiology
 Lippmann, Edmund von (1857 Vienna, A – 1940 Halle, G); chemistry
 Lipschitz (Lindley), Werner (1892–1948); pharmacology
 Lipschütz, Benjamin (1878–1931); dermatology
 Litten, Moritz (1845–1907); internal medicine
 Loeb, Jacques (1859–1924); physiology, biology
 Loeb, Leo (1869–1959); pathology, professor of pathology in Washington
 Loeb, Leonard Benedict (1891–1973); physics, professor of physics in Berkeley
 Loewe, Fritz (1895–1974); meteorology
 Loewenherz, Leopold (1847–1892); physics, promoter of fine mechanics
 Loewenstein, O.; neurology
 Loewi, Otto (1873 Frankfurt, G – 1961 New York, USA); pharmacology,
 physiology, professor of pharmacology in Graz, Nobel Prize in Medicine 1936
 Loewit, Moritz (1851–1918); pathology
 Loewy, Adolf; internal medicine
 Loewy, Alfred (1873–1935); mathematics
 Loewy, Julius (b. 1885); hygiene
 London, Heinz (1907 Bonn, G – 1970 Cumnor Hill, GB); physics
 London, Franz (1863–1917); mathematics, professor of mathematics in Bonn
 London, Fritz (1900 Breslau, G – 1954 Durham, USA); physics
 Löwe, Siegfried Walter (1884–1963); pharmacology
 Löwenbein, Adalbert (b. 1893); organic chemistry
 Löwenstein, Ernst (1878 Karlsbad – 1950 Berkeley, USA); pathology, bacteriology
 Löwenstein, Leo (1879–1956); chemistry, physics, Jewish official
 Löwy, Alfred (1873–1935); mathematics
 Löwy, Maurice (1833 Preßburg-Bratislava – 1907 Paris, F); astronomy
 Lubarsch, Otto (1860–1933); anatomy
 Ludwig (Cohn), Hermann (1838–1906); ophthalmology, professor of ophthalmology
 in Breslau
 Lunge, Georg (1839–1923); chemistry
 Lustig, Ernst (b. 1921); chemistry
- Machlup, Stefan (b. 1927); physics, professor of physics in Cleveland
 Magnus, Heinrich Gustav (1802–1870 Berlin, G); physics
 Magnus, Ludwig Immanuel (1790–1861); mathematics
 Magnus, Paul Wilhelm (1844 Berlin, G – 1914 Berlin, G); botany
 Magnus, Rudolf (1873–1927); zoology
 Magnus, Werner (1876–1942); botany, professor of botany in Berlin
 Magnus-Levy, Adolf (b. 1865); internal medicine
 Mandl, Felix (1892 Brünn – 1957 Vienna, A); surgery
 Marburg, Otto (1874 Römerstadt – 1948 New York, USA); neurology
 Marckwald, Willy (1864 Jakobskirch, G – 1942 Rolandia, Brazil); chemistry
 Marcus, Ernst-G. (1893–1968); zoology
 Marcuse, Adolf (1860–1933); astronomy

- Marcuse, Max (1877–1963); sexual research
- Margalith, Pinchas (b. 1926); microbiology in Haifa
- Margules, Max (1856–1920); meteorologygeophysicsVienna
- Mark, Hermann Franz (1895 Vienna, A); physical chemistry
- Marx, Walter (b. 1897); organic chemistry
- Mautner, Hans (1886 Budweis – 1963 Boston, USA); paediatrics
- Mayer, Edmund; pathology
- Meirowsky, Emil (b. 1876); dermatology
- Meitner, Lise (1878 Vienna, A – 1980 Cambridge, GB); physics
- Melamid, Alexander (1914, Freiburg, G – 2001 New York, USA); geography,
professor of geography of economy in New York
- Melamid, Michael (1882 or 1883–1950); industrial chemistry
- Melchior, Eduard; surgery
- Mendel, Bruno (1897–1959); pharmacology
- Mendelssohn, Bartholdy Paul (1879–1956); chemistry
- Mendelssohn, Georg Benjamin (1794–1874); geography
- Mendelssohn, Kurt A. (1906 Berlin, G – 1980 Oxford, GB); physics
- Menzel, Karl Moritz (1873 Mistelbach – 1944 Bruxelles, Belgium);
rhinolaryngology
- Merton, Hugo (1879–1954); zoology
- Meyer, Edgar (1879–1960); physics
- Meyer, Edmund; otorhinolaryngology
- Meyer, Erich (b. 1874); internal medicine
- Meyer, Fritz; infectiology
- Meyer, H.H.; zoology
- Meyer, Hans (1871–1942); chemistry, constitution research, professor in Prague
- Meyer, Karl (b. 1899); medical biochemistry
- Meyer, Ludwig F. (b. 1879 Tel Aviv, Israel); paediatrics
- Meyer, Max; neurology
- Meyer, Richard (1846–1926); chemistry
- Meyer, Richard Joseph (1865–1939 or 1942); chemistry, organic chemistry
- Meyer, Robert; gynaecology
- Meyer, Stefan (1872–1950); chemistry
- Meyer, Victor (1848–1897); chemistry
- Meyerhof, Otto (1884–1951); biochemistry, physiology, Nobel Prize in Medicine
1922
- Meyerhof, Walter Ernst (1922 Kiel, G); physics; son of Otto Meyerhof, professor of
physics in Stanford
- Michael, Ernst Arthur (b. 1925); mathematics
- Michaelis, Leonor (1875–1949); chemistry, physiology
- Michaelis, Max Hugo; physiological chemistry
- Michelson, Albert Abraham (1852 Strelno, Posen – 1931 Pasadena, USA); physics
- Minkowski, Hermann (1864 Aleksotas bei Kowno – 1909 Göttingen, G); physics,
mathematics
- Minkowski, Oskar (1858 Kowno -1931); internal medicine
- Mises, Richard Edler von (1883 Lemberg, A – 1953 Boston, USA); physics,
mathematics
- Mond, Ludwig (1839 Kassel, G – 1909); chemistry, industrialist

- Moos, Salomon (1830–1895); otorhinolaryngology
 Morgenroth, Julius (1871–1924); bacteriology, medicine, immunology, Co-founder of chemotherapy
 Moszkowicz, Ludwig (1873 Krakau – 1945 Vienna, A); surgery
 Motzkin, Theodor Samuel (1908–1970); mathematics
 Mühsam, Richard; surgery
 Müller-Deham, Albert (1881 Vienna, A – 1971 Santa Barbara, USA); internal medicine
 Munk, Felix Baruch (b. 1903); chemistry
 Munk, Hermann (1839 Posen – 1912 Berlin, G); physiology, zoology
 Munk, Immanuel (1852–1903); physiology, professor of physiology in Berlin
 Munk, Siegmund; pathology
 Münzesheimer, Fritz; dentistry
- Nachmansohn, David (1899–1983); physiology, biochemistry
 Nagelschmidt, Franz; internal medicine
 Natanson, Wladyslaw; botany
 Nathan, Ernst; dermatology
 Necheles, Heinrich (1897–1979); physiology, zoology
 Neisser, Albert (1855–1916); dermatology
 Neisser, Max (1869–1938); hygiene, bacteriology
 Neuberg, Carl (1877 Hannover, G – 1956 New York, USA); biochemistry
 Neuberg-Rabinowitsch, Irene Stephanie (1908–1994); biochemistry, daughter of Carl Neuberg
 Neuburger, Camillo (b. 1900); physics, x-ray research
 Neumann, Heinrich (1873 Hethars – 1939 New York, USA); otology
 Neumann, Heinrich (b. 1864); otorhinolaryngology
 Neumann, Isidor; dermatology
 Neumann, Johann von (1903–1957); mathematics
 Neumann, Salomon (1819–1908); social hygiene
 Neumann, Samuel (died in the twentieth century); mathematics, bank officer, social democrat
- Neurath, Hans (1909 Vienna, A – 2002 Seattle, USA); biochemistry
 Neurath, Rudolf (1869 Vienna, A – 1948 New York, USA); paediatrics
 Nicolaier, Arthur; physiological chemistry
 Nirenstein, Ernst; zoology, cell physiology
 Nissen, Rudolf (1896–1981); surgery
 Nobel, Edmund (1883 Esztergom – 1946 London, GB); paediatrics
 Noether, Alfred (1883–1918); chemistry
 Noether, Emmy (1882 Erlangen, G – 1935 Bryn Mawr, USA); mathematics
 Noether, Fritz (1884 Erlangen, G – 1941 arrested and disappeared); mathematics
 Noether, Gottfried (1915–1991); statistics
 Noether, Max (1844–1921); mathematics
 Nothmann, Max; internal medicine
 Novak, Josef (1879 Hostomitz, Böhmen – 1963); gynaecology
 Nußbaum, Julius; zoology
 Nußbaum, Willi; genetics

- Oppenheim, Albin (1875 Brünn – 1945 Los Angeles, USA); dentistry
Oppenheim, Hermann; neurology
Oppenheim, Leo Paul (1863 Berlin, G – 1934 Berlin, G); naturalist
Oppenheim, Martin; anthropology
Oppenheim, Moritz (1876 Vienna, A – 1949 Chicago, USA); dermatology
Oppenheim, Samuel (1857–1928); astronomy
Oppenheimer, Chanan (1905–1978); plant physiology
Oppenheimer, Carl (1874 Berlin, G – 1941 The Hague, NL); biochemistry, chemistry, professor at the Agricultural University in Berlin
Oppenheimer, Hillel (b. 1899); plant physiology, gardening
Oppenheimer, Robert (b. 1904); nuclear physics
Oppolzer, Robert (1899 Prague – 1972 Vienna, A); surgery
Orbán, Bálint (1899 Temesvár – 1960); dentistry
Oser, Leopold (b. 1839); pathology
Ostriwski, Alexander (b. 1893); mathematics
- Pagel, Walter (1898–1983); medical history, pathology
Paneth, Friedrich A. (1887 Vienna, A – 1958 Vienna, A); organic chemistry
Panofsky, Hans (1917–1988); meteorology
Panofsky, Wolfgang (b. 1919 Berlin, G); physics, professor of physics in Stanford
Pappenheim, Arthur (1870–1916); haematology, internal medicine
Pappenheim, Martin (1881 Preßburg – 1943 Tel Aviv, I); neurology, psychiatry
Pappenheim, Samuel Moritz (1811–1882); physiology
Pasch, Moritz (1843 Breslau, G – 1930 Hamburg, G); mathematics, professor of mathematics in Gießen
Paschkis, Rudolf (1879 Vienna, A – 1964 New York, USA); urology
Pauli, Wolfgang Josef (1900 Vienna, A – 1958 Zürich, CH); physics, Nobel Prize in Physics 1945
Peierls, Rudolf E. (Sir) (1907 Berlin, G – 1995 Oxford, GB); physics, nuclear physics
Peritz, G.; neurology
Perles, Max (1867–1894); ophthalmology, bacteriology
Perutz, Max (1914 Vienna, A – 2002 Cambridge, UK); organic chemistry, Nobel Prize in Chemistry 1962
Péter, Franz (1889 Szentes, HU – 1963 Vienna, A); dentistry
Peterfi, Tibor (1883–1953); cytology
Philip, Ursula (b. 1908); zoology, genetics
Philippson, Alfred (1864–1953); geography
Philippson, Maurice (1877–1938); physiology, zoology
Pick, Alois (b. 1859); internal medicine
Pick, Arnold (1851–1924); pathology, neurology
Pick, Ernst Peter (1872 Jaromer, Böhmen – 1960 New York, USA); pharmacology
Pick, Friedel (1867–1926); internal medicine
Pick, Georg (1859–1942); mathematics
Pick, Ludwig (1868–1944); pathology
Pick, Philipp Joseph (1834–1910); dermatology
Pilcz, Alexander (1871 Graz, A – 1954 Vienna, A); neurology, psychiatry
Pincussen, Ludwig; physiological chemistry, Biochemical Department of the Urban Clinic

- Pinkus, Felix (b. 1868); dermatology, pathology
Pinner, Adolf; chemistry, veterinary medicine
Plaut, Hugo Carl (1858–1928); bacteriology, mycology
Plesch, Johann (1878–1957); internal medicine
Pleschner, Hans Gallus (1883 Karlsbad – 1950 Seefeld); urology
Plessner, Abraham Ezechiel (1900–1961); mathematics
Pohl, Julius (1861–1942); pharmacology
Polanyi, John Charles (1929 Berlin, G); physical chemistry, professor of chemistry at the TH Berlin, Nobel Prize in Chemistry 1986
Polanyi, Michael (1891 (Budapest, HU – 1976 Oxford, GB); physical chemistry, philosophy
Politzer, Adam (1835–1920); otorhinolaryngology
Politzer, Georg (1898 Vienna, A – 1956 Vienna, A); embryology
Poll, Heinrich (b. 1877); genetics
Pollack, Amalie (1879–1956); physics
Pollak, Eugen (1890 Bielitz, A – 1953 Manchester, GB); neuroanatomy, neuropathology
Pollak, Jacob (1872–1942); organic chemistry
Pollak, Leo (1878 Prague – 1946 London, GB); internal medicine
Polya, Georg (1887 Budapest – 1985); mathematics
Popper, Hans (1903–1988); hepatology
Popper, Hugo (b. 1879 Vienna, A); internal medicine
Porges von Portheim, Leopold (1869–1947); plant physiology
Porges, Karl Gustav (1920 Vienna, A); nuclear physics, professor of nuclear physics in Troy, USA
Porges, Otto (1879 Brandeis an der Elbe – 1968 Chicago, USA); internal medicine
Posener, Ludwig (1902–1978); statistics
Posner, Carl (1854–1928); urology
Prausnitz, Carl (1876–1963); hygiene, bacteriology
Prausnitz, Wilhelm; hygiene
Pribram, Alfred (1841–1912); pathology, professor in Prague
Pribram, Bruno (b. 1887); surgery
Pribram, Ernst August (1879–1940); bacteriology
Pribram, Richard (1847–1928); chemistry
Pringsheim, Alfred (1850 Ohlau, G – 1941 Zürich, CH); mathematics
Pringsheim, Ernst (1881–1970); botany
Pringsheim, Hans (1876–1942); organic chemistry
Pringsheim, Nathanael (1823–1894); botany, professor of botany in Jena
Pringsheim, Peter (1881 Munich, G – 1963 Antwerpen, B); physics
Przibram, Hans (1874–1944); zoology
Przibram, Karl (1878 Vienna, A – 1973 Vienna, A); physics

Rabinowitch, Eugene (1901 St. Petersburg, Russia – 1973 Washington, USA); chemistry
Rabinowitsch-Kempner, Lydia (1871–1935); bacteriology
Rapaport, Samuel M. (b. 1912 Woloczysk, Russia); biochemistry
Rauch, Maximilian (b. 1868 Czernowitz); otology
Raudnitz, Harry (b. 1899); organic chemistry

- Rawitz, Bernhard (d. 1932); histology, veterinary medicine
Reach, Felix (1872 Prague – 1943 KZ Theresienstadt); physiology
Redlich, Emil (1866–1930); neurology
Redlich, Otto (1896 Vienna, A – 1978 Berkeley, USA); physical chemistry
Reinach, Zacharias Jerrold Reinach (b. 1905); nuclear physics
Reis, Alfred (1882–1951); physical chemistry
Reiss, Eduard (b. 1878); neurology
Remak, Robert (1815–1865); medicine, embryology, professor of medicine in Berlin
Remak, Robert (1888 Berlin, G – 1942 Ausschwitz?); mathematics, national economy
Rheinboldt, Heinrich (1891 Karlsruhe, G – 1955 Sao Paolo, Brazil); organic chemistry
Richter, Friedrich Paul; internal medicine
Riesenfeld, Ernst (1877–1957); organic chemistry
Rieß, Peter Theophil (1804 or 1805–1883); physics
Rießler, Otto (b. 1882); pharmacology
Romberg, Ernst von (1865–1933); internal medicine
Romberg, Moritz Heinrich (1795–1873); neurology
Rona, Elisabeth (1890 Budapest, HU – 1981 Oak Ridge, USA); chemistry
Rona, Peter (1871 Budapest – 1945 Berlin, G); chemistry, medical biochemistry, Pathological Department of Charité in Berlin
Rosanes, Jacob (1842–1922); mathematics
Rose, Maximilian; neurology
Rosen, Boris (b. 1900); physical chemistry
Rosenbach, Ottomar (1851–1907); internal medicine
Rosenbaum, Julius; dermatology
Rosenheim, Arthur (1865–1942); chemistry, physical chemistry
Rosenheim, Theodor; internal medicine
Rosenstein, Samuel Siegmund (1832–1906); internal medicine
Rosenstein, Arthur; inorganic chemistry
Rosenthal, Arthur (1887 Fürth, G – 1959 Lafayette, USA); mathematics
Rosenthal, Isidor (1836–1915); physiology
Rosenthal, Moritz (1833–1889); neurology
Rosin, Heinrich (b. 1863); internal medicine, professor of internal medicine at the University of Berlin
Rothberger, Carl Julius (1871 Vienna, A – 1945 Vienna, A); pathology
Rothmann, Max; neurology, neurosurgery
Rothschild, Paul (1901–1965); medical biochemistry
Rothschild, Walter Freiherr von (1868–1937); zoology
Rubens, Heinrich (1865–1922); physics
Rudenberg, Gunther (b. 1920); physics, electrical engineering
Rudenberg, Hermann (1927–1994); physiology
Ruttin, Erich (1880 Bielitz – 1940 Vienna, A); otology

Saalschütz, Louis (1835 Königsberg, G – 1913 Königsberg, G); mathematics
Sachs, Hans (1877–1945); serology, immunology, cancer research
Sachs, Heinrich; dentistry
Sachs, Julius (1832–1897); botany

- Sackur, Otto (1880–1914); chemistry, physical chemistry, co-worker of Fritz Haber
Saenger, Max (b. 1853); gynaecology
Safar, Karl (1892 Vienna, A – 1963); ophthalmology
Sallmann, Ludwig J.K. (1892 Vienna, A); ophthalmology
Salomon-Calvi, Wilhelm (b. 1868); geophysics
Samuel, Simon (1833–1899); pathology, University of Königsberg
Saxl, Alfred (1877 Vienna, A – 1962 Vienna, A); orthopaedic surgery
Schacherl, Max (1876 Vienna, A – 1964 Vienna, A); neurology
Schapira, Hermann (1840–1898); mathematics, rabbi
Scheff, Georg (b. 1897); physiology
Schenk, Fritz (1874 Vienna, A – 1942 KZ Theresienstadt); dentistry
Schenk, Samuel Leopold (1840–1902); zoology
Scherf, David (1899 Kimpolung, Rumania – 1977 New York, USA); internal medicine
Schick, Bela; pediatrics
Schiemann, Günther (1899–1967); organic chemistry
Schiff, Moritz (1823 or 1803–1896); physiology
Schiff, Arthur (1871 Vienna, A – 1953 Vienna, A); internal medicine
Schiff, Erwin (b. 1891); internal medicine, pediatrics
Schiff, Fritz; serology
Schiff, Hugo (1834–1915); chemistry
Schiff, Robert (1854–1949); chemistry
Schiffmann, Josef (1879 Vienna, A – 1944 Vienna, A); gynaecology
Schilder, Paul (1886 Vienna, A – 1940 New York, USA); neurology, psychiatry
Schlander, Emil (b. 1888 Oberburg bei Cilli); otorhinolaryngology
Schleich, Hans; organic chemistry
Schlesinger, Hermann (b. 1866); internal medicine
Schlesinger, Ludwig (1864–1933); mathematics
Schlesinger, Wilhelm (1869 Vienna, A – 1947 Grenoble, F); internal medicine
Schloßmann, Arthur (1867–1932); pediatrics
Schneidemühl, Georg; veterinary medicine
Schoenflies, Arthur Moritz (1853–1928); mathematics
Schönberg, Alexander (b. 1892); organic chemistry
Schönheimer, Rudolf (1898 Freiburg, G – 1941 New York, USA); medical biochemistry
Schück, Franz; surgery
Schück-Breslauer, Franz (b. 1888); brain surgery, professor of brain surgery in Berlin
Schüller, Artur (1874 Vienna, A – 1957 Melbourne, Australia); neurology, psychiatry
Schur, Heinrich (1871 Nachod – 1953 Vienna, A); internal medicine
Schur, Issai (1875 Mohilew, Russia – 1941 Tel Aviv, I); mathematics
Schuster, Arthur (Sir) (1851 Frankfurt a.M., G – 1934); physics
Schuster, Paul (b. 1867); neurology
Schwab, Georg-Maria (1899 Berlin, G – 1984 Munich, G); physical chemistry
Schwarz (Evenari), Walter (Michael) (1904–1989); botany
Schwarz, Gottwald (1880 Brünn – 1959 New York, USA); medical radiology
Schwarz, Heinrich (1899 Mährisch Ostrau, A); internal medicine
Schwarz, Oswald (1883 Brünn – 1949 London, GB); urology
Schwarzschild, Karl (1873–1916); astronomy

- Seidel, Felix (b. 1897); organic chemistry
- Seligmann, Erich; hygiene
- Seligsberger, Ludwig (b. 1904); organic chemistry
- Semon, Felix (1849 Danzig, G – 1921); otorhinolaryngology
- Semon, Richard (1859–1919); physiology, zoology
- Senator, Hermann (1834–1911); internal medicine
- Seybert, Viktor (1866–1924); medicine, pharmacy
- Sgalitzer, Max (1884 Prague – 1973 Princeton, USA); medical radiology
- Sicher, Harry (1889 Vienna, A – 1974 USA); dentistry
- Silberstein, Friedrich (1888 Teschen – 1975 Perth, Australia); pathology
- Simha, Robert (1912 Vienna, A); chemistry
- Simon, Ernst Eytan (b. 1893); biochemistry
- Simon, Franz Eugen (Francis) (1893 Breslau, G – 1956 Oxford, GB); nuclear physics, low temperature physics, physical chemistry
- Simon, Siegfried Veit (b. 1877); botany, professor in Bonn
- Singer, Richard (b. 1894 Witkowitz); internal medicine
- Sobernheim, Georg (b. 1865); bacteriology, veterinary medicine
- Söllner, Karl (b. 1903 Berlin, G); physical chemistry
- Sorauer, Paul (1839–1916); botany
- Speyer, Edmund (b. 1878); organic chemistry
- Spiegel, Ernst Adolf (1895 Vienna, A – 1985 Philadelphia, USA); neuroanatomy; neurophysiology
- Spiegel-Adolf, Anna Simona (1893 Vienna, A – 1983 Philadelphia, USA); applied medical chemistry
- Spiegelberg, Otto (1830–1881); gynaecology
- Spiro, Karl (1867–1932); biochemistry
- Spitzer, Alexander (1868 Miskolc, HU – 1942 KZ Theresienstadt); neuroanatomy, neuropathology
- Spitzer, Bertold (1878 Deutsch-Liebau); dentistry
- Springer, Ursula (1924); genetics
- Stammreich, Hans; physical chemistry
- Starkenstein, Emil (1884 Ronsberg, A – 1940 KZ Mauthausen); pharmacology
- Stein, Conrad (1870 Prague – 1940 Brindisi); otology
- Stein, Robert Otto (1880 Vienna, A – 1951 Vienna, A); dermatology
- Steiner, Werner (b. 1896); physical chemistry
- Steinitz, Ernst (1871–1928); mathematics, founder of modern abstract algebra
- Steinitz, Kurt (1907 Breslau, G – 1966 Petah Tikva, I); biochemistry
- Steinitz, Walter (b. 1882); zoology
- Stengel, Erwin (1902 Vienna, A – 1973 Sheffield, GB); neurology, psychiatry
- Stern, Curt (1902 Hamburg, G – 1981 Sacramento, USA); zoology, genetics
- Stern, Hugo (1875 Prague – 1941 Nizza, F); rhinology
- Stern, Kurt G. (1904 Tilsit, G – 1956 London, GB); biochemistry
- Stern, Kurt; botany
- Stern, Moritz Abraham (1807–1894); mathematics, number and progression theory, student of K. F. Gauß
- Stern, Otto (1888 Sohrau, G – 1969 Berkeley, USA); physical chemistry, physics
- Stern, Richard (b. 1878 Vienna, A); neuropathology
- Stern, Richard (d. 1911); internal medicine

- Stern, Rudolf; internal medicine
Sternberg, Carl (1872–1935); pathology
Stiasny; chemistry Darmstadt
Stilling, Benedikt (1810–1879); anatomy physiology, surgery
Stilling, Jacob (1842–1915); ophthalmology, professor of ophthalmology
Stoerk, Karl (1832–1899); otorhinolaryngology
Stransky, Erwin (1877 Vienna, A – 1962 Vienna, A); psychiatry, neurology
Strasser, Alois (1867 Budapest – 1945 Vienna, A); internal medicine
Straßmann, Paul (1866–1933); gynaecology
Straus, Erwin (b. 1891); neurology
Straus, Fritz (1877–1942 Pisagh, USA); organic chemistry
Strauß, Hermann (b. 1868); internal medicine
Sträussler, Ernst (1872 Hung. Hradisch – 1959 Vienna, A); psychiatry, neuroanatomy
Stricker, Salomon (1834–1898); pathology
Strisower, Rudolf Martin (b. 1886 Jaroslau); internal medicine
Suess, Eduard (1831 London, GB – 1914 Vienna, A); geophysics
Szegö, Gabor or Gabriel (1895 Kunhegyes, HU – 1985 Palo Alto, USA);
 mathematics
Szilard, Leo (1889 Budapest – 1964 La Jolla, USA); physics
- Tandler, Julius; hygiene in Vienna
Teller, Edward; 1908 Budapest, HU – 2003 Stanford, USA); physics, inventor of the
 hydrogen bomb
Thannhauser, J.; physiology
Toeplitz, Otto (1881 Breslau, G – 1951 Jerusalem, I); mathematics
Traube, Isidor (1860–1943); biochemistry, physical chemistry, Professor Technical
 University in Berlin
Traube, Ludwig (1816 or 1818–1876); internal medicine, pathology
Traube, Ludwig; zoology
Traube, Wilhelm (1866–1942); organic chemistry
Tuerck, Ludwig (1810–1860); otorhinolaryngology
Tuerkheim, Hans; dentistry
- Ubisch, Gerta von (1882–1965); botany, genetics
Ubisch, Leopold von (1886–1965); zoology
Unger, Ernst; surgery
Unna, Paul Gerson (1850–1929); dermatology, biochemistry
Unna, Peter; dermatology
Urbach, Erich (1893 Vienna, A – 1946 Philadelphia, USA); dermatology
- Valentin, Gabriel Gustav (1802 or 1810–1883); physiology
Volk, Richard (1876 Lundenburg – 1943 Mexico City, Mexico); dermatology
- Waelsch, Heinrich B. (1905–1966); medical biochemistry
Wagner, Richard (1887 Vienna, A – 1974 Cambridge, USA); paediatrics
Waldenburg, Ludwig (d. 1881); pneumology
Wallach, Otto (1847 Königsberg, G – 1931); chemistry
Wallenberg, Hans (b. 1880); neurology

- Warburg, Emil (1846 Altona, G – 1931 Berlin, G); physics, father of Otto H.
Warburg
Warburg, Otto (1859 Hamburg, G – 1938 Berlin, G); botany, professor of botany in Berlin
Warburg, Otto H. (1883 Freiburg i. Br., G – 1970 Berlin, G); biochemistry, Nobel Prize in Medicine 1931
Wasicky, Richard Balthasar (1884 Teschen – 1970 Sao Paulo, Brazil); pharmacognosy
Wassermann, Albert (1901 Vienna, A – 1971 London, GB); organic chemistry
Wassermann, August von (1866–1925); bacteriology, serology, chemistry
Wechselmann, Wilhelm; dermatology
Weichbrodt, Raphael (b. 1886); serology
Weidenreich, Franz; anthropology, University of Frankfurt
Weigert, Carl (1845–1904); anatomy, zoology
Weigert, Fritz (1876 Berlin, G – 1947 Northwood, GB); physical chemistry
Weil, Edmund (1879–1922); bacteriology
Weil, George Leon (b. 1907); nuclear physics
Weinberg, Arthur von (1860–1943); chemistry
Weinberger, Maximilian (1875 Schaffa – 1954 New York, USA); internal medicine
Weinstein, Max Bernhard; theoretical physics
Weiss, Joseph J. (1905 Vienna, A – 1972 Newcastle, GB); physical chemistry
Weiß, Paul (b.1898); zoology
Weißberger, Arnold (1898 Chemnitz, G – 1984 Rochester, USA); organic chemistry
Weißenberg, Karl; chemistry
Weisskopf, Viktor Frederick (1908 Vienna, A – 2002 New York, USA); nuclear physics
Wertheim, Ernst (1864–1920); gynaecology
Wertheimer, Ernst (1893 Bühl, G – 1978 Jerusalem, I); physiological chemistry, medical biochemistry; University of Jerusalem
Weyl, Theodor (b. 1851); bacteriology
Wiesner, Julius Ritter von (1838 Tschechen bei Neu-Raussnitz in Mähren – 1916 Vienna, A); botany
Wiesner, Richard (1875 Vienna, A – 1954 Vienna, A); pathological anatomy
Wiethe, Camillo (1889 Vienna, A – 1949 Vienna, A); otorhinolaryngology
Wigner, Eugene (b. 1902 Hungary, died in the USA); nuclear physics
Willheim, Robert (b. 1885 Krakau); medical chemistry
Willstätter, Richard (1872 Karlsruhe, G – 1942 Locarno, CH); chemistry, organic chemistry, Nobel Prize in Chemistry 1915
Winternitz, Wilhelm von (1834–1917); internal medicine
Winterstein, Hans (1879 Prague); biochemistry, Professor in Breslau
Wohl, Alfred (1863 Graudenz, G – 1939 Stockholm, Sweden); organic chemistry
Wohl, Kurt (1896 Berlin, G – 1962 Newark, USA); physical chemistry
Wöhler, Lothar (1870–1952); organic chemistry
Wohlgemuth, Julius; physiological chemistry, Chemical Department of the Virchow Clinic
Wolf, Ludwig (b. 1891); organic chemistry
Wolff, Julius (1836–1903); surgery
Wolff, Max; bacteriology
Wolff-Eisner, A.; bacteriology

Wolffenstein, Richard (b. 1864); chemistry

Zabludowski, Isidor; surgery

Zak, Emil (b.1877 Brünn); internal medicine

Zappert, Julius; pediatrics

Zdansky, Erich (1893 Vienna, A – 1978 Basel, CH); medical radiology

Zeißl, Hermann (1817–1884); dermatology

Zollschan, Ignaz (b.1877); anthropology

Zondek, Bernhard (b.1891); gynaecology

Zondek, Hermann (b. 1887); internal medicine

Zondek, Samuel Georg (b. 1894, Wronke, died in Tel Aviv, I); biochemistry, internal medicine

Zuckerandl, Emil (1849–1910); dentistry, anatomy, brain pathology

Zuelzer, Georg; internal medicine

Zuntz, Nathan (1847–1920); physiology

Zweig, Walter (1872 Brünn – 1953 Oxford, GB); internal medicine

Notes on Contributors

Ulrich Charpa is research professor at the Leo Baeck Institute London, professor of philosophy at the Ruhr-Universität Bochum, and reader in intellectual history at the University of Sussex. He is author of many articles and several books on philosophy and history of science, including *Philosophische Wissenschaftshistorie* (1995), *Grundfragen der Wissenschaftsphilosophie* (1996), and *Wissen und Handeln – Grundzüge einer Forschungstheorie* (2001).

Ute Deichmann is research professor at the Leo Baeck Institute London, research group leader (History of the Biological and Chemical Sciences) at the Institute of Genetics, University of Cologne, and research reader in intellectual history at the University of Sussex. She is author of *Biologists under Hitler* (1992; 1996), *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker im Nationalsozialismus* (2001), and of many articles in the history of biology and chemistry. She was awarded the Ladislaus Laszt Award of Ben Gurion University of the Negev in Beer Sheva, Israel (1995) and the Gmelin Beilstein Medal of the *Gesellschaft Deutscher Chemiker* (2005).

Moritz Epple is professor of history of science at the University of Frankfurt am Main. He studied physics, mathematics and philosophy in Tübingen, Copenhagen and London. After obtaining a doctorate in mathematics at the University of Tübingen in 1991 he focussed on the history of the mathematical sciences. His habilitation thesis was published as *Die Entstehung der Knotentheorie: Kontexte und Konstruktionen einer modernen mathematischen Theorie* (1999). His main research interests concern the history of topology, the interactions between physics and mathematics, the history of the philosophy of mathematics and the role of mathematics in modern society. He is editor of volume 6 of Felix Hausdorff's *Collected Works* containing writings and manuscripts on space, time, and geometry.

Raphael Falk is professor emeritus of genetics at the Hebrew University of Jerusalem. Beginning in 1953, he studied the effects of X-ray induced mutations in *Drosophila melanogaster*, mutation loads in populations, chromosome organisation in *Drosophila*, and mutations affecting development in *Drosophila*. Since 1983 he has been writing on concepts in genetics and evolution, history of genetic analysis, and genetics and society. He is on the edito-

rial boards of *Biology and Philosophy* and *Theory and Biosciences* and has organised several conferences on genetics. Most recently he published the book *Zionism and the Biology of the Jews* (1998) (in Hebrew).

Yael Hashiloni-Dolev, PhD, teaches sociology of health and illness, new reproductive technologies and social studies of science at Tel-Aviv University and Academic College of Tel-Aviv-Yaffo. She is author of *A Life (un) Worthy of Living: Reproductive Genetics in Germany and Israel* (2007). Currently she is conducting a study about the Israeli public's opinion concerning sex selection at the Gertner Institute for Epidemiology and Social Policy.

Nurit Kirsh, PhD, teaches at the Science, Technology and Society Graduate Program, Bar Ilan University. Her research interests include the history of science in Israel, ideology and science, and women in science. Recent publications: "Geneticist Elisabeth Goldschmidt: A Twofold Pioneering Story" in *Israel Studies* (2004) "The Beginning of Genetics in the Hebrew University" in Hagit Lavski (ed.) *The History of the Hebrew University of Jerusalem* (2007, in Hebrew).

Ruth Lewin Sime is a physical chemist who recently retired from Sacramento City College in California where she taught chemistry for over thirty years. In addition to numerous articles on the history of science, she has written the biography, *Lise Meitner: A Life in Physics* (1996), which was translated into German, Chinese, and Japanese and provided base material for several documentary films. Professor Sime's current work focusses on Otto Hahn from 1933 to the post-war period, and on a related study of Max von Laue.

Aharon Loewenstein

Aharon Loewenstein, born 1929 in Verden (Aller), Germany, emigrated to Palestine in 1934. Agricultural High School at Pardes Hanna (1942–47) and served in the IDF (PALMACH) from 1947–49. He studied chemistry at The Hebrew University Jerusalem and obtained his Ph.D. in 1958. He then held post-doc positions at the California Institute of Technology and Columbia University (1958–1960), he was Research Associate at the Weizmann Institute of Science (1960–1962) and Professor at the Chemistry Department, Technion (1962–97). Aharon Loewenstein spent Sabbaticals at Oxford, Cambridge, Paris. Since 1997 he is Professor emeritus. His research interests include magnetic resonance, liquids and liquid crystals, molecular structures and dynamics. Other interests are: science and society with emphasis on the mid-20th century.

Anthony S. Travis is deputy director of the Sidney M. Edelstein Center for the History and Philosophy of Science, Technology and Medicine, The He-

brew University of Jerusalem, and a senior research fellow at the Leo Baeck Institute London. He has published widely on the history of chemical technology in Europe and North America since the mid-nineteenth century. Biographical studies include (with C. Reinhardt) *Heinrich Caro and the Creation of Modern Chemical Industry* (2000). His most recent book is *Dyes Made in America, 1915–1980: The Calco Chemical Company, American Cyanamid and the Raritan River* (2004).

Simone Wenkel finished her diploma thesis at the MPI for Neurological Research in Cologne in 2003. At present she is working on her doctoral thesis on the history of molecular biology in the “History of the Chemical and Biological Sciences” group of Ute Deichmann at the Institute of Genetics at the University of Cologne. She is currently a visiting graduate student at the History and Philosophy of Science and Technology Program at Stanford University.

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