

Introduction

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“A Riddle, Wrapped in a Mystery, inside an Enigma”

This volume is a necessarily multidisciplinary collection dedicated to the extremely difficult task of uncovering and exploring what can be reconstructed of the dimensions and the scale of the historical impact of sexually transmitted infections (STIs) on human infertility.¹ As a subject for inquiry, this comes close to Winston Churchill’s celebrated phrase, “a riddle, wrapped in a mystery, inside an enigma.” The riddle, which remains for medical and epidemiological science today, is how to quantify just how much the different STI organisms have affected female and male infertility. The mystery is how to find sufficient evidence to reveal how far different populations in the past were afflicted by these potentially sterilizing social diseases. The enigma is the question of whether any of the STIs have afflicted human populations from time immemorial, or whether there is evidence of more specific dating of the emergence of any STIs in historical, archaeological, or biogenomic records and, if so, when? The pandemic of HIV/AIDS in the late twentieth century demonstrated unequivocally not only that STDs are culturally refracted and technologically defined, which we already knew, but also that the infective microorganisms—being socially constructed through human activity—can themselves have a history and a potentially discoverable origin date in their entry into their human hosts. Therefore, there is a meaningful historical debate to be had over their origins.²

Owing to the conjectural state of both scientific and historical knowledge in all three of these areas—the riddle, the mystery, and the enigma—for us to make intellectual progress with uncovering the infertility implications of the historical STIs, *The Hidden Affliction* is burdened with simultaneously pursuing several related but distinct tasks—none of them easy. In particular, the study of venereal syphilis, caused by *Treponema pallidum* (subspecies

pallidum), and its contested history has an important part to play in this volume.³ Syphilis does not directly cause an incapacity to conceive, as gonorrhea and chlamydia both do, though it can certainly result in effective infertility for individual women due to fetal morbidity, multiple miscarriages, and early infant mortality, as chapter 9 harrowingly demonstrates.⁴ However, its primary value for historians who wish to evaluate the likely role of historical STIs in causing infertility among past populations lies in the far greater visibility of syphilis in the documentary record. It is rarely completely asymptomatic, unlike both gonorrhea and chlamydia. There is consequently a much greater range of opportunities available for historians to study various, quite detailed, medical, legal, military, and other institutional records concerning affliction with syphilis.⁵

This can be of assistance because, in a number of circumstances, the incidence of syphilis may be able to provide a proxy indicator for the scale of gonorrhea likely to have been experienced in a population in the past. In relatively well-documented official studies, it was found that during the early twentieth century in Europe the rates of reported gonorrhea infection tended to be three to four times more prevalent than syphilis in unprotected populations lacking effective treatment.⁶ Such a ratio is to be expected, since gonorrhea not only is much more infectious than syphilis but also confers no immunity to reinfection.⁷ This could, then, enable informed estimates of the extent to which infertility, due to secondary sterility from gonorrhea, may have affected various temperate zone societies in the past, even where we have little or no surviving direct evidence for either gonorrhea or chlamydia (the restriction of such a method to temperate zone populations follows from the prevalence of the other three non-venereal species of *Treponema pallidum* in more tropical climates, each of which confers immunities against venereal syphilis). The application of this method, using historical epidemiological data on syphilis incidence to provide an estimate of STI-induced infertility, is discussed and presented in the final chapter in this volume, in a study of the modern demographic history of England and Wales during its initial period of modern fertility decline in the decades just before the Great War. The results of this exercise indicate that STIs may, indeed, have played a substantial and hitherto unacknowledged contributory role in the low marital fertility recorded in that period, as a number of doctors and many feminists claimed at the time.

To what extent might this approach be more widely usable for other times and places in European history, supposing appropriate data were available? There may be no possibility at all before the sixteenth century—or perhaps

even before the seventeenth century. There has been a justly famous debate, itself over a century old, reviewed in chapter 3, positing a date of origin for venereal syphilis, at least as far as European populations are concerned, following the return of Columbus and his crew from the Americas in 1493. And what of gonorrhea—was it already extant in Europe in 1493? There are currently live debates about the origins of gonorrhea, and of chlamydia too, which each draw on a fascinating range of sources and scientific methods, and which are reviewed here in chapters 1, 3, 4, and 7.

Unveiling the Hidden Affliction

Infertility is now a high-profile contemporary public policy issue around the world.⁸ A 2017 major literature review has reconfirmed that, even with today's public health surveillance systems and treatment facilities, gonorrhea and chlamydia remain the main cause of the most preventable condition, tubal factor infertility (TFI). In the United States chlamydia is the most common reportable disease (1.5 million annually), and gonorrhea is the second most common, while 30 percent of female infertility is attributed to tubal factor infertility.⁹

Nevertheless, it is appropriate in many ways to describe the historical infertility consequences of the “venereal diseases” as the *hidden affliction*, for at least five distinct reasons. There has been some recent attention given to infertility by historians.¹⁰ Nevertheless, there has been remarkably little systematic and comparative historiography addressing the infertility aspects of historical STIs.¹¹ With the infectiousness of both gonorrhea and chlamydia and their known sequelae of secondary sterility, it is clear that infertility due to what were called in the past “venereal diseases,” and today STIs, must have been a repeated occurrence among many populations. There has been a very considerable output of excellent studies of various aspects of such historical STIs.¹² However, the impact of STIs on reproduction has surfaced only rarely in historians' work as an explicit focus of attention.¹³ Until Shane Doyle's important monograph, there have been relatively few extended treatments by historians: Michael Worboys's and Elliott Bowen's excellent social constructionist studies of gonorrhea bacteriology; the exemplary study by Megan Vaughan of the shared “panic” about sterility and venereal disease among both some colonial medical officers and indigenous chiefs in sub-Saharan Africa in the early part of the twentieth century; and the work of Noel Butlin on aboriginal population decline in Australia.¹⁴

As chapters 10, 11, and 12 explain, this historiographic inattention largely reproduces a constructed neglect by politicians, demographers, and medical epidemiology in the interwar decades, emerging, albeit in quite distinctive ways, in Germany, France, and Britain (and also in the United States and elsewhere). Consequently, historians, led by the availability of the primary sources, have produced excellent studies of venereal diseases and eugenics, feminism, social purity, prostitution, and public health policy, but no studies specifically in relation to infertility. Contemporary eugenicists and others focused their fears on their conviction (later shown to be an impossibility) that “congenital syphilis” showed it was a heritable taint (reflected in the title of Edvard Munch’s 1897 painting *The Inheritance*, which adorns this volume’s cover). They ignored the evidence already available—until feminists forcefully brought it to their attention—that gonorrhea caused infertility.¹⁵ Not until the 1890s and 1900s (and initially only in Germany and Austro-Hungary) was there a growing acceptance of Emil Noeggerath’s pioneering evidence and thesis, originally published in 1872, regarding the importance of latent (i.e., symptomless) gonorrhea, which was crucial to his claim that this STI was a major cause of sterility in both sexes.¹⁶

Gradual international acceptance of this link followed the publication in 1891 of Ernst Wertheim’s conclusive supporting evidence from the university hospital in Prague (see chapter 10). In the United States Margaret Marsh and Wanda Ronner concur with Allan Brandt’s pioneering study showing that, while there was medical consideration of gonorrhea as a cause of marital infertility in the first decade of the twentieth century, thanks to the medicomoral campaigning of Prince Albert Morrow (since 1884 professor of genitourinary diseases at New York University), nevertheless little practical attention was given to it, probably in part because doctors could not offer any revenue-generating treatment.¹⁷ Brandt has documented how, even as late as the 1930s in the United States under surgeon general Thomas Parran’s personal crusade, syphilis and its amenability to prenuptial Wassermann testing remained the primary focus of attention, not gonorrhea, despite the latter’s known capacity to render marriages sterile.¹⁸ Thus, this lack of historiographic attention reflects the fact that contemporary biomedical, demographic, and epidemiological science has consistently paid only intermittent attention to the infertility consequences of the pre-HIV STIs, and this has broadly continued into the second half of the twentieth century.

However, from the 1950s onward, biomedical science developed increasing interest in a newly recognized disease entity with infertility implications: chlamydia. In chapter 5 Worboys provides the first historical account

available of the complex story of its emergence from the range of imprecisely termed conditions known variously as blennorrhoea, Waelsch's urethritis, then NGU and NSU (nongonorrhoeal and nonspecific urethritis, respectively). Worboys shows that during the 1980s and 1990s the newly created NHS specialism of GUM (genital and urinary medicine) effectively used the perceived fertility threat of the recently identified disease entity of chlamydia to justify professional claims for expanding resources for new, improved microscopy tests. Professionally, this was a highly successful strategy, in the sense that each new test identified more and more chlamydia in the population, requiring more resources to treat it.¹⁹ However, Worboys points out that, despite this, both the public's and medical science's primary attention by the mid-1980s was rapidly becoming much more exclusively focused on combating the threat of the frightening and even newer STI of HIV/AIDS, pushing chlamydia onto the sidelines until the very late 1990s, when a partial national screening approach was launched in the United Kingdom. This intervening period of predominant attention to HIV, in both the global North and South, perhaps partly explains why there has been no general account specifically addressed to the subject of infertility and pre-HIV STIs since 1984.²⁰

A second general reason for neglect of the subject is that the relationship between sex, disease, and infertility has often, as a matter of behavioral, cultural, and associated medical practice, been imperfectly understood throughout most of history. Sociologists have insightfully explored the cultural, medical, and technological constructions of the contemporary positive concept of "in-fertility" as one scientific form of "disrupted reproduction."²¹ But in the past, where such disrupted reproduction was actually due to an individual contracting an often-asymptomatic STI, childlessness—or the inability to conceive further children—was experienced as something far less well defined: something that simply did not happen, and for no manifest, physical reason. It has comprised for many such sufferers, not the certainty of an act of commission, nor even a focused regret, but the amorphous and imprecise uncertainty of an absence, of being denied something available to others, but for no apparent reasons.

It is entirely rational in those circumstances that the search for meaning and attribution of responsibility for their inexplicable misfortune might often have taken the form of superstition and suspicion of malevolence or witchcraft on the part of others.²² Another explanation was divine punishment for wrongful behavior, especially since miscarriages, disfigured stillbirths, or sickly infants, as depicted in Munch's 1897 composition, would

also occur in communities where syphilis as well as gonorrhea was rife. Often both illicit sexual acts and disease manifestations were involved in this infertility. In such cases chapters 1 and 2 both discuss explanations invoked in the European ancient and early modern past, in terms of the morally “wrong” kind of sex (too much, too little, “impure”). Closely associated with such transgressive notions, further levels of deliberate concealment have often been added in many cultures by those afflicted. It is therefore a fundamental premise of research on the association between infertility and STIs in the past that scholars and scientists must actively engage with the clandestine nature of the subject. Even the name *Chlamydia*, adopted by science for the organism responsible, *C. trachomatis*, as recounted in chapter 5, translates from the Greek original as “cloaked.”

The third reason for the historically hidden nature of the affliction is that the other main pre-HIV STIs with implications for human infertility, gonorrhea and syphilis, were also relatively opaque to the medical gaze until late in the nineteenth century. Previously gonorrhea and syphilis had often been considered as manifestations of a single affliction varying in severity, the clap and the pox in early modern English vernacular. In contrast, today, following the shift from a physiological to the ontological conception of disease, we see them as the product of two quite distinct microorganisms.²³ The gonococcus was first seen under the microscope by Albert Neisser in 1879, and the transparent spirochete of syphilis was only finally visually identified as recently as 1905.²⁴ Furthermore, even the potentially lethal nature of each of the two diseases was long hidden from medical knowledge. It is now well known that syphilis, after a varying duration of deceptive latency amounting even to several decades, has the capacity to kill a significant proportion of its victims of both sexes in various ways, mainly through damage to the brain, the nervous system, or the aorta. This was increasingly suspected by specialist medical professionals in the late nineteenth century, particularly those working in asylums with those suffering from conditions given the medial names of “locomotor ataxy” and “GPI” (general paralysis of the insane), but it could not be finally proven until several years after identification of the spirochete.²⁵ Gonorrhea can result in acute pelvic inflammatory disease in women. It is certainly a cause of secondary sterility for a proportion of those infected, through blockage of the fallopian tubes (salpingitis), but it can also be fatal, not least due to associated ectopic pregnancies.

Fourth, gendered power relations have undoubtedly played a formative role, not simply in the most obvious sense of the behaviors involved in transmitting the diseases, but more insidiously, on account of the patriarchal lens

and interests through which the diseases have been viewed by the medical profession. As Worboys has shown, both gonorrhea and then chlamydia, the two most serious sterilizing diseases of women, were each initially treated indulgently by the medical profession in the nineteenth and again in the mid-twentieth centuries, respectively, as minor nuisance conditions afflicting only young men “sowing their wild oats.” It took scientific breakthroughs, which in each case were not initially believed, before the medical patriarchy came to acknowledge each disease as a serious threat to female fertility.

As J. D. Oriel pointed out, Noeggerath challenged the patriarchal legal assumptions and cultural practices of the male medical profession as much as he challenged medical science. He caused a furor when presenting his research to the inaugural meeting of the American Gynecologic Society in 1876. The reaction there was less because of any discussion of the validity of his research methods and findings and more because of a claim he made that over half of men in large US cities had been infected with gonorrhea at some point and that because of his latency theory this meant that over half of the wives of such men would then be infected. Consequently, “the president of the society said that he regarded these estimates as not only offensive but an unwarranted attack on the moral standards of the American male.”²⁶ The evasive disposition of the predominantly male medical profession toward this morally challenging disease continued for decades to exert insidious effects, including perpetuating its own ignorance of best practices, with harmful consequences. Half a century later, Dr. Percy Pelouze claimed, in the preface to the 1928 first edition of his commercially successful practical handbook on gonorrhea, aimed at informing American practitioners, that “at least 90 per cent of those afflicted are treated by men who frankly confess to themselves, and to their medical companions, that they really have but very meager knowledge of the scientific facts of the disease and of the precise methods of its most effective treatment.”²⁷

Fifth, the venereal diseases, and their manifestations and consequences, were not only passively hidden by the limitations and biases of male medical science and knowledge until well into the twentieth century but also often actively hidden by the sufferers themselves, as explored in chapter 2 by Olivia Weisser, where early modern medical practitioners are shown to have prided themselves on coaxing accounts of clandestine sexual encounters out of unwilling patients presenting with certain symptoms. In many societies sexual behavior is subject to widely observed restrictive customs or laws, often associated with the prevailing religious codes, whose transgressions are sources of shame or guilt, though in some cultures there is wider

latitude, as today in many “Western” societies and also in some other communities in the past, such as in the “Aphrodisian” cultures encountered in certain Pacific Islands, which are discussed in Tim Bayliss-Smith’s chapter 6. In the rather more numerous cultures, including those subscribing to Christianity, Judaism, and Islam, which proscribe sex outside marriage or its equivalent, to contract a disease that appears, from the bodily location of the manifest lesions and sources of discomfort, to be associated with sexual intercourse, is problematic for the affected individuals. Indeed, in a model chaste and nuptial society, in which sexual activity only ever occurred between legally married adults, the microorganisms of STIs would invariably fail to spread and would not exist, nor manifest themselves as disease entities. This would be as true of polygamous as of monogamous societies, regardless of sexual orientation.

However, given that human sexual behavior in most known populations of any size has often been conducted by some, at least, outside the moral prescriptions and even the strictest, formal legal codes governing sexual expression, to hide their shame such individuals have frequently sought in many societies to deny and to conceal the disease from themselves, from their spouses, and from the community in which they were living.²⁸ In the self-publicizing accounts of their curative prowess published by the early modern medical practitioners (all men) that Weisser examines in chapter 2, they dwelled on the importance of their skill in extracting a secular “confession” of the clandestine and transgressive extramarital liaison that accounted for their patients’ conditions—the confession was itself a morally purgative part of their cure. Echoing this clandestine situation, but in an inverted fashion two centuries later in the closing decades of the nineteenth century, it seems likely that it was common practice among many male medical practitioners in western Europe and North America to collude with the wealthy men who formed much of their clientele to save them from the embarrassment of informing their wives of evidence of the venereal disease that their husbands had given them.²⁹ This zealous adherence to the notion of patient confidentiality interestingly paralleled the code governing priestly receipt of confessions in the Catholic Church. There were cases where the evidence of the disease was clearly manifest in the bodies of the clients’ wives, who might be kept in ignorance by medical practitioners of a condition transmitted to them by their husbands that could on occasions prove fatal to them.³⁰

Such patriarchal collusion against the health of the women of their own class became a major provocation to outrage expressed by the more courageous and iconoclastic figures within the early twentieth-century feminist

movement, in the United States, Britain, and elsewhere. This was most famously expounded in Christabel Pankhurst's coruscating polemic, *The Great Scourge and How to End It*, published in 1913.³¹

As chapters 10 and 11 contrastingly explore, across the channel in France and also in Germany at this time, both the medical science of the infertility threats posed by the venereal diseases and the politicized interpretations of those threats took somewhat different public and political manifestations. A male bias was certainly common to the medical professions and the political classes in all these western European national cultures. In Britain, as in the United States, this bias manifested itself as discretion and public silence until feminists forced it onto the public agenda. In Germany it was expressed in positive encouragement to men to use the condom by German medical authorities because of the precocious acceptance there by the early 1890s that gonorrhoea could cause *male* infertility.³² Christina Benninghaus finds a widening acceptance among the educated class of laboratory microscopy to test for male azoospermia among infertile couples as early as the 1890s. By contrast, French medical practitioners remained skeptical and uninterested in subjecting their fee-paying clients to semen tests.

There may be larger historical and institutional influences at work here. Whereas the tradition of *Medizinpolizei* in German-speaking states had long linked issues defined as being of national medical interest with obedience to officially sanctioned medical authority (and Robert Koch's officially funded Prussian bacteriological science was flying high in this period), the practice of medicine in France has been characterized as the most dominated by private interests in Europe.³³ In pre-1914 Britain and the United States, there was preparedness to consider psychological conditions such as neurasthenia or masturbation in relation to impotence, but male infertility as a consequence of STIs went almost completely undiscussed, as in France.³⁴

As Benninghaus shows, approbation for prophylactic condom use in Germany went alongside a relaxed attitude to demography. With its national birthrate remaining high for several decades after the United States', France's, and Britain's declined, political anxiety in Germany about the nation's falling fertility did not appear until after the 1910 census first showed an incipient fall. However, subsequent attention in the Weimar era was primarily focused on voluntary childlessness attributed to the supposed selfishness of women of luxury, not to STIs. This was despite the fact that throughout this period it was widely accepted in Germany that STIs accounted for about half of the 10 percent of couples that official statistics showed to be experiencing childlessness. In low-fertility France, by contrast, Fabrice Cahen and

Adrien Minard find in chapter 11 that the long-standing, official pronatalist obsession dating back to defeat in the Franco-Prussian War, along with pronounced Catholic influence, ensured aversion to any public sanctioning of condom use in marriage, formalized by legal prohibition in 1920. This was also despite widespread venereal infection due to the acceptability of the custom of initiation of young men through visits to prostitutes and the associated “manly” badge of the experience, in the form of a ritual bout of gonorrhea (“chaude-pisse” in the French colloquialism). Even after the Great War, and despite an evident rise in gonorrhea infections among the wives of *poilus* who served at the front, chapter 11 shows that French official, medical, and public opinion and indignation was focused on a campaign against female-procured abortions as the great social evil in the patriotic battle to raise the French birthrate, not on male responsibility for gonorrhea-induced sterility. In the 1960s French men were apparently still highly averse to using condoms, even when engaging—as a great many still did—in commercial sex. So the only time when condoms have been widely used in France was probably by the Wehrmacht during the Nazi occupation in World War II.

Thus, the chapters in part 4 show how in Germany, France, and Britain by the 1920s all public, political, and scientific attention was devoted to the voluntary and sociocultural sources of reduced national birthrates, not to the involuntary infertility due to STIs. Chapters 6 and 7 show that such a view also prevailed where Europeans studied population decline in the Pacific, which was attributed to “culture shock” after contact with the West. Only in parts of sub-Saharan Africa, as chapter 8 shows, was there any focus by the colonial authorities at this time on STIs as a remediable cause of infertility, but even here that interest evaporated once antibiotics appeared to solve the problem from the later 1940s onward.

This brings us back full circle to the five reasons why infertility due to STIs has remained mostly a hidden affliction, both in history and in historiography, such that even in a 2017 multiauthored volume devoted to childlessness, the chapter offering a historical survey of European trends since the beginning of the twentieth century makes no reference at all to STIs.³⁵

The Benefits of a Multidisciplinary Approach

How, then, to reveal the concealed infertility due to STIs in the past? To give ourselves the maximum opportunity to learn as much as possible, we need to study carefully the various reports of the experiences of the afflicted.

We should certainly study the humanly constructed and recorded history of the disease entities, which have gone under various names in the past before coming to be known today as syphilis, gonorrhoea, and chlamydia. But we also need to study and integrate into our historical understanding the most up-to-date scientific knowledge available regarding the three bacterial microorganisms principally responsible: *Treponema pallidum* (*pallidum*), *Neisseria gonococcus*, and *Chlamydia trachomatis*.

A purist historicist approach might insist that, especially given the clandestine nature of the subject, all we can uncover from the past are our attempts to capture various meanings that contemporaries in different eras and places attributed to a range of disputed and negotiated disease conditions observed to affect the genital organs. Such contemporaries may or may not have believed these conditions affected fecundity in some way. Certainly, the recovery of these diverse perceptions, anxieties, and understandings is of primary significance for any history of the meanings of sex, disease, and infertility.³⁶ Such an approach informs much of the subject matter presented in the chapters in this volume: by Rebecca Flemming, relating to the ancient world; by Weisser, on early modern Britain; by Cahen and Minard and by Benninghaus, relating to later nineteenth-century and early twentieth-century France and Germany; and by Worboys, relating to the evolving understandings of what we now call the disease category of chlamydia during the course of the early and mid-twentieth-century decades.

However, to restrict our curiosity and range of inquiry solely to approaches fashioned to investigate literary, medico-scientific, and representational texts is to adopt an unnecessarily circumscribed and limited approach, even to the effort of understanding those texts and signifiers themselves. Dimensions of meaning concealed within and evaded by the surviving texts, along with understanding of the anxieties and wider social and economic pressures that were conducive to texts being framed in the ways that they were in the diverse cultures of the past, will ultimately be accessible to us as historians only by juxtaposing against these texts all the range of insights from the other forms of evidence available to us. This includes such archaeological and paleopathological evidence as is presented and discussed in the chapter by Charlotte Roberts and Rebecca Redfern; the fascinating new genomic reconstructions of the evolutionary history of the currently extant range of disease organisms, discussed by Ian N. Clarke and Hugh R. Taylor in chapter 4; and whatever other scientific or historical evidence we can assemble and compare. Depending on what kind of sources have survived, some of this evidence may even be rendered into epidemiological and quantifiable form

for certain populations in different times and places, such as that which is presented in chapters 6, 7, 8, 9, and 12, relating to diverse populations in Oceania and Africa, Britain and Australia.

All these different dimensions of evidence need to be understood by reference to the most up-to-date scientific knowledge we have today about the medical manifestations and the social and biological transmissibility of such clandestine diseases. It is extremely important to know, for example, that many men and most women infected with gonorrhea (and chlamydia) are symptomless.³⁷ The power of these diseases to cause infertility is not dependent on their capacity to manifest symptoms, especially in women. Therefore, many women in many cultures psychologically suffering the curse of barren sterility would have had no perceptible bodily signs or symptoms of the likely reasons for their affliction.³⁸

To take another crucial example of the importance of applying current scientific knowledge to our historical researches, the historical STI that has left most evidence for us to study, both of a written form and in the archaeological bone record, as discussed in chapter 3, has been syphilis. However, an understanding of the research and transmission models of contemporary clinical epidemiologists, reviewed in the next section, informs us that, among the historical STDs, syphilis was characterized by a relatively low prevalence and low incidence compared with both gonorrhea and chlamydia. Thus, it is of cardinal importance for us as historians to understand that syphilis, the disease most highly visible in the available historical record from both textual and paleopathological sources of evidence, is not the one that most afflicted various populations in the past, nor of course is it the disease that has most directly impacted both female and male infertility in history. If we want to infer something of value about the hidden affliction of infertility from the surviving historical sources of evidence documenting either past perceptions or other surviving markers of the venereal diseases, it is vital also to know as much as we can from today's biological, evolutionary, and epidemiological sciences about the differential visibility and infertility consequences of the distinct STIs, and it is crucial not to restrict ourselves only to texts from the past but to embrace all available forms of relevant evidence.

Science—both expert and lay understandings of it—along with belief, morality, public policy, ideology and politics, medicine, education, gender relations, reproductive customs, familial property, and survival strategies have all been involved, often in a highly integrated fashion, in determining the experience and the patterns of STI-related infertility in the past.³⁹ We need a multiplicity of disciplinary approaches to grasp the interrelations among

all these aspects to understand how sexuality, disease, and fertility have had an often hidden but nevertheless influential history in different times and places. For instance, in Western societies, though medical scientists were discussing new findings about the STIs and influencing government policies throughout the first half of the twentieth century, the communication of such knowledge to the general public through sex education in schools or via the mass media remained evasive, sporadic, moralizing, and crudely admonitory at best.⁴⁰ It did very little, except in Germany, to publicize the one measure that would have made a difference to communicability of the microorganisms: condom usage.⁴¹ Indeed, in both France and the United States legislation supposed to promote the sanctity and fruitfulness of marriage prohibited the sale of contraceptives.

Among the Haya people in Uganda, as Doyle's chapter 8 documents, the constellation of factors conducive to the spread of fertility-impeding STIs was of course quite different from that in Europe, but it did share the feature of, in part, springing from self-defeating publicly articulated motives. Both popular belief and practical economic considerations dictated that childlessness must be avoided at all costs because it could spell the loss of vital landed property. Consequently, high rates of STIs were exacerbated by a range of contributory practices: impatient, rapid divorce of "barren" wives even within a year of marriage, young wives advised by canny older women to ensure their fertility by going with other supposedly potent men as well as their husbands, older infertile men repeatedly trying to produce an heir with untaken young teenage girls.

Integration with the cultural history of the emotions is important, too. The capacity of biological sterility due to STIs to inflict both physical pain and emotional suffering on women and men is currently still a largely hidden aspect of their history. Nevertheless, it is a crucial aspect of this volume's goals, embracing not only medical, epidemiological, and demographic history but also sexual, gender, social, and emotional history, to acknowledge that lives are damaged by STIs. This is most clearly conveyed in chapter 9 and also in chapters 1 and 2. A public clarion call for historians to embrace and learn from the rapidly changing biological sciences with their new agenda of epigenetics has come in 2014 from Lynn Hunt, the leading cultural historian. Hunt acknowledges that in fact demographic, epidemiological, and environmental historians have been continually engaging with biology since at least the 1960s (and indeed even before that, in French historiography of the *Annales* school and among Anglophone economic historians and historical geographers). Her call, however, is addressed to the mainstream body of

historians who have tended to pursue more exclusively literary, cultural, and intellectual history approaches during the past several decades. It is through a focus on furthering the history of the emotions, to which her own seminal work on *Inventing Human Rights* has made a major contribution, that Hunt has extolled the virtues of all historians engaging with biological sciences and their findings.⁴²

The approach adopted in *The Hidden Affliction* fully endorses that call for multidisciplinary and sharing of knowledge across the humanities and the sciences.⁴³ Combining diverse knowledge bases helps us to begin to make more sense of the relationship between STIs and infertility in the past, opening-up many illuminating comparative insights.

How Important Have STIs Been as a Cause of Infertility in History?

The simple answer to this question is that currently we do not have extensive documented evidence. Owing to what is understood today by medical science of the capacity of the three main STIs present in the pre-HIV/AIDS era—gonorrhea, syphilis, and chlamydia—to affect fertility negatively, it is certainly eminently plausible that these diseases, especially gonorrhea, may at times have had a very substantial impact, not only on individuals and couples but on the fertility of whole populations, societies, and their cultures, as Roy Scragg argues in chapter 7. Other chapters here also document this.

The biological pathways through which each of these three STIs affect fertility is different. The two most important STIs that, if untreated, are known today to each exert a direct negative impact on the fertility of a proportion of their human hosts are gonorrhea and chlamydia, caused by *Neisseria gonococcus* and the genital serovars of *Chlamydia trachomatis*, respectively. Gonorrhea is epidemiologically the more important of the two, in terms of its quantitative capacity to cause permanent sterility in women through salpingitis, which is the form of pelvic inflammatory disease (PID) specific to the fallopian tubes, resulting in tubal factor infertility (TFI). It causes sterility in women by attaching to the epithelial mucosal cells lining the fallopian tubes, which then results in the destruction of the associated ciliated cells, which provide the hair-like structures that transport the egg from the ovary down the fallopian tube.⁴⁴ Damage may be either in the initial section before fertilization can happen or in the final section of the tube before delivery of the fertilized egg to the uterus. In the latter case an ectopic pregnancy can ensue, though of course in the past this would invariably have resulted not

in infertility but in the death of the would-be mother. Gonorrhea additionally has a far from insignificant capacity to render infected males infertile through epididymitis: infection and inflammation of the long, coiled tube where sperm matures after initial production in the testes and before ejaculation; the physical blocking of this tube, as shown in Figure 10.3 below (page 320), impedes healthy sperm production.

The principal mechanism through which an infection by chlamydia can damage the fallopian tubes in such a way as ultimately to cause either infertility or ectopic pregnancy is fundamentally different. It occurs as a side effect of the body's immunologic response causing tissue scarring and fibrosis of the tube walls due to an inflammatory cytokine response.⁴⁵ Unlike gonorrhea, it seems that the scarring does not progress to the same sterilizing degree in the male epididymitis. A likely reason for this is the lack of a reservoir of indole in the male urogenital system, which is abundantly available among the vaginal microbiota. As is explained in chapter 4, *C. trachomatis* is dependent on tryptophan (an amino acid), which it biosynthesizes from indole. Therefore, a single original episode of infection into the female urogenital system can produce a much longer-lasting episode of disease with continual scarring while *C. trachomatis* remains present, whereas in a male any single episode of infection will run out of tryptophan much sooner, and so scarring will cease until another infection is acquired, introducing a new colony of *C. trachomatis*.

Syphilis, by contrast, has no direct effect on the capacity of either sex to conceive. It probably exerts, overall, a relatively neutral net effect on a population's apparent, observed fertility rate, if simply measured in narrow demographic terms as the collective rate of childbearing. It causes miscarriages, stillbirths, and early deaths among infants, who can contract the disease from infectious mothers either in utero or during parturition shortly after childbirth. This increase in fetal and premature deaths tends, in those many populations throughout history that have practiced breastfeeding for many months after birth, to reduce the average time elapsed before the next conception due to the earlier cessation of lactational amenorrhea and the return of ovulatory cycles. An individual woman's capacity to bear healthy live-born children may be interrupted for a period by an infection with syphilis, but her capacity to conceive is not permanently curtailed. Once the syphilitic infection has been fully contained by her immune system, she will usually be able to take healthy fetuses to term again, provided she has no other illnesses.⁴⁶ However, it should be noted that in a population suffering extensively from syphilis, other STIs are always also present along, often,

with a range of other vectors of morbidity. Thus, the net effect of syphilis on any real population's capacity to reproduce may not be positive, especially if the disease is widespread in the community, since it exerts a toll of serious morbidity and therefore vulnerability to coinfections on adults of both sexes and also especially on the health and survival of infants, who may register as live births but fail to survive childhood. In chapter 9 Janet McCalman and Rebecca Kippen document such infertility and premature mortality problems of oppressed populations suffering from a heavy burden of syphilis infections in association with other STIs.

The potential of STIs to endanger even the very survival of some island populations was first conclusively demonstrated by the extraordinary pioneering study conducted during the early 1950s by Roy Scragg.⁴⁷ In his chapter below, he revisits these findings among the dwindling population of the island of Tabar in New Ireland (today a province of Papua New Guinea). Combining demographic survey and clinical medical histories with rigorous diagnostic investigations including semen microscopy and pelvic X-rays of the fallopian tubes, Scragg overturned the previous dominant view of Pacific Islanders' infertility. This view was derived from the fieldwork and interpretation of the eminent anthropologist and psychiatrist, William H. R. Rivers (sometimes known as the "English Freud"), who held that the islanders were suffering from enervating "culture-shock" following contact with the West.⁴⁸

Scragg found from his medical histories of the infertile that, far from having given up in despair, the islanders' plight was made worse by the behavior of childless, infected older males, desperate to have heirs, who sought young virginal partners, a practice facilitated by the island's sexual culture and rituals. Scragg found very high rates both of double-tubal blockage and male sterility and subfertility (caused mainly by the male gonorrheal sequelae of epididymitis, also known as epididymo-orchitis, or by stricture of the urethra).

Bayliss-Smith's chapter explores this theme further with a comparative historical demographic study of four different island societies of Oceania in the Solomon Islands. On Simbo and Vella Lavella there was a sexually libertarian "Aphrodisian" culture, not dissimilar to Tabar in New Ireland. Bayliss-Smith presents evidence that gonorrhea became prevalent there following first contact in the nineteenth century with Western sailors, whalers and traders, resulting in low birthrates and a documented shrinking population in the subsequent generations. By contrast, he shows that the inhabitants of Malaita and Guadalcanal subscribed to an entirely distinct sexual code of strict virgin marriage—this contrast was also noted historically by maritime visitors. On Malaita and Guadalcanal, Bayliss-Smith is able to document

stable high birthrates and a sustained population on the island throughout the period of contact with the West.

Thus, as both Scragg's and Bayliss-Smith's chapters make clear, the gonococcus—biology alone, in other words—does not have the autonomous power to cause the decline of a population. This depends critically also on the moral codes, cultural practices, and accepted behaviors of a society and how these interact with the presence of other diseases in the population. Where such practices combine to positively encourage the coupling of infected individuals with a large proportion of the young females in the community, the most extensive diffusion of the gonococcus among women with an early reproductive age is assured, and this is likely to have the greatest impact on the entire community's infertility, even to the point of threatening the survival of the population.

STIs are, of course, not the only widespread historical afflictions that could have caused populations to experience infertility. Although this volume does not focus its attention on nonsexual sources of infertility, they should be mentioned.⁴⁹ Puerperal fever or sepsis after giving birth due to streptococcus infection, can result in secondary sterility (and can also cause loss of the mother's life), as Worboys notes in his chapter. Tragically, as Irvine Loudon has shown, the dangers of puerperal fever were exacerbated during the late nineteenth and early twentieth centuries, due to the increased willingness of (mostly male) doctors to intervene in various ways during childbirth while paying insufficient attention to their own hygienic practices.⁵⁰ McCalman and Kippen's chapter 9 presents distressing evidence of some of the unfortunate consequences and of others, too, due to additional shortcomings of medical practices, which can be reconstructed from the preserved case records of the Melbourne Lying-In Hospital from 1883 to 1909.

Two other diseases are also potentially demographically significant. Tuberculosis bacilli can spread to the genital organs among some of those infected and cause consequent sterility (which, unlike gonorrhea, typically takes the form of primary sterility in both sexes, since tuberculosis is usually acquired in childhood, and it is most likely that its nodules will develop to block the fallopian tubes or the epididymis in males during adolescence).⁵¹ Certainly, tuberculosis has been prevalent in many crowded and impoverished populations throughout much of history, and there is some clinical evidence that it could be a cause of infertility at least among a fraction of those manifesting illness and seeking treatment.⁵²

The high fevers of the falciparum variant of malaria is the other major nonsexually transmitted disease with infertility implications: these can cause

both impaired sperm production for up to two months after the fevers and the possibility of pregnancy loss. Its possible contribution has been evaluated in another major, well-known and well-documented case of the suspected extensive impact of historical STIs on human fertility, the so-called equatorial African infertility belt. This has been the subject of some debate and a sequence of influential studies, which began with those of colonial medical officers raising the alarm in the early twentieth century, as studied by Megan Vaughan.⁵³ In chapter 8 Doyle reviews this debate and offers a new contribution derived from some of his own researches on the Bahaya and Baganda peoples in contemporary Tanzania and Uganda. By studying the subsequent mid-twentieth-century rise in fertility in these communities Doyle concludes that reduced STIs were probably the most important single factor contributing to a prior decline in infertility but that a range of other influences were also involved, related to the arrival of a much enhanced and more accessible primary health care system during the midcentury decades, itself in part due to the mobilization of resources to deal with the STI threat. This delivered, in addition, falling rates of malarial infection, postpartum infection, and malnutrition. In Tabar, by contrast, Scragg has presented compelling evidence that female gonorrhoea infection at early ages was probably the sole cause of the high rates of early twentieth-century infertility, since there was such a spectacular positive effect on fertility of an unusual initiative in Tabar, which saw the universal administration of penicillin to the whole population in the early 1950s. This tells strongly, in that case at least, against the importance of tuberculosis, malaria, or indeed chlamydia, since none of these, unlike gonorrhoea (at that time), respond to penicillin.

Thus, the patterns that can be uncovered, where the rare opportunity of the availability of the right evidence occurs, show a strong relationship between gonorrhoea and threateningly high levels of infertility in some societies in the past. This comparative historical evidence can be productively juxtaposed with the analytic insights and predictions that have been developed by contemporary epidemiological models of the transmissibility and infectiousness of STIs. This shows that the spread of an STI through a population can be analyzed as the product of three factors: the transmission probability of each specific STI organism; multiplied by the contact rate between those currently infected and those currently uninfected (the “susceptible” population, which technically excludes those enjoying immunity due to a past infection); and further multiplied by the duration a current sufferer remains infectious (before death or recovery).⁵⁴

Evidently, each of these three components of the model has a purely biological but also an equally integral sociocultural and sociomedical aspect to its determination, especially where sexually transmitted diseases are concerned. On the one hand, the different microorganisms have quite distinctive biological properties. The syphilitic spirochete typically elicits a strong symptomatic reaction and antibodies, which makes it unlikely that an infected individual will be unaware of their state of illness and which also means they are highly unlikely to be subsequently reinfected; so a single infection removes most individuals permanently from the pool of susceptibles. It is also an organism that requires access to the bloodstream of a new host via a small abrasion, and so it is not routinely caught from a single sexual encounter with an infectious individual; hence its overall transmission probability is relatively low unless a susceptible individual is exposed regularly to an infected individual (as could happen in a stable relationship, but where one of the two parties has “cheated”). Due to immunity among its ex-victims and relative difficulty of transmission, syphilis tends to exhibit a relatively low prevalence (defined as the proportion of currently infectious cases in the population) and also a relatively low rate of incidence (number of newly infected cases reporting the disease).

Neisseriae gonorrhoeae, by contrast, eludes the body’s immunological defenses and therefore often produces no apparent symptoms in its victims, who may infect others without realizing. With no protective immunity, individuals can continually reinfect one another, and the pool of susceptibles is continuously close to maximum. Thus, in modern populations with sophisticated public health surveillance and laboratory diagnostics, gonorrhea tends to exhibit the epidemiological characteristics of higher prevalence than incidence, within the terms of the epidemiologists’ transmission models.

Finally, the several genital serovars of *Chlamydia trachomatis* are also often symptomless because they evade the immunological system by residing within the cytoplasm of body cells for a large part of the life cycle (hence Chlamydia is termed an “obligate intracellular pathogen”). Chlamydia has two developmental stages: the elementary body and the reticulate body. Reticulate bodies are the noninfectious intracellular-dwelling form and they make up the metabolically active replicating stage of the life cycle, through binary fission. After this division the resultant elementary body exits the host cell (through reverse endocytosis), and it is only these elementary bodies that are susceptible to antibiotics in the period before they enter new cell hosts (through endocytosis). Chlamydia therefore has the additional distinctive property that hosts can remain infectious for a very long time, even with

modern treatments. Not all the active organisms are eliminated by any one single course of antibiotics, and so treatment has to be repeated several times before a victim is entirely clear. Consequently, in modern populations its incidence level is approximately as high as its very high prevalence level.

On the other hand, all of the three dimensions of the epidemiologists' transmission model are also subject to sociocultural, as well as biological, codetermination. This involves malleable beliefs and behaviors, as well as scientific understandings and diffused medical practices in relation to the STIs. The different sexual and gendered attitudes and behavioral norms of different societies and of their various subcultures—often reflecting ethnicity and past migration and current mobility patterns as well as socioeconomic inequalities—can all influence patterns of contact and transmission of the STIs and, consequently, their capacity to affect overall fertility. For instance, Doyle's research reported in chapter 8 includes interview evidence that reveals not only levels of infertility but also the family-size aspirations of potential parents. Both factors adapted across generations in East Africa, as people attempted to respond both to the implications of secondary sterility and to the consequent perceived economic predicaments for the family unit of fewer children. Conversely, Doyle also documents the cultural responses following the arrival of penicillin, which was perceived to have substantially lifted the threat. As a result, aspirations for family size now increased significantly, showing how rising fertility was not simply an involuntary product of the lifting of a biological restraint but also reflected the cultural values and changing desires of the populace. Similarly, as the earlier reference to modern populations with modern laboratory diagnostics makes abundantly clear, changes in medical technology and associated public education propaganda can alter a population's symptom-recognition capabilities and so can influence voluntarily preferred patterns of sexual contact. As Doyle also shows, the arrival of penicillin in East Africa had similar impact to that seen in the Pacific, but with widely differing effects on sexual behavior. In Buganda it was viewed as a license for a rise in male promiscuity without fear, whereas in neighboring Buhaya marriage became more stable once STI-related infertility was reduced because wives were more likely to be able to produce the heir that married men desperately wanted (for land-inheritance purposes).

The clinical epidemiological transmission model very helpfully identifies the key factors and their interrelationships that produce different rates of the spread of different STIs. It has been developed primarily to assist contemporary public health analysts, with access to the appropriate data, to design prevention and treatment strategies through understanding the dynamics

of rates of transmission between infectious sections of the population, usually of course a minority at any point in time, and the uninfected “susceptibles”—the rest of the population. However, the framework of understanding that the model offers can equally provide historians with a critical resource to help them place in epidemiological context the forms of evidence available to them on the incidence and the prevalence of STIs in past populations, even though they will not necessarily have all the range of information available to fully operationalize the model empirically.

For instance, Turner and colleagues report a 1990s study finding gonorrhea rates strongly correlated with poverty both nationally and in a more detailed study in South London, where incidence was ten to twenty times higher among black Caribbean ethnic groups than among whites, reflecting similar, earlier findings in the distinct circumstances of black poverty in United States.⁵⁵ In London black males were identified as also performing a “bridging” function, since black women tended to have only black male partners, but black males also had white female partners. Obviously, the further explanation for this particular pattern lies in the intersectionality of cultural and socioeconomic relationships of gendered power and inequality.

By comparison, McCalman and Kippen in chapter 9 investigate in illuminating detail the health and infertility problems of an impoverished section of the British and Irish population 150 years earlier than Turner et al.’s study. Without the prospect of treatment in the pre-antibiotic era, a proportion of those infected were also marked by the sequelae of infertility. The primary sources relate to nine thousand female and sixteen thousand male convicts arriving in Van Diemen’s Land (Tasmania) between the 1840s and 1860s. These documents allow exploration of the infertility consequences for some of these most unfortunate individuals, those whose lives were lived within the eye of the storm of the structural violence perpetrated on the poor of Britain during the early decades of expansionary industrial capitalism. They find 80 percent of the transported males remaining in Tasmania were recorded as fathering no more than one child, while over 35 percent of the females were subsequently infertile, notably those originating from the streets (literally) of London—and of Britain’s industrial cities. The designation “on the town” in their transportation record signified a previous life in Britain of survival through commercial sex, which was probably part of the coping strategies for many very poor women in urban Britain, especially after the withdrawal of long-standing sources of social security and the new practice of stigmatizing unmarried mothers brought in with the draconian, moralizing reforms of the New Poor Law of 1834.⁵⁶

The details the authors have elicited from their various Australian sources also include the information that in Melbourne in the 1870s there was a child sex trade related to the folk superstition (brought from Britain) that sex with a virgin was a cure for the pox. This, then, is a practice that links, with a common cause, the infertility of some of the urban poor in Australia with that of the Haya in Tanzania and the Melanesian island of Tabar, where it was also found by Doyle and by Scragg that the patriarchal power of infertile or infected elderly males to command the sexual services of younger females was a significant cause of STI transmission. Those transactions formed a bridge, in the terminology of the epidemiologists' transmission model, between the infected and the susceptible sections of the population and thereby accounted significantly for a wider prevalence of gonorrhea among young females than would otherwise have been the case, so maximizing its sterilizing consequences.

Thus, several of the chapters here show that historic STIs significantly impacted fertility, often associated with the dynamics of power and inequality between the sexes, the races, and different individuals in imperialist and capitalist contexts.⁵⁷ In helping us to understand more fully the hidden history of infertility and sexual disease, this volume exposes a further aspect of the structured violence that characterizes the patterns of health in human history.⁵⁸

When Was Infertility Caused by STIs, and When Did They Originate?

The vital importance of drawing on multidisciplinary knowledge is nowhere more evident than in relation to the most fundamental of questions for a volume devoted to the history of sex, disease, and infertility: when did the STIs causing infertility first appear in human history?

The easy assumption that the "venereal diseases" must surely have always been with human society, since time immemorial, rests in fact on rather slender evidence. In chapter 1 Flemming discusses anew the long-running debate over whether the disease first named as gonorrhea in texts of ancient Greek medicine should be equated with the disease currently recognized by that term. She concludes that skepticism on this point is the more justifiable position, because a careful rereading of the texts of antiquity reveals that the two conjoined symptoms that are today recognized as diagnostic of likely gonorrhea—pain in urination combined with a discharge—never in fact occur together in those texts. Flemming's view is that these texts, referring for

instance to an involuntary flowing of seed, are more reliable for informing us about sexual behavior and attitudes in Hellenistic society: in particular, a commonly held view that lack of moderation and self-control might impair fertility. This opening chapter in the volume thereby provides an intriguing echo of the furious debate in Germany just over a century ago over the same intellectual turf of classical texts, also in relation to the then-new findings of laboratory science, in this case over the issue of the disputed origins of syphilis rather than gonorrhoea.⁵⁹ That debate still remains an unsettled matter between the thesis of a European or American “origin” of syphilis, also addressed here in chapter 3 by Roberts and Redfern.

It may well be that the classical texts are in fact more consistent with reportage on manifestations of chlamydial, not gonorrhoeal, infection. As Flemming notes, that would also be consistent with the argument that the pronatalist Roman state would have been hard-pressed to maintain its demographic vigor if the gonococcus of modern clinical experience had been present, given the socially extensive scale of Rome’s commercial sex industry. One of the conclusions of the research reviewed in this volume is that chlamydia does not appear to have quite the same potential as gonorrhoea for causing widespread, community sterility and that it would not, alone, have caused population decline. There are certainly a number of symptoms in the classical sources that are much more consistent with chlamydia (such as bleeding between periods and increased vaginal discharge in conjunction with low, abdominal pain).

Chlamydia’s ancient lineage would be a striking reversal of previous assumptions. Chlamydia has had the superficial appearance of being, rather like HIV/AIDs, a brand new epidemic sweeping through the populations of the world in the past few decades. However, Worboys’s interpretation, shared by Clarke and Taylor in their review, contributory to chapter 4, of the long-term history of both the ocular and genital trachoma clades is that this has been primarily an illusionary statistical artifact. It is the result of dramatic improvements in the observational instruments developed to track a widely prevalent organism, which, it has been progressively found, has at least fifteen distinct serovars, some of which are adapted to ocular epithelial cells, while the original variants colonized genital tract tissues.⁶⁰

As chapter 4 by Clarke and Taylor shows, it is highly probable that chlamydia, the most newly identified of the three major pre-HIV STIs, is in fact the longest-lived unwanted companion of the human species among all the currently known STIs. This follows from the fact that it has a particularly complex parasitic life cycle, living within the mucous membrane cells of its

host for a considerable portion of its life cycle, a pattern that cannot have evolved at all rapidly. Second, *C. trachomatis* variants are commonly found across so many diverse species, famously including koalas, but also reptiles.⁶¹ (It is a so far unexplained oddity that all other large primates—except *Homo sapiens*—are among the minority of vertebrates that are apparently not afflicted by chlamydia.)

A newly available and rapidly developing scientific approach for examining the historical provenance of disease organisms derives from gene-sequencing technologies applied to the study of genomes and their evolutionary ancestry (in terms of Bayesian phylogenetics). As Clarke explains in his contribution to the joint chapter with Taylor, these techniques permit bounds to be placed around the likely timescale of existence of different organisms, in terms of reproductive generations. These are estimates from the knowledge of the complexity of the organism's genetic structure and calculations of its associated "molecular clock." This technique uses the mutation rate of biomolecules—that is, molecules involved in the maintenance and metabolic processes of living organisms—to deduce the point in their prehistory when two or more current life forms diverged, termed their "time to most recent common ancestor," tMCR (the biomolecular data used for such calculations are usually nucleotide sequences for DNA or amino acid sequences for proteins). This line of research confirms that the human variants of *C. trachomatis* have almost certainly accompanied humankind at least throughout the era of recorded written history and, furthermore, that the urogenital trachoma clade (T1), transmitted sexually, is the earlier variant, from which the ocular clade (T2) mutated.

The latest findings using these new scientific techniques currently indicate that gonorrhoea, by contrast, may be a relative newcomer, emerging circa 1544–1622, thus provisionally confirming Flemming's skeptical reading of the ancient texts.⁶² However, gonorrhoea has a well-attested capacity in the twentieth century to adapt and coevolve rapidly in the presence of antibiotic threats, which has resulted in a classic "Red Queen" dogfight between medical science and gonorrhoea. The sulfonamides were first successfully applied to cure gonorrhoea in the late 1930s but were then quickly found before the end of the 1940s to be less effective than initially hoped for and were then replaced by penicillin—for a while.⁶³ Indeed, renewed concern over antibiotic-resistant gonorrhoea has in part stimulated the current research on its genome.⁶⁴ We cannot therefore be sure, as Scragg avers, that earlier mutational variants of the gonococcus did not previously exist and then disappear

before the mid-twentieth century making them now unavailable for the genomic back-projection dating technique.

If correct, however, then this latest biogenomic research interestingly suggests that the form of gonorrhea with which modern medical science is familiar and which carries its threat to fertility may have an approximately similar, relatively short, history of afflicting humankind to that of syphilis. That would be the case if, also, a version of the old “Columbian” theory was proved to be correct, namely, that sexually transmitted syphilis first erupted in western Europe shortly after the return of Columbus from the Americas. Indeed, Piers Mitchell proposes a variant of this theory, arguing that a less harmful, non-venereal treponemal disease, widely prevalent in the pre-Columbian Americas (i.e., yaws or endemic syphilis, which, in sufficiently warm climates, can be passed merely by skin and surface contact) was brought back to temperate Europe, where in the climatically different and more urban environment it rapidly mutated into the devastating venereal form, dependent in these temperate climates on access to the temperature-controlled environment internal to the human body.⁶⁵ If the provenance of both syphilis and gonorrhea, each originating sometime in the late fifteenth and sixteenth centuries, were, indeed, to be proved correct, this would of course bring up the intriguing possibility that the emergence of venereal syphilis in comparatively recent human history may have also had something to do with the emergence, at the same time or shortly thereafter, of gonorrhea (or possibly even vice versa, or some form of coevolution), further illustrating the significance of Emmanuel Le Roy Ladurie’s celebrated thesis of the importance of the microbial unification of the world in these early modern centuries of transoceanic contact.⁶⁶

However, there is much yet to be further researched about the putative origins and history of syphilis itself, before any such speculations about possible early modern coevolution with gonorrhea can be further entertained. As the chapter by Roberts and Redfern indicates, bioarchaeology remains divided over the interpretation of major finds of skeletal remains, notably those recovered from the St. Mary Spital site in London, which has permitted analysis by chronological phasing of large numbers of European remains going back to the eleventh century, long before the Columbian encounter with the Americas. This evidence, placed alongside that from other Eurasian excavated sites and also from the Americas, is critically reviewed in their chapter. The evidence is tantalizing in suggesting the possible—but unfortunately not entirely conclusive—presence of venereal syphilis in Europe before 1492. For the data to be entirely convincing, there would need to

be a good number of intact, whole skeletons, definitely dated to pre-1492 and exhibiting the unambiguous syphilitic combination of both long-bone tibia deformities (sabre shins) and frontal, cranial pitting of the skull in the same individual. There are very few such attested cases pre-1492, but a relative abundance for the following century. Thus, the archaeological evidence currently available would also be consistent with the proposition that even if venereal syphilis did exist in pre-Columbian Europe, for some reason it may not have existed very extensively. Its infectious or its pathological—or both—characteristics may have been transformed shortly after the return of Columbus and his crew. This could have been due to coincident changes in the socioecological environment and sexual behavior of urban communities in Europe at this time. Alternatively, the archaeological evidence may be picking up on the effects of something else entirely in pre-1492 Europe, including perhaps the skeletal marks of disease-causing microorganisms no longer extant. In that case the sexually transmitted *Treponema pallidum* may have been genuinely new to Europe after 1492, hence its well-documented rapid and frightening impact in that virgin population and the apparent absence of pre-1500 evidence for it elsewhere in Eurasia.⁶⁷

Treponema pallidum pallidum, which causes venereal syphilis, is, like the other treponemes—*Treponema pallidum endemicum* (bejel) and *Treponema pallidum carateum* (pinta)—both morphologically and serologically identical to *Treponema pallidum pertenuis*, which causes yaws. Phylogenetic analysis has established that yaws is the oldest of the four treponemes and that there are minute genetic differences between each of them.⁶⁸ Yaws, pinta, and bejel (sometimes called “Arab” syphilis) are all endemic to rural populations and are relatively easily passed by simple, physical contact. Yaws is prevalent in humid, warm conditions and the other two in less humid and even arid (bejel) but also warm conditions.⁶⁹ Venereal syphilis appears to be adapted more exclusively to a sexual transmission path and is therefore not dependent on any specific climatic conditions but is dependent on intimate human contact. It is therefore likely to be strongly human density-dependent and to flourish in urban settings, especially if there are no strict codes of restricted sexual interaction—or if such codes are not observed (as for instance in wartime by armies, which are considered to have been a principal agent in the frightening proliferation of syphilis in Europe during the protracted wars on the Italian peninsula between 1494 and 1559). Yaws was quite definitely endemic in South America when Columbus arrived, and it would have conferred cross-immunity against syphilis on the indigenous population.⁷⁰ Venereal syphilis could therefore also have been present in the

pre-Columbian Americas, but, if so, it would have been at relatively low levels of incidence due to cross-immunities and also it would not have appeared as a distinctive health threat to the community, since quite a number of dermatological symptoms are common between yaws and venereal syphilis (though only syphilis exerts the potentially fatal tertiary-stage effects on a proportion of its victims).⁷¹ Its manifestation as a widespread and apparently new illness would then have become possible only when *Treponema pallidum pallidum* was brought back by Columbus's crew to temperate Europe, where it could spread within urban populations with no cross-immunities, since there was no yaws in Europe.

It currently remains unclear whether either venereal syphilis or gonorrhea in fact afflicted any human populations in the world before the 1490s and differences of opinion on this are expressed by different contributors to this volume. The latest genomics research would back a post-Columbian dating for *Treponema pallidum*.⁷² Similar research methods would also appear to suggest that the strains of gonorrhea available to science for study today probably were not present before the sixteenth century. However, as noted, the gonococcus, unlike *Treponema pallidum*, is a formidably adaptive and mutable microorganism.⁷³ Other now-extinct variants may well have preexisted, though whether posing the same threat to human fertility we may never know. Equally, research also suggests that, independently of either syphilis or gonorrhea, due to the enduring presence of genital serovars of *Chlamydia trachomatis*, the capacity of sexual behavior to transmit infections that cause infertility has been a hidden affliction of long provenance among human populations. The more visible and well-studied history of human affliction from the ocular variants of *C. trachomatis*, documented by Taylor in chapter 4, suggests that chlamydia may have become a serious threat to the infertility of human groups only when living for long periods in conditions that were crowded, unhygienic, and stressed. Such conditions probably became a regular experience in the course of human history only after the domestication of plants and animals led to increasingly dense settlement patterns, as in the urban centers of past empires and more generally across the globe after the industrial revolution's intensification of densely crowded forms of urbanization and the expansion of the transoceanic communications, whose effects ultimately even on island populations in the Pacific are so fascinatingly documented in chapters 6 and 7.

The chapters in parts 3 and 4 of this volume show that the history of STIs and their perceived capacity to cause infertility—even to the point of “race suicide,” as a eugenics-inflected language over fears of depopulation

or “degeneration” portrayed these issues in the early twentieth-century decades—was thoroughly integrated in diverse ways into imperial, and postimperial political economy and its accompanying racial discourses and medico-scientific practices. As chapters 7 and 9 document in certain Pacific islands and in outback Australia, indigenous populations occupying territory with little strategic or economic value were perceived fatalistically as “dying races” by the occupying European powers. Yet, in East Africa, where military control of territory was competitive between the imperial powers and where tax revenue was wanted from the local population to pay for their “protection,” proactive medical policies were pursued, in collaboration with local leaders, in the attempt to forestall unwanted depopulation. Intriguing and unexpected parallels occurred: government-sponsored health policies to control the fertility-threatening STIs emerged as an early universalist, free health care system to protect the military and industrial effectiveness of the British working class in the interwar United Kingdom and, almost simultaneously, was also instigated in colonial East Africa to protect Africans. Furthermore, while in both the Pacific and in East Africa, gonorrhea may well have been brought to these indigenous populations by outsiders, venereal syphilis may also have been inadvertently exacerbated by European doctors. They often misdiagnosed, as venereal syphilis, various symptoms of the non-venereal tropical treponemes, which in fact conferred immunity against syphilis; when the latter were “cured” by Western antibiotics, venereal syphilis could become a greater problem in such tropical populations.

Behind the Veil

To make progress with the study of sex, disease, and infertility, we need the combined—not separated—insights of very different disciplines and their approaches, embracing history and the life sciences. We need to study texts and all other relevant sources of information on the interactions in different times and places between humans and the relevant microorganisms—those that we today recognize as causing the diseases of syphilis, gonorrhea, and chlamydia but that have had revealingly different designations (or none at all) in the past and in other cultures. We need to relate this to changing cultures of the perception of these diseases and also to our contemporary, increasing, and quite rapidly changing scientific and epidemiological understanding of the characteristics and the likely natural histories of the relevant microorganisms, which we today identify as *T. pallidum*, *N. gonorrhoeae*, and

C. trachomatis. This introduction can only hope to provide a survey and some summary—but necessarily provisional—thoughts, which reflect the current state of knowledge at this point in time.

Each of these three major historical STIs was capable of preventing or prematurely destroying human life. Each has its unique characteristics of concealment as a hidden affliction, both at the microbial level and as manifest disease. Syphilis, though often evident and sometimes quite hideous in its bodily manifestations, could also hide in plain sight as the “great imitator,” causing a wide range of symptoms similar to many other diseases, while its entirely transparent spirochete, the pale treponeme, eluded microscopic identification for decades.⁷⁴

Gonorrhea was the great deceiver. It was thought of as “merely” the clap, *Tripper* (in German) or the jocular *chaude pisse*, which remained the subject of manly banter in France as recently as the mid-twentieth century, as chapter 11 mentions. It was also often completely asymptomatic for many women. Yet, of the three, it was the most deceptive in its destructive powers, being the most ferocious sterilizer of both sexes.

Chlamydia, however, was the most clandestine of all. It was the last to be literally uncloaked by science, not emerging as a clinical entity—an identified microorganism officially considered definitely responsible for a defined disease—until as recently as the 1970s, as chapter 5 recounts. Yet in all probability it has abided with its human host in its several genital serovar forms, for many millennia. Like gonorrhea, it silently sterilizes a proportion of women infected, with the majority of them unaware of the danger they are in, and it is consequently the subject of massive screening efforts today.

However, unlike gonorrhea, which has been documented to have brought some island populations to their knees, it seems unlikely that chlamydia, alone, has exerted such a virulent sterilizing power on an entire population. As would be predicted from evolutionary theory, such a very long-term and ubiquitous, if largely unsuspected, parasite accompanying the human species through much of its history would be highly adaptive and therefore unlikely to exert the kind of scale of effect on its host’s reproductive capacities as to threaten their mutual survival. But that does not of course mean that it has not also been responsible for much individual psychological pain and suffering for the many individuals who found themselves inexplicably infertile, as most searingly brought to life for theater audiences in Federico García Lorca’s stage masterpiece of 1934, *Yerma*.

The essays in this volume cannot realistically aspire to move us in a single leap from a state of dimly perceived ignorance to a comprehensive solution

to the riddle at the volume's heart, the history of pre-HIV STIs and their manifold consequences for human infertility. For instance, there are no chapters here focused on evidence relating to either Asia or the Americas. Though the geographic and temporal coverage may be finite and only partial, there has been a more comprehensive effort to draw together a sufficiently wide, if not quite "global," range of relevant disciplinary knowledges with which to approach an understanding of the riddle. We may perhaps, with the appearance of this volume, no longer be under the spell of the enigma, and, though we may yet have much to contend with, it is hoped that we have at least made a helpful start with unwrapping some of the mystery.

Notes

1. Google Ngrams indicates that since 1994 the abbreviation *STI* has been increasingly replacing *STD* (sexually transmitted disease), in recognition of the clinical importance of the asymptomatic nature, especially in women, of both gonorrhea and chlamydia. Ngrams also indicates that previously the collective noun, *venereal disease*, was about twice as commonly used as *venereal diseases* throughout the twentieth century, until both were overtaken around 1983 by the abbreviation *STD*, which had been on the rise since the early 1950s. https://books.google.com/ngrams/graph?content=STDs%2CSTIs%2Cvenereal+disease%2Cvenereal+diseases&year_start=1900&year_end=2008&corpus=18&smoothing=5&share=&direct_url=t1%3B%2CSTDs%3B%2Cc0%3B.t1%3B%2CSTIs%3B%2Cc0%3B.t1%3B%2Cvenereal%20disease%3B%2Cc0%3B.t1%3B%2Cvenereal%20diseases%3B%2Cc0, accessed February 14, 2019. Readers will note that in the text of this chapter and elsewhere in the volume the terms *venereal disease(s)* and *STI* are both in use (and sometimes *STD*), with the usage dependent on context.

2. For the pioneering study demonstrating the early twentieth-century origins of HIV/AIDs in Africa, see John Iliffe, *The African AIDS Epidemic: A History* (Athens: Ohio University Press, 2006).

3. The three other variants are *Treponema pallidum pertenue* (yaws), *Treponema pallidum endemicum* (endemic syphilis or bejel), and *Treponema pallidum carateum* (pinta), none of which are specifically sexually transmitted or cause fertility-related problems.

4. Lauren Arnesen, Suzanne Serruya, and Pablo Duran, "Gestational Syphilis and Stillbirth in the Americas: A Systematic Review and Meta-analysis," *Revista Panamericana de Salud Pública* 37, no. 6 (2015): 422–29.

5. For an example, see Simon Szreter, "Treatment Rates for the Pox in Early Modern England: A Comparative Estimate of the Prevalence of Syphilis in the City of Chester and Its Rural Vicinity in the 1770s," *Continuity and Change* 32, no. 2 (2017): 183–223.

6. See Simon Szreter, “The Prevalence of Syphilis in England and Wales on the Eve of the Great War: Re-visiting the Estimates of the Royal Commission on Venereal Diseases, 1913–1916,” *Social History of Medicine* 27, no. 3 (2014): 508–29; see page 528 on Swedish and British evidence.

7. Richard Pattman et al., eds., *Oxford Handbook of Genitourinary Medicine, HIV, and Sexual Health*, 2nd ed. (Oxford: Oxford University Press, 2010).

8. Ulla Larsen et al., “Suffering Infertility: The Impact of Infertility on Women’s Life Experiences in Two Nigerian Communities,” *Journal of Biosocial Science* 42 (2010): 787–814; Aditya Bharadwaj, *Conceptions: Infertility and Procreative Technologies in India* (Oxford: Berghahn 2016); Michaela Kreyenfeld and Dirk Konietzka, eds., *Childlessness in Europe: Contexts, Causes and Consequences* (Cham, Switzerland: Springer Open, 2017). However, this is a relatively new development, with the first substantial global academic focus on the subject appearing as recently as 2002: Marcia C. Inhorn and Frank van Balen, eds., *Infertility around the Globe: New Thinking on Childlessness, Gender and Reproductive Technologies* (Berkeley: University of California Press, 2002).

9. Danielle G. Tsevat et al., “Sexually Transmitted Diseases and Infertility,” *American Journal of Obstetrics and Gynecology* 216 (2017): 1–9, <https://doi.org/10.1016/j.ajog.2016.08.008>.

10. See the many contributions to Gayle Davis and Tracey Loughran, eds., *The Palgrave Handbook of Infertility in History: Approaches, Contexts, Perspectives* (London: Palgrave Macmillan 2017). The editors discuss in their introduction the limited attention historians have previously given to the subject, identifying the only dedicated previous study as Naomi Pfeffer’s polemic, *The Stork and the Syringe: A Political History of Reproductive Medicine* (Cambridge: Polity, 1993). There is also now a historical monograph: Daphna Oren-Magidor, *Infertility in Early Modern England* (London: Palgrave Macmillan 2017); and a journal special issue on medical understandings: Daphna Oren-Magidor and Catherine Rider, “Infertility in Medieval and Early Modern Medicine,” *Social History of Medicine* 29 (2016): 211–23. See also Rebecca Flemming, “The Invention of Infertility in the Classical Greek World: Medicine, Divinity, and Gender,” *Bulletin of the History of Medicine* 87 (2013): 565–90, <https://doi.org/10.1353/bhm.2013.0064>.

11. This is a statement about the output of historians. There has of course been plenty of significant attention given by clinicians, demographers, and public health epidemiologists to infertility aspects of gonorrhea and more recently chlamydia and HIV/AIDS. In his extensive history of STDs, Milton Lewis restricts his discussion of the relationship with infertility to a review of the Butlin-Gray debate (see below, note 14): *Thorns on the Rose: The History of Sexually Transmitted Diseases in Australia in International Perspective* (Canberra: Australian Government, 1998): 34–37, 365–67. A historical survey volume of STDs in Asia and the Pacific, though generally informative, does not appear to mention infertility at any point, and there is only one point in a companion survey volume on Africa where the subject is mentioned, which is briefly in relation to Uganda in the 1950s and 1960s:

Milton Lewis, Scott Bamber, and Michael Waugh, eds., *Sex, Disease and Society: A Comparative History of Sexually Transmitted Diseases and HIV/AIDS in Asia and the Pacific* (London: Greenwood, 1997); Philip W. Setel, Milton Lewis, and Maryinez Lyons, eds., *Histories of Sexually Transmitted Diseases and HIV/AIDS in Sub-Saharan Africa* (London: Greenwood, 1997), 108–9, 115.

12. A selection, only, of such studies includes Alain Corbin, *Women for Hire: Prostitution and Sexuality in France after 1850* (1978; repr., Cambridge, MA: Harvard University Press, 1990); Judith R. Walkowitz, *Prostitution and Victorian Society: Women, Class and the State* (Cambridge: Cambridge University Press, 1980); Kenneth Ballhatchet, *Race, Sex, and Class under the Raj: Imperial Attitudes and Policies and Their Critics, 1793–1905* (London: Weidenfeld and Nicholson 1980); Claude Quézel, *History of Syphilis* (1986; repr., Cambridge: Polity, 1990); Allan M. Brandt, *No Magic Bullet: A Social History of Venereal Disease in the United States since 1880* (Oxford: Oxford University Press, 1987); Lesley A. Hall, *Hidden Anxieties: Male Sexuality, 1900–1950* (Cambridge: Polity, 1991); Jon Arrizabalga, John Henderson and Roger French, eds., *The Great Pox in Renaissance Europe* (New Haven: Yale University Press, 1997); Mary Spongberg, *Feminizing Venereal Disease: the Body of the Prostitute in Nineteenth-Century Medical Discourse* (New York: New York University Press 1997); J. David Oriel, *The Scars of Venus: A History of Venereology* (London: Springer, 1998); Randolph Trumbach, *Sex and the Gender Revolution. Volume One.* (Chicago, University of Chicago Press, 1998), chap.7 “The Foul Disease”; Peter Baldwin, *Contagion and the State in Europe, 1830–1930* (Cambridge: Cambridge University Press, 1999), chap. 5; Lutz Sauerteig, *Krankheit, Sexualität, Gesellschaft: Geschlechtskrankheiten und Gesundheitspolitik in Deutschland im 19. und frühen 20. Jahrhundert* (Stuttgart: Steiner, 1999); Roger Davidson, *Dangerous Liaisons: A Social History of Venereal Disease in Twentieth-Century Scotland* (Amsterdam: Rodopi, 2000); Roger Davidson and Lesley A. Hall, eds., *Sex, Sin and Suffering: Venereal Disease and European Society since 1870* (London: Routledge, 2001); Philippa Levine, *Prostitution, Race and Politics: Policing Venereal Disease in the British Empire* (London: Routledge, 2003); Kevin Siena, ed., *Sins of the Flesh: Responding to Sexual Disease in Early Modern Europe* (Toronto: Centre for Reformation and Renaissance Studies, 2005); Kevin Siena, *Venereal Disease, Hospitals and the Urban Poor: London’s “Foul Wards,” 1600–1800* (Rochester, NY: University of Rochester Press, 2004); Antje Kampf, *Mapping Out the Venereal Wilderness: Public Health and STD in New Zealand, 1920–1980* (Berlin: LIT Verlag 2007); Gayle Davis, *The Cruel Madness of Love: Sex, Syphilis and Psychiatry in Scotland, 1880–1930* (Amsterdam: Rodopi, 2008); Claudia Stein, *Negotiating the French Pox in Early Modern Germany* (Farnham: Ashgate, 2009); Philip Howell, *Geographies of Regulation: Policing Prostitution in Nineteenth-Century Britain and the Empire* (Cambridge: Cambridge University Press, 2009); Laura J. McGough, *Gender, Sexuality and Syphilis in Early Modern Venice: The Disease That Came to Stay* (London: Palgrave Macmillan, 2011); Julia Laite, *Common Prostitutes and Ordinary Citizens: Commercial Sex in London, 1885–1960* (Basingstoke: Palgrave Macmillan, 2011); Lisa Featherstone, *Let’s Talk*

about Sex: Histories of Sexuality in Australia from Federation to the Pill (Newcastle-on-Tyne: Cambridge Scholars 2011), chap. 4; Christian Bonah and Anja Laukötter, eds., “Screening Diseases: Films on Sex Hygiene in Germany and France in the First Half of the 20th Century,” special issue, *Gesnerus* 72, no. 1 (2015): 5–158; Monika Pietrzak-Franger, *Syphilis in Victorian Literature and Culture: Medicine, Knowledge and the Spectacle of Victorian Invisibility* (Cham: Palgrave Macmillan 2017); Kari Nixon and Lorenzo Servitje, eds, *Syphilis and Subjectivity: From the Victorians to the Present* (Cham: Palgrave Macmillan, 2018); Noelle Gallagher, *Itch, Clap, Pox: Venereal Disease in the Eighteenth-Century Imagination* (Yale University Press 2018). For two overviews, see Kevin Siena, “‘The Venereal Disease,’ 1500–1800,” and Lesley A. Hall, “Sexual Disease since 1750,” both in *The Routledge History of Sex and the Body 1500 to the Present*, ed. Sarah Toulalan and Kate Fisher (New York: Routledge, 2013), 463–78, 479–92.

13. But see Donna T. Andrew, *Philanthropy and the Police: London Charity in the Eighteenth Century* (Princeton: Princeton University Press, 1989), 98–134; and Anne Hanley, “‘The Great Foe to the Reproduction of the Race’: Changing Medical Knowledge and Practice; Diagnosing and Treating Infertility Caused by Venereal Diseases, 1880–1914,” in Davis and Loughran, *Palgrave Handbook of Infertility*, 335–58. There is no mention of the link with infertility in Ornella Moscucci’s pioneering study, *The Science of Woman: Gynecology and Gender in England, 1800–1929* (Cambridge: Cambridge University Press, 1990).

14. Shane Doyle, *Before HIV: Sexuality, Fertility and Mortality in East Africa, 1900–1980* (Oxford: Oxford University Press, 2013); Mick Worboys, “Unsexing Gonorrhoea: Bacteriologists, Gynaecologists and Suffragists in Britain, 1860–1920,” *Social History of Medicine* 17, no. 1 (2004): 31–59; Elliott Bowen, “Limits of the Lab: Diagnosing ‘Latent Gonorrhoea,’ 1872–1910,” *Bulletin of the History of Medicine* 87 (2013): 63–85; Megan Vaughan, *Curing Their Ills: Colonial Power and African Illness* (Stanford, CA: Stanford University Press, 1991), chap. 6. The thesis of aboriginal decline due to STI infertility was championed by Butlin and contested by Gray: Noel Butlin, *Our Original Aggression: Aboriginal Populations of Southeastern Australia, 1788–1850* (Sydney: Allen and Unwin, 1983); Alan Gray, “Some Myths in the Demography of Aboriginal Australia,” *Journal of Australian Population Association* 2 (1985): 136–49; see also Hanley, “Great Foe.”

15. Art and literature at this time was much preoccupied with fears of syphilis and particularly its supposed hereditary nature. Meegan Kennedy, “Syphilis and the Hysterical Female: The Limits of Realism in Sarah Grand’s *The Heavenly Twins*,” *Women’s Writing* 11 (2004): 259–80.

16. On the slow and reluctant reception of “latent” gonorrhoea in Britain, see Worboys, “Unsexing Gonorrhoea,” who notes that William Japp Sinclair, professor of obstetrics and gynecology at the University of Manchester, was an exceptional early advocate of Noeggerath’s findings; see also Bowen, “Limits of the Lab” and, more generally, Hanley, “Great Foe.”

17. Margaret Marsh and Wanda Ronner, *The Empty Cradle: Infertility in America from Colonial Times to the Present* (Baltimore: Johns Hopkins University Press, 1996), 89–92, 116–18; Brandt, *No Magic Bullet*, 11–17.

18. Brandt, *No Magic Bullet*, chap. 4; Thomas Parran, *Shadow on the Land: Syphilis* (New York: Reynald and Hitchcock 1937).

19. As chapter 4 details, the species *Chlamydia trachomatis* comprises at least eight variants—serovars—that cause the fertility-threatening genital infections with which this volume is primarily interested, as well as four that cause ocular disease and three LGV variants producing lymphogranuloma venereum.

20. Joseph A. McFalls and Marguerite H. McFalls, *Disease and Fertility* (London: Academic Press, 1984), pt. 3. The literature on HIV and AIDS is legion, especially for sub-Saharan Africa. For the best single historical account of the disease, see Iliffe, *African AIDs Epidemic*; and for an example of the work of a leading analyst of HIV and infertility in Africa, see Larsen, “Suffering Infertility.” On the timing of evolving public perceptions of the international AIDS threat, see Virginia Berridge, *AIDS in the UK: The Making of Policy, 1981–1994* (Oxford: Oxford University Press, 1996); and Rich A. McKay, *Patient Zero and the Making of the AIDS Epidemics* (Chicago: University of Chicago Press, 2017).

21. Inhorn and van Balen, *Infertility around the Globe*, pt. 1, esp chap. 2; Marcia C. Inhorn, ed., *Reproductive Disruptions: Gender, Technology and Biopolitics in the New Millennium* (London: Berghahn 2007). For the prior elucidation of the politics of reproduction and the associated concept of “stratified reproduction,” see Faye D. Ginsburg and Rayna Rapp, eds., *Conceiving the New World Order: The Global Politics of Reproduction* (Berkeley: University of California Press, 1995).

22. Caroline Bledsoe, *Contingent Lives: Fertility, Time and Ageing in West Africa* (Chicago: University of Chicago Press, 2002), 228.

23. Worboys has noted that it was gonorrhea itself that was the first disease seen to satisfy Koch’s four postulates for proving a specific bacteriological etiology for a communicable disease and thereby heralding this shift from doctors defining disease according to symptoms and effects on the body’s functioning and instead increasingly turning to the laboratory for microscopic or serological identification of the presence of specific microbes: “Unsexing Gonorrhea,” 41–42; and see K. M. Flegel, “Changing Concepts of the Nosology of Gonorrhea and Syphilis,” *Bulletin of the History of Medicine* 48, no. 4 (1974): 571–88, 576–84.

24. Oriel, *Scars of Venus*, 73; see also Bowen, “Limits of the Lab.” For documentation of the difficulties, confusions, and crude racial stereotyping that even doctors trained in Germany, where the science of the diseases was most advanced, continued to experience in the period before the Great War in dealing with the practicalities of attempting to treat the disease, see Daniel J. Walther, *Sex and Control: Venereal Disease, Colonial Physicians and Indigenous Agency in German Colonialism, 1884–1914* (New York: Berghahn 2015), especially 60–72, 80–84, 104–7, 122–24.

25. Davis, *Cruel Madness*. On Sir Frederick W. Mott’s work on GPI, see J. D. Hurn, “The History of General Paralysis of the Insane in Britain, 1830 to 1950”

(PhD diss., University of London, 1998), chap. 3; and S. Matthews, “Matter of Mind: The Contributions of Neuropathologist Sir Frederick Walker Mott to British Psychiatry, c. 1895–1923” (PhD diss., University of Manchester, 2006), esp. chap. 6.

26. Oriel, *Scars of Venus*, 126.

27. Percy S. Pelouze, *Gonorrhoea in the Male and Female: A Book for Practitioners*, 3rd ed. (Philadelphia: Saunders, 1941), 9–10 (“Preface to the First Edition”).

28. Linda E. Merians, ed, *The Secret Malady: Venereal Disease in Eighteenth-Century Britain and France* (Lexington: University Press of Kentucky 1996).

29. See the contemporary critical discussion by the reforming US doctor Prince A. Morrow: *Social Disease and Marriage: Social Prophylaxis* (New York: Lea Brothers, 1904), chap. 3. For a relatively brief comparative historical study, see Andreas-Holger Maehle, *Contesting Medical Confidentiality: Origins of the Debate in the United States, Britain, and Germany* (Chicago: University of Chicago Press, 2016), esp. chap. 2. Victoria Bates, *Sexual Forensics in Victorian and Edwardian England Age, Crime and Consent in the Courts* (London: Palgrave 2016) is also of relevance.

30. Jill Harsin, “Syphilis, Wives, and Physicians: Medical Ethics and the Family in Late Nineteenth-Century France,” *French Historical Studies* 16 (1989): 72–95.

31. Christabel Pankhurst, *The Great Scourge and How to End It* (London: E. Pankhurst, 1913). See also Susan K. Kent, *Sex and Suffrage in Britain, 1860–1914* (London: Routledge, 1990). In the United States Charlotte Perkins Gilman’s short novel of 1911, *The Crux*, also mounted an influential feminist denunciation. Perkins Gilman, *The Crux: A Novel*, edited with an introduction by Jennifer S. Tuttle (Newark: University of Delaware Press, 2002).

32. Lutz Sauerteig, “The Fatherland Is in Danger: Save the Fatherland! Venereal Disease, Sexuality and Gender in Imperial and Weimar Germany,” in Davidson and Hall, *Sex, Sin and Suffering*, 76–92, 82.

33. Matthew Ramsey, “Public Health in France,” in *The History of Public Health and the Modern State*, ed. Dorothy Porter (Amsterdam: Rodolpi 1994), 99–102; on Johann Peter Frank’s famous doctrine of *Medicinische Polizey*, see George Rosen, *A History of Public Health* (Baltimore: Johns Hopkins University Press, 1993), 137–43.

34. Angus McLaren, *Impotence: A Cultural History* (Chicago: University of Chicago Press, 2007), chap. 5; and see Hanley, “Great Foe.”

35. Tomas Sobotka, “Childlessness in Europe: Reconstructing Long-Term Trends among Women Born in 1900–1972,” in Kreyenfeld and Konietzka, *Childlessness in Europe*, 17–53. Other historical studies of childlessness have similarly only mentioned STIs, if at all, as one of a list of possible causal factors: Dudley L. Poston and Katherine Trent, “International Variability in Childlessness: A Descriptive and Analytical Study,” *Journal of Family Issues* 3 (1982): 573–91; S. Philip Morgan, “Late Nineteenth and Early Twentieth-Century Childlessness,” *American Journal of Sociology* 97, no. 3 (1991): 779–807; Donlad T. Rowland, “Historical Trends in Childlessness,” *Journal of Family Issues* 28, no. 10 (2007): 1311–37; Sandra Brée, Thierry Eggerickx, and Jean-Paul Sanderson, “Low Fertility, Childlessness and

Family Changes in the First Half of the 20th Century in France and Belgium,” *Revue Quetelet Journal* 5, no. 1 (2017): 7–31, <https://doi.org/10.14428/rqj2017.05.01.01>.

36. For an exemplary study adopting this approach, see Stein, *Negotiating the French Pox*.

37. The estimates are 40–50 percent of men and 70–80 percent of women: Pattman et al., *Oxford Handbook*, 150.

38. Arthur L. Greil, Kathleen Slauson-Blevins, and Julia McQuillan, “The Experience of Infertility: A Review of Recent Literature,” *Sociology of Health and Illness* 32, no. 1 (2010): 140–62, <https://doi.org/10.1111/j.1467-9566.2009.01213.x>. On the English-language etymology of the key terms *barren*, *sterile* and *infertile*, see Tracey Loughran and Gayle Davis, “Introduction: Defining the ‘Problem’; Perspectives on Infertility,” in Loughran and Davis, *Palgrave Handbook of Infertility*, 29–35, 30.

39. Grmek’s capacious 1969 concept of pathocenosis may be particularly applicable to STIs, as he himself has argued. Mirko D. Grmek, *History of AIDS: Emergence and Origin of a Modern Pandemic* (Princeton, NJ: Princeton University Press, 1990), esp. 156–60.

40. See Lutz Sauerteig and Roger Davidson, eds., *Shaping Sexual Knowledge A Cultural History of Sex Education in Twentieth Century Europe* (London: Routledge, 2012), 40–43, 56–58, 76–92, 176–83, 218–27, on interwar Britain, Sweden, and Poland; Angela Davis, “‘Oh No, Nothing, We Didn’t Learn Anything’: Sex Education and the Preparation of Girls for Motherhood, c. 1930–1970,” *Journal of the History of Education* 37 (2008): 661–77; and Simon Szreter and Kate Fisher, *Sex before the Sexual Revolution: Intimate Life in England, 1918–1963* (Cambridge: Cambridge University Press, 2010), chaps. 2–3, 6. More generally on the media in Britain, see Adrian Bingham, *Family Newspapers? Sex, Private Life and the British Popular Press, 1918–1978* (Oxford: Oxford University Press, 2009).

41. A rare example in English of such direct public advice given in the context of a fully informative guide was available only at the very end of the interwar period and was in fact a translation of a German text: Fritz Kahn, *Our Sex Life: A Guide and Counsellor for Everyone*, trans. George Rosen (London: Heinemann Medical Books, 1939), chap. 21.

42. Lynn Hunt, “AHR Roundtable: The Self and Its History,” *American Historical Review* 119 (2014): 1576–86; Hunt, *Inventing Human Rights: A History* (New York: Norton, 2007).

43. For another volume explicitly committed to this approach, see Philip Kreager et al., eds., *Population in the Human Sciences 2015: Concepts, Models, Evidence* (Oxford: Oxford University Press, 2015).

44. Harold C. Wiesenfeld and Willard Cates Jr, “Sexually Transmitted Diseases and Infertility,” in *Sexually Transmitted Diseases*, ed. King K. Holmes et al., 4th ed. (New York: McGraw-Hill Medical, 2008), chap. 79, pp. 1511–27, 1514–15.

45. Wiesenfeld and Cates, “Sexually Transmitted Diseases,” in Holmes et al., *Sexually Transmitted Diseases*, chap. 79, pp. 1511–27, 1514–15. However, while the mechanism of damage is known, the relationship between chlamydial infection and

infertility remains a complex matter open to considerable current scientific debate over the pathways involved, in part because of the difficulty in defining a discrete episode of infection. Even among clinical populations receiving monitored treatment, a single initial infection can result in an inflammation continuing for many weeks, if not months, because a single course of antibiotics will not completely clear the infection. See chapter 12, appendix E, in this volume, for further discussion and references to current research.

46. This pattern of repeated syphilitic miscarriage and stillbirths followed by sickly and then healthy live births was sufficiently evident to nineteenth-century medical observers that it was termed Kassowitz's Law and considered diagnostic of syphilitic infection: Hanley, "Great Foe," 343. For a summary, see McFalls and McFalls, *Disease and Fertility*, 333–40.

47. Roy F. R. Scragg, *Depopulation in New Ireland* (Port Moresby: Administration of Papua and New Guinea, 1957).

48. William H. R. Rivers, 1864–1922, an eminent anthropologist and early psychiatrist, was much involved in treating shell-shocked troops (including Robert Graves and Siegfried Sassoon) during World War I, and the concept of shell shock was collectively developed through this clinical experience. Peter Leese, *Shell Shock: Traumatic Neurosis and the British Soldiers of the First World War* (London: Palgrave Macmillan, 2002); Tracey Loughran, *Shell-Shock and Medical Culture in First World War Britain* (Cambridge: Cambridge University Press, 2016).

49. On tuberculosis, malaria, and postpartum infection, see McFalls and McFalls, *Disease and Fertility*, chaps. 3, 4, 16. Other, less widely prevalent, infectious diseases that can cause infertility are also considered at length in other chapters by the McFalls: Filiaris (chap. 5), Schistosomiasis (chap. 6), African Sleeping Sickness (chap. 7), and Chagas Disease (chap. 8).

50. Irvine Loudon, *Death in Childbirth: An International Study of Maternal Care and Maternal Mortality, 1800–1950* (Oxford: Clarendon, 1992), chaps. 12–15.

51. McFalls and McFalls, *Disease and Fertility*, 484.

52. Tsevat et al., "Sexually Transmitted Diseases," 9. A rare report on clinical research reported that 1.32 percent of 3,088 female cases registered and treated for TB during 1989–99 in Fars Health Center (Iran), were diagnosed with genital tract TB, and 76 percent were infertile. This would imply that about 1 percent of women sufficiently unwell to come to this clinic and who were then diagnosed with TB had a sterilizing case of infertility. B. Namavar Jahromi, M. E. Parsanezhada, and R. Ghane-Shirazib, "Female Genital Tuberculosis and Infertility," *International Journal of Gynecology and Obstetrics* 75 (2001): 269–72. It is not possible, however, to draw any inference from the information contained in this article about the extent to which TB, alone, was responsible for the sterility, nor what proportion the population of the Fars province (population 4.6 million in 2011) was affected. It has been argued, though not on the basis of any robust clinical epidemiological evidence, that TB was a significant cause of rising infertility among the US black population during the period 1880–1960, where its impact has even been claimed to have been

comparable to that of gonorrhea. However, that claim was a self-generated one due to the authors' unwarranted assumption that genital TB rates in 1880 would have been one-fifth the rate found in 1940: McFalls and McFalls, *Disease and Fertility*, 484–500, esp. 498.

53. Vaughan, *Curing Their Ills*, chap. 6.

54. The epidemiologists' transmission model is expressed mathematically in the equation $R_0 = \beta * c * D$ (where R_0 is the basic reproductive rate of a parasite or an infectious disease agent, measured in terms of the ability of an infection to produce a secondary case (or a second-generation parasite) before it dies or enters a persistent (dormant) state due to the host's immunological response. The Greek letter β is the transmission probability (how likely the microorganism is to pass from one host to another per discrete contact episode); c is the contact rate between infectious and susceptible (noninfected) individual members of the host population; and D is the duration of infectiousness (how long an infected individual can pass on the disease). When $R_0 = 1$ a disease is just maintaining itself within a host population with, on average, each case of infection leading to just one further case of infection. For public health preventive epidemiology the measurement of the value of R_0 is extremely useful to estimate the proportion of a closed population needing to be immunized or treated either to eradicate or to reduce a disease's prevalence to a desired minimal level. For a classic full exposition, see Roy M. Anderson and Robert M. May, *Infectious Diseases of Humans: Dynamic and Control* (Oxford: Oxford University Press, 1991).

55. Katy M. E. Turner et al., "Investigating Ethnic Inequalities in the Incidence of Sexually Transmitted Infections: Mathematical Modelling Study," *Sexually Transmitted Infections* 80 (2004): 379–85, <https://doi.org/10.1136/sti.2003.007575>; on the United States, see McFalls and McFalls, *Disease and Fertility*, chap. 19.

56. Thomas Nutt, "Illegitimacy, Paternal Financial Responsibility, and the 1834 Poor Law Commission Reports: The Myth of the Old Poor Law and the Making of the New," *Economic History Review* 63 (2010): 335–61. On the plight of poor women in London, see Lynn MacKay, *Respectability and the London Poor, 1780–1870* (London: Pickering and Chatto 2013); and Samantha Williams, *Unmarried Motherhood in the Metropolis, 1700–1850: Pregnancy, the Poor Law and Provision* (London: Palgrave 2018).

57. For a wide-ranging cultural and historical consideration of many of these issues in relation to medicine, biology, race, and social stigma, see Sander L. Gilman, *Diseases and Diagnoses: The Second Age of Biology*, 2nd ed. (New York: Routledge, 2017), notably chapter 2 in relation to STIs.

58. See Paul Farmer on the concept of structured violence: *Pathologies of Power* (Berkeley: University of California Press, 2003), chap. 1. More generally, see Richard Wilkinson and Kate Pickett, *The Spirit Level* (London: Lane 2009).

59. Claudia Stein, "Divining and Knowing: Karl Sudhoff's Historical Method," *Bulletin of the History of Medicine* 87 (2013): 198–224.

60. See also Hugh Taylor, *Trachoma: A Blinding Scourge from the Bronze Age to the Twenty-First Century* (Melbourne: Centre for Eye Research Australia, 2008).

61. Indeed, there is considerable current public concern over koala susceptibility to chlamydia. Mindy Weisberger, “Why the Heck Do So Many Koalas Have Chlamydia?,” *Live Science*, May 9, 2018, <https://www.livescience.com/62517-how-koalas-get-chlamydia.html>.

62. Leonor Sánchez-Busó et al., “Antimicrobial Exposure in Sexual Networks Drives Divergent Evolution in Modern Gonococci,” *bioRxiv*, preprint posted May 31, 2018, <https://doi.org/10.1101/334847>.

63. Leigh Van Valen, “A New Evolutionary Law,” *Evolutionary Theory* 1 (1973): 1–30.

64. Magnus Unemo and William M. Shafer, “Antimicrobial Resistance in Neisseria Gonorrhoeae in the 21st Century: Past, Evolution, and Future,” *Clinical Microbiology Reviews* 27, no. 3 (2014): 587–613, <https://doi.org/10.1128/CMR.00010-14>; Alan P. Johnson and Gwenda Hughes, “The Prospect of Untreatable Gonorrhoea: An International Threat That Requires a Coordinated International Response,” *BMJ* 358, no. 3973 (2017), <https://doi.org/10.1136/bmj.j3973>.

65. Piers Mitchell, “Pre-Columbian Treponemal Disease from 14th Century AD Safed, Israel, and Implications for the Medieval Eastern Mediterranean,” *American Journal of Physical Anthropology* 121, no. 2 (2003): 117–24.

66. Emmanuel Le Roy Ladurie, “Un concept: L’unification microbienne du monde (XIVe–XVIIe siècles),” *Revue suisse d’histoire* 23, no. 4 (1973): 627–96.

67. As Peter Boomgardt has remarked in his review of the scattered evidence relating to South and East Asia, “After all, most regions of Eurasia had been part of a common disease pool for a long time. . . . The fact that syphilis was apparently new in Asia around 1500 is a confirmation of the notion that it was new to Europe, too, thus supporting the Columbian hypothesis.” “Syphilis, Gonorrhoea, Leprosy and Yaws in the Indonesian Archipelago, 1500–1950,” special issue, *MANUSYA: Journal of Humanities* 14 (2007): 20–41, 36. On related evidence for an upsurge in global demand, including in China and Japan, for a range of cures from sarsaparilla and guaiacum to mercury and China root (*tu fu ling*) in the sixteenth century and after, see Anna E. Winterbottom, “Of the China Root: A Case Study of the Early Modern Circulation of *Materia Medica*,” *Social History of Medicine* 28 (2014): 22–44.

68. Oriol Mitjà, Kingsley Asiedu, and David Mabey, “Yaws,” *Lancet* 381, no. 9868 (2013): 763–73, [http://dx.doi.org/10.1016/S0140-6736\(12\)62130-8](http://dx.doi.org/10.1016/S0140-6736(12)62130-8).

69. Peter L. Perine et al., *Handbook of Endemic Treponematoses: Yaws, Endemic Syphilis and Pinta* (Geneva: World Health Organization, 1984), table 1.

70. Bayliss-Smith, in chapter 6 in this volume, notes that in the Solomon Islands endemic yaws minimized the impact of syphilis but could not, of course, protect against gonorrhoea when both diseases were brought to the islands through Western contact.

71. Doyle, in chapter 8, and Cahen and Minard, in chapter 11, note that European observers often mistook yaws or endemic syphilis (bejel) for venereal

syphilis or “Arab syphilis” among sub-Saharan and North African populations, respectively.

72. N. Arora et al., “Origin of Modern Syphilis and Emergence of a Pandemic *Treponema pallidum* Cluster,” *Nature Microbiology* 2 (December 5, 2016), article number 16245, <https://www.nature.com/articles/nmicrobiol2016245.pdf>. For a wide-ranging review pre-dating the 2016 research results, see Lorenzo Giacini and Sheila A. Lukehart, “The Endemic Treponematoses,” *Clinical Microbiology Reviews* 27 (2014), 89–115.

73. Richard B. Rothenberg, “Gonorrhea,” in *The Cambridge World History of Human Disease*, ed. Kenneth F. Kiple (Cambridge: Cambridge University Press, 1993), 756–63.

74. It was the great turn-of-the-century physician Sir William Osler (1849–1919), founding professor of medicine at Johns Hopkins and concluding his career as regius professor of medicine at Oxford, 1905–19, who was the source of the description of syphilis as the “great imitator.”