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Untimely Morbidities: Tuberculosis, HIV, India

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by

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Professor Lawrence Cohen, Chair
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Abstract

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This dissertation traces specific figurations of tuberculosis and HIV in India, stretching from the late nineteenth century, with the inception of germ theory, into the present moment. I consider how tuberculosis and HIV are related, as co-infections but also as conditions that have produced a certain set of analogous institutional arrangements and modes of response in India. In recent years, there have been more new cases of tuberculosis in India than anywhere else in the world. The emergence of HIV in India has only exacerbated this problem. In contrast to the primarily historicist accounts of tuberculosis in Europe and the United States, this dissertation focuses on the ways in which disease and the body can be rendered untimely. I contend that historicism is only one means of approaching the past and ask about what it might mean to approach these conditions in a non-historicist manner. I argue that an examination of the untimeliness of these conditions forces a rethinking of diagnosis, cure, sign and symptom, as well as received notions of certainty and causality.

This dissertation begins in the waning years of the nineteenth century by discussing the life and work of a Tamil Christian tuberculosis specialist named David Chowry Muthu. I draw upon Muthu's extensive medical and metaphysical writings to think about how tuberculosis was diagnosed and treated in the late nineteenth and early twentieth centuries, which was the period immediately following Robert Koch's proclamation that tuberculosis was caused by bacteria. Muthu's ideas about causality put him into direct contention with Koch and his students. Muthu's professional life unfolded in the gap between the proclamation of a bacterial cause of disease and the development of a specific treatment in the form of antibiotics. I consider the possibilities for treating tuberculosis during this gap in relation to the Indian nationalist movement, focusing on Jawaharlal Nehru's account of his wife Kamala's death in the *Discovery of India*, as well as on the correspondences between Nehru and Gandhi on the role of environment in treating tuberculosis.

A pivotal episode in the development of a specific cure for tuberculosis was the 1950s Madras Study, which demonstrated the efficacy of home-based antibiotic treatment for tuberculosis. The Madras Study is often recognized as the death knell of the sanatorium movement. I reflect on the Madras Study in order to trace the emergence of mass chemotherapy for tuberculosis. I argue that this specific cure brought with it new figurations of anxiety: treatment failure, the non-

adherent patient and drug resistance. I locate the Madras Study within a broader history of specific cures for tuberculosis. I consider how the evidential grounds for what constituted a cure changed with the development of the randomized controlled trial, as well as how previous forms of research and treatment were retroactively denounced as lacking proper grounds. I turn form cures for tuberculosis to the recent development of a "functional cure" for HIV, to consider what we might make of the paradox that HIV has been cured but remains uncurable.

I move from the question of cures to the temporally prior problem of diagnosis. Taking inspiration from the Victorian anthropologist Edward Burnett Tylor, I trace the persistence of old diagnostic technologies like x-rays and sputum microscopy into the present moment. I focus in particular on the uncertainty and indeterminacy that suffuse acts of diagnostic semeiosis, as part of a system in which many patients are continuously referred elsewhere or deferred to some point in the future. I examine diagnosis as a process that equally applies to non-human animals, turning to bacterial interplay between bovine, sloth bears and humans. In thinking through the lethality of certain forms of bacterial exchange in the encounters between species, I question more optimistic visions of interspecies relationships premised on companionship and liberal notions of tolerance.

In the final sections, I consider the relationship between chronic, curable and terminal conditions. Specifically, I examine the ways in which HIV reshapes the time of the body. I demonstrate how the time of the body is split from itself, as clinicians separate chronological and biological or developmental age in assessing the deleterious impact of HIV and antiretroviral drugs. Working through the figure of natural history, I consider how clinicians chart both the movement of bacterial and human bodies through time, rendering certain kinds of bodies untimely. If the end point of such timelines is death, I argue that such deaths can have very different meanings, as I demonstrate through cases in which HIV-positive patients in South India seem to be asking to die. Despite the hopes that have surrounded all cures for tuberculosis and HIV, these conditions continue to shape the lives and deaths of people in India, as well as many others around the world. I end by asking what kinds of temporal conditions we might expect to see in the near future.

For my *patti*, Muthulakshmi, whose passing was truly untimely
For my *thatha,* T.R.P. Kesan, and my *chitti*, Sudha, who gave me a home

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Unhappily, time seems more normative than place.

Lyn Hejinian 2001:11

The belief that time is morally destructive is the basis of the myth of the four Ages . . . In the Hindu view, human beings caught up in the process of time are inherently, naturally inclined to fall prey to evil. The pure creatures of the original Golden Age are not a part of time at all; for them, karma doesn't exist; they are beyond good and evil. Their 'fall' consists of passing from eternity into time; once caught up in the flow of time, they are no longer immune to evil.

Wendy Doniger 1976:25-6

INTRODUCTION: HISTORICAL CONDITIONS

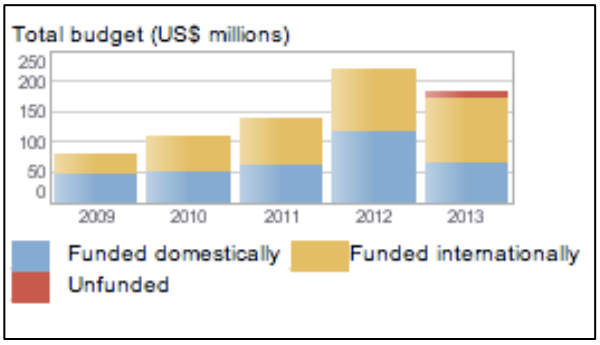
Two Conditions

When it comes to HIV, determining a cause of death is no straightforward matter. Most people living with HIV do not die from the virus, but rather from an opportunistic infection or an AIDS-related condition like cancer. Outside of the borders of Western Europe and the United States, people living with HIV are more likely to fall ill from tuberculosis than from any other opportunistic infection.

The World Health Organization (WHO) estimates that there are over two million new cases of tuberculosis in India every year, more than anywhere else in the world. In 2012, the number of old and new cases totaled about 2.8 million. Almost six percent of these tuberculosis cases involved an HIV infection. By contrast, India's National AIDS Control Organization (NACO) estimated that there were 130,000 new cases of HIV in the country in 2011, with over two million cases in total. In the same year, about 148,000 cases of HIV in India ended in death.[1]

India is home to slightly more than a quarter of all tuberculosis cases in the world. Yet, the WHO reports that less than sixty percent of tuberculosis cases in India are diagnosed. Taking into account both the diagnosed and the undiagnosed, there are estimated to be 310,000 tuberculosis-related deaths in India per year, with about fifteen percent of these deaths occurring in people infected with HIV. In addition to the complications of TB-HIV co-infection, drug-resistant strains of tuberculosis are on the rise. In 2012, there were over sixteen thousand cases of multiple-drug resistant (MDR) tuberculosis confirmed in laboratories across India, with many more cases that went undiagnosed.[2]

In part, this work examines some of the reasons why diagnosing a "disease of antiquity" remains so difficult in twenty-first century India. Part of the problem has to do with money. The budget for the Indian tuberculosis control program in 2013 amounted to $182 million, with over fifty percent coming from international sources. As the graph below illustrates, the amount allocated for tuberculosis programs decreased considerably from 2012 to 2013, with the Indian government significantly lowering its investment in preventing and treating the disease.



[1] Estimates produced by India's National AIDS Control Organization. Retrieved from http://www.naco.gov.in/upload/Publication/Annual%20Report/NACO_AR_Eng%202011-12.pdf

[2] Estimates from WHO Tuberculosis Profile of India for 2012, based on joint consultations between the WHO and the Indian government. Retrieved from https://extranet.who.int/sree/Reports?op=Replet&name=%2FWHO_HQ_Reports%2FG2%2FPROD%2FEXT%2FTBCountryProfile&ISO2=IN&LAN=EN&outtype=html

Tuberculosis budget for India, 2009-2013

The budget for tuberculosis is greatly overshadowed by the funding allocation for HIV programs, much of which has historically come from the United States Agency for International Development (USAID), the Joint United Nations Programme on HIV/AIDS (UNAIDS), the Global Fund, the United Kingdom's Department for International Development (DFID) and the Bill and Melinda Gates Foundation. By 2007, NACO's budget was greater than the entirety of the budget for the rest of India's Ministry of Health. The budget for the third phase of India's National AIDS Control Programme alone, which stretched from 2007-2014, was over $2.4 billion.[3]

There is a clear disparity in how programs addressing these two conditions have been funded in India. In comparison to HIV, tuberculosis receives not only less money, but also less scholarly and popular attention. Although I often heard talk of an "AIDS industry," there was no similar sense of commercialization attached to tuberculosis. The comparative dearth of investment in tuberculosis can be related in part to the power of foreign policy decisions, the lack of patient activist movements around tuberculosis, and the priorities of philanthropic organizations. The high cost of antiretroviral therapy for HIV also helps to justify the size of the national budget, as patients require treatment for life. Global regulatory regimes and patent protections have worked to maintain the high prices of these drugs. In the last decade, however, activists, legal advocates, generic pharmaceutical manufacturers, philanthropic organizations and even government officials have campaigned to bring down the price of first-line and some second-line antiretroviral drugs.[4] By contrast, tuberculosis can in theory be treated in as little as six to eight months. The drugs currently used to treat tuberculosis are also much older and generally off-patent, making them cheaper if not necessarily affordable.

In addition, there is merit to the argument that tuberculosis stopped mattering to the governments of Western Europe and the United States as the number of new infections in those countries gradually decreased from the mid-nineteenth century onward. Tuberculosis, which has been largely expelled from the United States and Western Europe in its epidemic form, was simultaneously expelled from a certain sense of the present. Significant interventions in the science of tuberculosis also helped to usher in a sense that the age of the dreaded white plague was over. As the historians Bryder, Condrau and Worboys have noted, both scientists writing history and historians of science have preemptively declared the end of the history of tuberculosis.[5] These stories about tuberculosis tend to make use of two preferred endings: the first was the isolation of *Mycobacterium Tuberculosis* by Robert Koch in 1882, and the second was the isolation of streptomycin in 1943 by Selman Waksman's laboratory at Rutgers University. These are histories of famous scientists and momentous discoveries, of paradigm shifts, all of which took place in specifically European and American places and times.[6] The Kochian ending involved learning a truth about the composition of the world, a truth that had been hidden from the limited capacity of the human eye.[7] The Waksmanian ending involved learning how to recompose the world by eradicating some of the bodies in it.

[3] Mahajan 2008:31
[4] See Biehl 2004 on the ways in which the state in particular becomes active in bringing down the price of drugs.
[5] Bryder, Condrau and Worboys 2010
[6] See Kuhn 1962 for the classic description of the paradigm shift in science.
[7] See Latour 1988 on the way in which microbes become actors in French relationships.

The idea that the history of tuberculosis is over has been compounded by the way in which the disease has been constantly referred to times past. Tuberculosis is often described as a "disease of antiquity." For example, references abound to Ayurvedic texts attributed to Sushruta and Charaka, which have been understood to contain descriptions of tuberculosis and its possible treatments.[8] Other writers offer a more recent periodization for tuberculosis, hinging on a history of European romanticism and the idea of epidemiological transitions. Perhaps most famously, the essayist and critic Susan Sontag declared that the nineteenth century was the age of tuberculosis, only to be succeeded by the age of cancer and HIV/AIDS.[9] Given the time and place from which Sontag was writing, her claim is understandable if lacking in evidence from outside of the United States. What is difficult to comprehend is the endurance of Sontag's claim in more recent popular writing on the history of disease. The physician Siddhartha Mukherjee, for example, has echoed Sontag's periodization in his history of cancer.[10]

In the last two decades, both scholars and the popular press have begun referring to the "return of the white plague." In obedience to divisions of race and class, tuberculosis has re-emerged among certain populations within both Europe and the United States. But as the physician-anthropologist Paul Farmer has argued in reference to his work in Haiti, there is nothing to suggest that tuberculosis ever went away.[11] The way in which tuberculosis had been relegated to the past despite its persistence across the world has much to do with the contemporary geographic, racial and class distribution of the disease. Having once marked the aesthetic and affective contours of nineteenth-century European nobility and genius, tuberculosis seems to have moved on to other people, other places and other times. This expulsion of tuberculosis from the bourgeois imagination is what makes possible the question that I have been asked many times in both the United States and India: is tuberculosis still a problem?

The problem posed by the low visibility of tuberculosis was made clear to me in a meeting with Dr. Nalini Krishnan, the director of a NGO based in Chennai that helped patients find treatment for tuberculosis. At the end of January 2012, I met Dr. Krishnan in her office in Royapettah, a bustling neighborhood located in the center of Chennai just west of Marina Beach. Dr. Krishnan had been involved with tuberculosis treatment for over a decade. Her office was covered with pamphlets about treating the disease and promotional material advertising World TB Day.

During our conversation, Dr. Krishnan lamented that tuberculosis was not HIV. What she meant by this surprising statement was something very specific. Where were the tuberculosis patient advocacy and activist organizations, she asked? She explained to me that having tuberculosis did not mark patients in the same way as being HIV-positive. Perhaps this was because tuberculosis was thought to be a transient condition, curable with the right treatment regimen. HIV infection, on the other hand, signaled a permanent ontological transformation. Whatever the reason, HIV has attracted more funding and attention than tuberculosis. Infection

[8] Latour (1999) argues against nominalist claims that things of the past cannot be articulated in terms of the words of the present. In examining the case of a mummy diagnosed in the present with tuberculosis, Latour suggests that it is the assemblage of knowledge, skills and technologies of the scientist-examiners that give reality to the postmortem diagnosis. Latour's questions is not whether the deceased died of tuberculosis, but rather for whom and under what conditions such a tuberculous death becomes possible.

[9] Sontag 1989

[10] Mukherjee 2010

[11] Farmer 2000

with HIV had also made possible the formation of communities, the possibility of engaging with a biosocial formation premised on a shared ontological status.[12] Positive People's groups have flourished across the state of Tamil Nadu. HIV was a condition that could be identified with, even if such an identification was by no means easy or uncomplicated. Although there are research groups organized around tuberculosis in India and elsewhere, biosocial movements composed of those who suffer from the disease are much more difficult to locate.

After speaking with Dr. Krishnan, I wondered if it was better to fall ill from the disease of the times, to take part in a moment through its dominant modes of morbidity and biosociality. Although HIV is chronic, it has opened up to the possibility of a solidarity based on a common identity. For the tuberculosis patient, no such identity or solidarity seemed to be possible.

With the large financial investments in HIV, many people living with the condition had found not only community but also employment through participating in the many HIV-focused NGOs located across India. In 2006, I began conducting ethnographic work with queer organizations engaged in HIV prevention work in the South Indian technology capital of Bangalore. Although the queer activist scene had been riven with discord for some time, the introduction of massive philanthropic aid for HIV prevention had led to the deepening of rivalries and the formation of new contingents.[13] Accusations of financial mismanagement and unethical practice were flung far and wide, as each organization attempted to consolidate or broaden their share of the in-flowing funds.

In the summer of 2006, I met with Alok, an employee of the Naz Foundation, an organization that works with people who were termed men who have sex with men (MSM) for the purposes of HIV prevention and education. Alok had spent the last year travelling around the state of Karnataka locating MSM in rural areas to help them set up community-based HIV prevention organizations. In Bangalore, Alok conducted training sessions to teach these men how to run such programs. For many of these men, joining with Naz meant getting a steady paycheck. As Vinh-Kim Nguyen has argued in his ethnography of HIV treatment programs in Burkina Faso and Cote d'Ivoire, having HIV or being considered "at-risk" for HIV paved the way for a form of "therapeutic citizenship" that entailed access not only to health care, but employment and other basic provisions. Nguyen writes that he "began to ask himself about what forms of politics might emerge in a world where sometimes the only way to survive is by having a fatal illness."[14] Over and above any ideological commitment to spreading knowledge about HIV, many of these men worked for NGOs as a means of survival.

Much of the financial support for these NGOs came from private philanthropic organizations. In my discussions with the leaders of various organizations in Bangalore, I was asked repeatedly about the Bill and Melinda Gates Foundation. As part of their Avahan Project, the Gates Foundation had first begun investing hundreds of millions of dollars into HIV prevention in India in 2003. *Avahan* is a Sanskrit word meaning to call or invite, an appeal or invocation. To learn more about the ways in which philanthropic giving had altered the landscape of HIV prevention in India, I made trips to Delhi in 2007 and Seattle in 2010, to conduct interviews with various staff members at the Gates Foundation.

In the way that Foundation employees described it to me, the Avahan Project was a call to the Indian government to take action about HIV. From the outset, the Gates Foundation had never intended to stop HIV in India. Their goal was more modest. The Foundation wanted to

[12] See Rabinow 1996 on biosociality.
[13] Cohen 2005, Venkat 2007
[14] Nguyen 2010:6

demonstrate that HIV prevention programs were possible on a nation-wide scale. Avahan projects around the country were meant to set an example, to show that prevention was an effective strategy for curtailing the HIV epidemic.

In recent years, the intensive investment in HIV programming in India has witnessed a dramatic reversal. Both USAID and the Gates Foundation have divested much of their support for such programs. Between 2010-2012, I watched as many NGOs and smaller organizations prepared themselves to withstand the transition away from international support, some more successfully than others.

In October of 2010, a senior program manager at the Gates Foundation in Seattle spoke with me about the inadvertent success of the Gates Foundation in India, despite its technical failure. On a rainy Seattle morning, I met with Lee Gardner, a high-level staffer who had degrees in public health and business. Lee had previously worked for a biotechnology firm before moving to the Foundation. I asked for her thoughts on the Avahan Project, now that the Gates Foundation was in the process of withdrawing their funding from HIV programs in India.

"We came in with the wrong assumption, that HIV in India would be a generalized epidemic, like most of Africa," she told me. "That was the general consensus at the time. Now we know that it hasn't become generalized, that it has remained largely a problem for high-risk populations." Rather than spreading to the general population, Lee explained that new infections had primarily occurred within so-called "high risk" groups: truck drivers, sex workers, men who have sex with men, and intravenous drug users.

Lee explained the mistaken assumption that had led the Foundation into India in terms of a data problem. Back in 2003, she said, everyone had looked at the data and come to the conclusion that the HIV epidemic in India was about to take off – much like the Indian economy. At that point, the Foundation had to make a decision: either get in on the ground floor, or stay out and risk the consequences. Like many of the other Gates Foundation employees that I spoke with, Lee made heavy use of the language of business and consulting. Philanthropic gifts were investments. Outcomes should be measurable quantitatively.

Prior to 2007, estimations of the prevalence of HIV in India were based on numbers obtained from sentinel surveillance sites like antenatal clinics. In 2007, the expansion of the number of sentinel sites along with a household-based HIV survey yielded a drastic epidemiological revision. The news was both hopeful and baffling: India did not have over five million cases of HIV. Rather, the number was closer to two million.[15] This revision undermined the assumptions that had guided the Gates Foundation and many other international funding bodies in their forays into HIV programming in India. This dramatic alteration of the country's epidemiological profile also added to the difficulty of assessing the Gates Foundation's efficacy in stymieing the spread of infection.

Epidemiologically, India had failed to become sub-Saharan Africa. Failure or success, Avahan had been an expensive endeavor, costing over three hundred million dollars. "You could say that it was a failure, but we learned, and that makes it a success," Lee told me. Though Lee could not speak with certainty about the effectiveness of Avahan's interventions, she argued that the project had still been a success for a very particular reason. Avahan had operated as a proof of concept – a "catalyst" – to compel the Indian government to take action, she explained. The demonstrative, catalytic power of this success had reached beyond national borders, as representatives from Mozambique had traveled to India to witness the miracle of what she called "rapid scale-up." India had not become Africa. Yet, as Lee hoped to demonstrate by telling me

[15] See Pandey et al 2009 for a longer discussion of this epidemiological revision.

about the Mozambiquan ambassadors, India had become an example for Africa.

The concept that had been proven by the Avahan Project was that HIV prevention could be rapidly scaled-up. What did Lee mean by scale, and how was scale measured? In the absence of numbers showing a decline in HIV infection that could be attributed to Avahan's interventions, certain surrogates of success, other numbers about other things, were used in their place. The numbers that came to matter for measuring success had to do with the number of condoms sold or distributed to "customers," the number of high-risk individuals contacted, and the number of peer outreach workers hired. These were numbers that could be counted, and these were numbers that could be scaled-up rapidly, in Lee's terms. These surrogate numbers helped the Foundation move from "wrong assumption" to "success."

Many of the Indian organizations that were funded through the Gates Foundation or USAID have had to turn to the Indian government for support. In mid-2011, I observed this process of transition unfold firsthand. Along with Gayatri, a member of the transition team from a larger coordinating NGO based in Chennai, I travelled to a small town a few hours south of the city. The small community-based organization that we were visiting worked primarily with sex workers, encouraging condom use and issuing referrals to the government HIV testing facility. This organization had creatively repurposed an old bus into its headquarters, conveniently located in a yard in front of the HIV clinic. We spent the day sitting with these field workers as they learned to properly fill out the monitoring forms issued by the Tamil Nadu State AIDS Control Organization (TANSACS).

I watched as each of the community-based workers completed their forms and approached Gayatri to have it checked. Gayatri made use of these evaluations to educate all of the field workers about the proper protocol, explaining out loud each of the mistakes that a particular field worker had committed. She explained to the field workers that they would lose their funding, and their jobs, if they could not learn how to properly fill out these forms. What struck me about this pedagogic encounter was that neither Gayatri nor the field workers were particularly concerned with evaluating the efficacy of the organization in preventing new HIV infections. Rather, their primary concern was whether these forms were properly filled out. Gayatri patiently explained that the old forms, which had been part of the monitoring protocol of USAID, and the new forms from TANSACS, were entirely different. The transition process in Tamil Nadu, which was in large part a transition from one mode of audit to another, was deemed a massive success and a model that should be emulated by other states. It seemed to me that finding success was less about measuring outcomes than about knowing which outcomes to measure.

Since its withdrawal from India, the Gates Foundation has doubled down on its investments into vaccine research. As Lee pointed out, this type of work requires long years of research and testing. It takes years to know whether a vaccine works, or whether, as in most cases, it is a failure, she told me. But this was precisely the kind of work that the Foundation wanted to fund. Vaccine research was technology-driven, innovative and "cost-effective in the long run," she said. An effective vaccine is a game changer, but the payoff is so long-term that private industry shies away from such investments. As the anthropologist Joseph Dumit has argued, a research trial is only successful if it results in a "product that will generate profit covering a number of failed trials as well."[16] Private industry was afraid to fail. This was why the Foundation stepped in, Lee explained. The Gates Foundation, it seemed, had the financial capital to absorb as many failures as needed to reach success.

[16] Dumit 2012:94

To supplement my research into HIV prevention, I began working in a private HIV hospital in Chennai in 2011 to learn more about treatment. At that point, treatment and prevention efforts were kept both financially and bureaucratically distinct, with separate pots of money and different government staff involved in one side or the other. In the hospital, I noticed that many of the HIV-positive patients were diagnosed and treated for tuberculosis. Similar to the division between HIV prevention and treatment programs, tuberculosis and HIV were also kept apart by a top-down vertical system of health strategies. NACO was responsible for HIV in India, but the Revised National Tuberculosis Control Programme (RNTCP) was accountable for tuberculosis. In government hospitals, efforts were made to create "linkages" between these programs, which amounted to the strategy of deferrals and referrals that I describe in the chapter entitled "Survivals."

In the private hospital, both tuberculosis and HIV could be treated simultaneously and by the same staff. I asked one of the doctors at the hospital about the many cases of co-infection that I had observed. Her response was telling: "Everyone has TB," she said to me. "Either they've had TB, they have TB or they will have TB." In an effort to learn more about this seemingly ubiquitous but neglected condition, I began fieldwork in government tuberculosis hospitals and laboratories in Chennai. I also undertook research in the Tamil Nadu State Archives and the library of the Tuberculosis Research Centre, both located in Chennai, as well as in the National Library in Calcutta. I wanted to learn more about the history of tuberculosis diagnosis and treatment in India, particularly in the period preceding and leading up to the development of antibiotics. Through this movement between archive and hospital, I realized that history was only one of many temporal frameworks that I would have to grapple with in order to come to an understanding of these two conditions in India.

Historicism and its Others

Tuberculosis and HIV have been periodized as ailments of past and present. Over the course of my ethnographic research, I found that these conditions also took shape within other temporalities. In discussing these often non-historicist framings of time, I draw inspiration from Nietzsche's thoughts on the untimely. Writing in the second half of the nineteenth century, he described the untimely as "acting counter to our time and thereby acting on our time."[17] For Nietzsche, untimeliness characterized his disjointed relation to the present. As a method, untimeliness also served as a critique of what he took to be an excess of historicism, an insistence that everything has its proper place in the movement of time. "We are all suffering from a consuming fever of history and ought at least to recognize that we are suffering from it," he wrote, offering a diagnosis of his moment that may or may not pertain to our present time.[18] For Nietzsche, the force of historicist thought threatened to stifle other modes of critique, to greatly diminish the kinds of resources that could be called upon in diagnosing a moment.

Historicism has posed a serious problem for anthropologists, historians and students of religion, particularly those engaged in producing scholarship about South Asia. Since the turn away from what was understood to be the oppressive and overly imaginative mode of orientalist scholarship that characterized studies of India, scholars have been for the most part committed to a thoroughgoing historicism.

The work of Bernard Cohn at the University of Chicago was central to this turn. Cohn, along with his colleagues and students, purged studies of South Asia of their timelessness,

[17] Nietzsche 1997:60
[18] Nietzsche 1997:60

insisting that cultural forms and institutions have traceable social and political histories. These histories were often glossed under the rubric of change, particularly social change. In 1968, Cohn and his colleague at the University of Chicago Milton Singer issued an edited volume entitled *Structure and Change in Indian Society*. Four years later, Singer would publish *When a Great Tradition Modernizes*. These studies of social change in India demonstrated in part the enduring influence of Robert Redfield's investment in theories of modernization. But modernization was far from the only form of change that interested anthropologists, as demonstrated by M.N. Srinivas' ethnographic and theoretical elaborations of the twin processes of Sanskritization and Westernization.

Though coming out of a different scholarly tradition, Said's *Orientalism* (1978) supported the view that scholarship premised on the timeless attributes of certain peoples was in serious need of critique. From the 1980s, Ranajit Guha and his Subaltern Studies Collective further elaborated on the historicity of India by offering Gramscian "histories from below." The turn to history in studies of South Asia was solidified in the generation of Cohn's students. In his *Imagining India* (1990), Ronald Inden argued against the idea of "system and essence" in favor of a model of change premised on historical actors who could actually make a difference.[19] In his view, Indian actors did not merely express some fundamental logic, variously understood as culture, caste, mind or spirit. In a similar vein, Nicholas Dirks demonstrated in his *Castes of Mind* (2001) that caste in its present incarnation has its roots in colonial modernity. His argument was not that there was no such thing as caste prior to the colonial encounter, but rather that caste became something fundamentally different under the aegis of colonial rule. The earlier comparative and culturalist modes of writing about India, exemplified in the debates between Louis Dumont and McKim Marriott, had been for the most part put to rest.

Contemporary studies of South Asia, especially in anthropology, are characterized by what Bhrigupati Singh has called the "dominance of history."[20] In South Asia, as elsewhere, a multitude of other modes of thinking, feeling, writing and living in time have flourished alongside a more linear sense of history.[21] At the same time, historicist critique of older modes of scholarship have allowed for a more nuanced understanding of how certain forms of being and ways of doing have emerged, mutated or disappeared.

Rather than deciding between these options, this work pays attention to both the properly historical as well as to the untimely. That which is untimely does not properly belong to more normative or orthodox temporalities. At the same time, Nietzsche insisted that the untimely had the capacity to act on these more orthodox temporalities by virtue of its very disjointedness, as a form of critique. Untimeliness was for Nietzsche not only a defining feature of his mode of critique, but of the critic as well.

Recently, anthropologists have turned to Nietzsche to think about what untimeliness might offer for a reconsideration of method. Paul Rabinow has elevated untimeliness to a methodological precept for anthropology, writing that "if one is committed to untimely anthropological work then being a bit late may well be timely; and being ahead of things, or slightly beside the point, is worth our while."[22] He advocates that the anthropologist adopt a position of adjacency with regard to the object of inquiry, as opposed to the proximity of identification or the distance of exotification.

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[19] Inden 1990:264
[20] Singh 2013
[21] See Guha 2002 and Shulman, Subrahmanyam and Rao 2003
[22] Rabinow 2008:50

Anand Pandian offers an alternative to Rabinow's formulation in an essay on the temporality of anthropological method. He asks: "What if the distance of the untimely was less critical, in other words, than affective or pathetic in its character, bound up with the faltering development of those ripening out of time?"[23] For Pandian, untimeliness is less about assuming a position from which a potent critique of the present could be articulated. Rather, becoming untimely is a way of becoming with others, of "passing with them into a time beyond this night."[24]

Pandian opens up the possibility that untimeliness has less to do with cultivating a critical position and more to do with a way of being in the world that may or may not be of one's own choosing. This line of thinking is developed in William Mazzarella's work on contemporary branding practices in India. Mazzarella points out that the controversy surrounding the use of Gandhi's name to sell commercial products had everything to do with Gandhi's "untimely corporeal provocation."[25] He makes it clear that this scandal had less to do with Gandhi's high-minded principles and more to do with the ways in which Gandhi made use of his body to create a public. Put differently, Gandhi was already making use of his own brand as form of mass publicity.

In regard to my work, the important point is that untimeliness is not just a condition of a disembodied critical mind. Bodies can be rendered untimely, either through deliberate experimentation, as Mazzarella argues was the case with Gandhi, or through falling ill within certain regimes of diagnosis and treatment, as was the case with many of the patients with whom I worked. The untimely can certainly be a condition of studied reflection, a vantage from which to see and to critique. However, becoming untimely can also be the result of marginalization, of being in and of a bad time. In the pages that follow, I ask about how certain ways of being ill have been rendered untimely, exiled beyond the pale of more orthodox temporal orders.

An Overview

Drawing upon my ethnographic and archival research, I think about how tuberculosis and HIV are related, as co-infections but also as conditions that have produced a certain set of institutional arrangements and modes of response in India. Ethnographic work on tuberculosis and HIV have tended to focus on these conditions as eminently social diseases, providing nuanced descriptions of social suffering, bureaucratic incoherence, stigma, discrimination, activism and access to treatment movements around the world. Historians have followed many of these same routes, but have also produced important work on the history of the science and public administration of these conditions. My work draws on the scholarship in both of these fields, as a historical anthropology that leads into the present moment. Throughout the following chapters, I engage with the scholarship in medical anthropology, the history of science and medicine, and science and technology studies.

The first chapter, "The Black Doctor," begins in the waning years of the nineteenth century. I discuss the life and work of a Tamil Christian tuberculosis specialist named David Chowry Muthu. With the support of English missionaries, Muthu sailed to London to train as a physician, at precisely the time that germ theory was beginning to take hold of the medical imagination. He established a sanatorium-based practice in England before heeding the nationalist call to return to India and treat his compatriots.

[23] Pandian 2012:554
[24] Pandian 2012:554
[25] Mazzarella 2010:26

I draw upon Muthu's extensive medical and metaphysical writings to think about how tuberculosis was diagnosed and treated in the late nineteenth and early twentieth centuries, which was the period immediately following Robert Koch's proclamation that tuberculosis was caused by bacteria. Muthu's ideas about causality put him into direct contention with Koch and his students. In describing how Muthu arrived at his vitalist vision of disease causality, I engage with a tradition in both anthropology and feminist studies of science committed to rethinking notions of causality. From E.E. Evans-Pritchard's work on Azande forms of reason to Michelle Murphy's account of sick-building syndrome and Karen Barad's investigations into quantum physics, causality has been shown to be anything but straightforward, universal or obvious.[26]

Muthu's professional life unfolded in the gap between the proclamation of a bacterial cause of disease and the development of a specific treatment in the form of antibiotics. In "An Elegy for Kamala," I think more about the possibilities for treating tuberculosis during this gap in relation to the Indian nationalist movement. I focus primarily on Jawaharlal Nehru's account of his wife Kamala's death in the *Discovery of India*, as well as on the correspondences between Nehru and Gandhi on the role of environment in treating tuberculosis. Although Dr. Muthu never directly treated Kamala, Gandhi drew upon what he had learned for Muthu to make the case that Kamala could be cured of tuberculosis without leaving India.

Disregarding Gandhi's advice, Kamala Nehru eventually left India to seek treatment in Europe. She died in a Swiss sanatorium, just a few years before the development of antibiotics that might have cured her. A pivotal episode in this "Chemotherapeutic Revolution" was the 1950s Madras Study, which demonstrated the efficacy of home-based antibiotic treatment for tuberculosis. The Madras Study is often recognized as the death knell of the sanatorium movement. Drawing on discussions with a surviving member of the research team, as well as on archival work in the library of the Tuberculosis Research Centre (one of the sites where the Madras Study was conducted), the chapter entitled "Cures" provides a framework for thinking about the emergence of mass chemotherapy for tuberculosis. It also traces the emergence of some present-day figurations of anxiety that had already emerged as problems by mid-century: the non-adherent patient, drug resistance, and treatment failure.

The Madras Study was the first randomized controlled trial in India, organized across a series of institutions in Madras (now Chennai). I locate the Madras Study within a broader history of specific cures for tuberculosis. I consider how the evidential grounds for what constituted a cure changed with the development of the randomized controlled trial, as well as how previous forms of research and treatment were retroactively denounced as lacking proper grounds. As such, this chapter provides an early history for much of the current anthropological research on present-day clinical trials both in India and in other parts of the world.[27]

"Berlin, Again" serves as a brief afterward to "Cures." I recount the recent case of Timothy Ray Brown, more popularly known as the Berlin Patient. Brown was "functionally cured" of HIV/AIDS after undergoing a bone marrow transplant. News of the Berlin Patient travelled to India, where I observed a patient asking a doctor whether there was in fact a cure for HIV/AIDS. I ask what it means to be functionally cured, and how we can understand a cure that has only worked on a single person. What can we make of the paradox that HIV has been cured but remains uncurable?

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[26] Evans-Pritchard 1937, Barad 2007, 2010, Murphy 2006

[27] See for example Petryna 2009 on clinical trials in the United States, Poland and Brazil. See Sunder Rajan 2007, 2010 on trials in India.

In “Survivals,” I turn from the question of cures to the temporally prior problem of diagnosis. Taking inspiration from the Victorian anthropologist Edward Burnett Tylor, I trace the persistence of old diagnostic technologies like X-rays and sputum microscopy into the present moment. Since the time of Robert Koch and David Chowry Muthu, tuberculosis diagnostics seem not to have changed very much. This lament concerning the lack of progress in diagnostic technology circulates throughout the global public health community. I consider critiques and defenses of these century-old technologies and explore the threat and promise of Gene Xpert, a new technology that diagnoses tuberculosis at the molecular level. I examine how these older technologies are employed in a tuberculosis hospital in Chennai. I focus in particular on the uncertainty and indeterminacy that suffuse these acts of diagnostic semeiosis, as part of a system in which many patients are continuously referred elsewhere or deferred to some point in the future.

“Lethal Exchanges” moves from Tylorian survivals to the survival of species. I focus here on concerns about bacterial exchange between humans, cows and sloth bears. I ask about how such concerns come to be articulated, and how certain groups are held to be responsible for the movement of bacteria between species. I also consider the morally ambivalent possibility of animal culling in the face of an undiagnosable and untreatable disease. In conversation with the historical and anthropological literature on zoonosis, I think about how we might understand the decimation of a population of sloth bears by the form of tuberculosis most closely associated with humans, as well as the fear that the bovine form of tuberculosis is affecting humans. In thinking through the lethality of certain forms of bacterial exchange in the encounters between species, I question more optimistic visions of interspecies relationships premised on companionship and liberal notions of tolerance.

In “The Ages of the Body,” I consider the relationship between chronic, curable and terminal conditions. Drawing on ethnographic work in a private HIV hospital in Chennai, I argue that chronicity is anything but even. I demonstrate how the time of the body is split from itself, as clinicians separate chronological and biological or developmental age in assessing the deleterious impact of HIV and antiretroviral drugs. Working through the figure of natural history, I consider how clinicians chart both the movement of bacterial and human bodies through time, rendering certain kinds of bodies untimely.

The final chapter, “Fatalities,” offers a counterpoint to the first chapter and its focus on Muthu’s vitalist vision of the body, health and disease. I offer a genealogy of fatalism and how it came to be attributed to India and Indians. I think about the fatalistic hermeneutics through which clinicians and counselors tended to interpret the actions of patients who were deemed “non-adherent.” I focus in particular on two HIV-positive men who were understood to be asking for death. I argue that adherence to treatment is not necessarily the same as adherence to one’s own life.

Despite the hopes that have surrounded all cures for tuberculosis and HIV, these conditions continue to shape the lives and deaths of people in Indian and many others around the world. I conclude by turning to the future of these conditions, focusing in particular on the early release of new drugs that are still in the research and development pipeline. The time of research has been bounded over in the name of urgency, in response to a demand that drugs be available now. Meanwhile, public health experts have expressed serious concern that the release of such drugs without proper oversight or monitoring tools will lead to immediate drug resistance. In other words, these experts fear that the first new drugs to be developed in years will be

immediately squandered away in a fit of urgency. In reflecting on these new drugs and old fears, I end by asking what kinds of temporal conditions we might expect to see in the near future.

THE BLACK DOCTOR

"The literature of tuberculosis is strewn with the wrecks of theories once popular, but now almost forgotten and cast away."[28]

A Gap

On March 24, 1882, the German bacteriologist Robert Koch announced to the Berlin Physiological Society that he had isolated the cause of tuberculosis, a rod-shaped bacterium visible only under a microscope. Since at least the time of Galen, etiological knowledge and therapeutic capacity were understood to be intimately linked.[29] With Koch's discovery of a bacterial cause for tuberculosis, hopes ran high among both physicians and suffers that a cure would soon follow.

But a cure that specifically targeted bacteria was slow to come. Between the time of Koch's proclamation and the development of anti-tuberculosis drugs beginning in the 1940s, a gap opened up. Between the time of these two revolutions in medicine – the articulation of germ theory and the production of antibiotics – the relationship between causality and cure was thrown out of sync. As historian Katherine Ott put it, "Koch's discovery created both a theoretical and technical void rather than any insight into therapeutics and prophylaxis."[30]

The failure of bacteriological science to make good on the promise of a cure, especially after Koch's botched attempts with tuberculin in 1891, diverted attention toward therapeutic forms that were non-specific and lacked a bacteriological basis.[31] The sanatorium treatment of tuberculosis was just such an alternative. The structure and logic of the sanatorium was first developed in mid-nineteenth-century Germany (in what is now a part of Poland) by Hermann Brehmer, and propagated by his many former patients and disciples across both Europe and the United States.

As the sanatorium spread, its architectural form and therapeutic mode underwent regional modifications. The original German sanatoriums focused on providing fresh air, rest and proper nutrition to patients. In Britain, by contrast, many sanatoriums operated along the model of the Brompton Hospital Sanatorium, established by Marcus Paterson in 1905. Paterson argued for the primacy of graduated occupational therapy in the treatment of tuberculosis, engaging patients in progressively more difficult physical activities. Sanatoriums in continental Europe were more likely to favor the architectural form of the single structure made famous by Thomas Mann's *The Magic Mountain*, whereas British sanatoriums often provided individual chalets for patients.

Despite these variations, the aim of sanatorium therapy was generally consistent: to strengthen the patient's constitution in order to promote self-cure. Even in the wake of Koch's announcement, sanatorium therapy could not offer a specific treatment against bacteria. But with Koch's failure to make good on a cure, "sanatorium doctors made the case that their institutions should now be seen as the only credible alternative left to provide large-scale treatment."[32] Although there were a plethora of therapeutic options for tuberculosis sufferers – gold treatment, heliotherapy, travel and confinement, to name just a few – sanatorium treatment enjoyed public

[28] Muthu 1922:72
[29] Porter 1997:68
[30] Ott 1996:53
[31] Condrau 2010:79
[32] Condrau 2010:79

visibility, (some) treatment success, and in certain times and places, government backing.[33]

Koch's declaration in Berlin exerted a powerful pull on scientists, physicians, sufferers and their families. At the same time, the poignantly simple idea that bacteria caused disease, and in particular tuberculosis, did not go uncontested. Beyond simply isolating bacteria, Koch developed the methods of bacteriology, rendering the germ visible under the microscope. Confronted with this graphic display of a microcosmos, Koch's disputants could not simply claim that bacteria did not exist. Instead, these debates focused on what germs were and what they could do. Many alternative and overlapping theories and practices put the germ to good use, often incorporating older ideas about disease.[34]

These contestations took place not only on European soil, but in the colonies as well. Koch and many other bacteriological detectives conducted short stints of field research in India to study and determine the causes of various "tropical diseases." Bacteriological laboratories sprang up across the country, starting with the Imperial Bacteriological Laboratory at Poona in 1890 and the Pasteur Institute of India at Kasauli in 1900. The twentieth-century field of tropical medicine brought together eighteenth- and nineteenth-century European experiences of Indian epidemiological exceptionalism with these new ideas about germs. [35]

Travelling bacteriologists from Europe made use of Koch's methods and produced much evidence in support of his ideas. It was from the ranks of the Indian Medical Service (IMS), composed almost exclusively of British medical officers stationed for long periods on the subcontinent, that Koch's model of disease causality faced serious resistance. Many IMS officials expressed the view that the diseases of India were qualitatively different than their European counterparts.[36] Medical officers who insisted upon voicing heterodox perspectives were summarily transferred to more difficult locales or deprived of resources, discouraging the adoption of these new ideas.

However, the explanatory power of specific causal microorganisms could not be entirely ignored. Service in the IMS was understood to be a largely practical craft, and the scant research that was conducted by the IMS on these causal questions "was reactive and generally negative in character, its chief purpose being to disprove the existence of a specific pathogen."[37] For researchers traveling from Europe, it was enough to establish a specific microbial cause for a disease. Such a cause was not of much use to the IMS if it did not lead to an effective, cost-efficient means of prevention or treatment that could be successfully deployed in the colonies.

As the research mounted and consensus grew in Europe, it became increasingly difficult for IMS officials to deny the importance of microbes. Rather than reject older, non-specific causal explanations and modes of intervention, the germ was absorbed into these ideas and practices. The microbe was folded into the notion of miasma as putrefaction, as well as into

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[33] In India, sanatorium treatment received little government support both during and after colonial rule. In Britain, by contrast, the National Insurance Act of 1911 provided free sanatorium treatment for the working class.

[34] Worboys 2010

[35] Chakrabarti 2012:9. For the history of tropical medicine in its relation to India, see especially Narraindas 1996 and Bhattacharya 2012. Another important aspect of the presumed exceptionality of India was the heat – for example, smallpox vaccines, while somewhat effective in England, were initially useless on the subcontinent, where they were quickly denatured by the extreme temperatures. Improvisations had to be made in order to render the vaccine useful again (see Bhattacharya, Harrison and Worboys 2005*)*. It was not only that the diseases were different – the treatments were as well.

[36] For example, Harrison describes an Indian sanitation commissioner who claimed in the 1880s that "specific germ theory was 'inapplicable' to the history of enteric fever in India" (1994:56).

[37] Harrison 1994:110

measures related to plague control. Koch's theories did not replace these broader etiological frameworks, but were instead incorporated into them.

In this chapter, I focus on the intervening period between Koch's etiological proclamation and the rise of antibiotic therapy, the time between the discovery of a cause and the development of a cure. The isolation of *Mycobacterium tuberculosis* not only reinvigorated debates around disease causality, but opened up the new diagnostic possibility of visualizing bacteria. Koch's discovery also raised a crucial ontological question: what precisely was a germ?

Within these broader debates about causality, diagnostics, and ontology, I turn to the work of a European-trained Indian doctor whose professional life played out in this gap between cause and cure, a time period that overlapped with the rise of the Indian nationalist movement. I examine how this doctor framed his thinking about bacteria in light of his experience diagnosing and treating tuberculosis in sanatoriums in Britain and India. In considering his life and work, I ask about how diagnostic uncertainty unsettled an account of disease causality premised on the germ, as well as threw into question the ontological status of the germ itself.

The Zenana and the Germ

David Jacob Aaron Chowry Muthu was born in the Madras Presidency in 1864, in or near the capital city of Madras. Muthu's father, Aaron Chowriappa, was most likely a farmer, but there is a remote possibility that he was a Preventive Officer with Madras Customs.[38] Muthu had four siblings – the Reverend Samuel Aaron, Joshua Abraham, Isaac Jacob Aaron and a Mrs. Baines. Given the Old Testament provenance of these names, as well as Muthu's later missionary engagements in Britain, it is quite likely that his family was heavily involved with the Evangelical missionary scene in Madras. It is even possible that Muthu's family had a much longer history of engagement with South Indian missions stretching back to the early eighteenth century.[39]

South Indian missions might well have financed Muthu's travel to Brussels, where he received his M.D. By the age of 20, he had relocated yet again from Belgium to England, in order to pursue further medical training. In London, he was named the secretary of the Indian Christians Union of Great Britain. He was also a member of the Young Men's Christian Association, attending its thirteenth triennial international conference and jubilee celebration as part of the Asian delegation in 1884.[40] Muthu also joined the British Medical Temperance Association, in connection to which he was referred to as the "Christian Brahmin" in the popular press.[41]

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[38] Muthu's marriage certificate lists his father's occupation as "retired farmer," but a family tree produced by one of his descendants describes Aaron Chowriappa as a Preventive Officer with Madras Customs. The marriage certificate seems to be the more reliable source, but if Chowriappa was a landowner, he might have rented land to farmers while simultaneously pursuing a government career.

[39] In the eighteenth century, a Roman Catholic fisherman named Savarimuthu, hailing from the seaside city of Nagapattinam, is reported to have traveled to the Danish colony of Tranquebar (now Tharangambadi) and converted to Lutheranism under the guidance of German missionaries. He worked as a teacher in a mission school in Tranquebar before establishing his own school in Cuddalore. Savarimuthu took on a Shaivite Pillai as a disciple, who was later baptized with the name Aaron and ordained as the first Tamil Lutheran pastor. The full name of Muthu, his siblings, and his father is vaguely suggestive of some relationship between this family and either Savarimuthu or Aaron. This connection, however, is speculative and offered as a guess about Muthu's family background. On the history of Savarimuthu and Aaron, see Hudson 2000 and Jeyaraj 2009.

[40]The report of the thirteenth triennial international conference and jubilee celebration of the World Council of YMCAs 1887:195

[41] *The Morning Star*. March 21, 1895:1

Dr. David Chowry Muthu

As his ties with missionary organizations deepened, Muthu was relied upon for his expertise on India. On May 6, 1887, Muthu was summoned to speak in London before the Zenana Missionary Society of the Church of England.[42] The Society, officially established in 1880, was comprised of British women tasked with traveling to India, and to a lesser extent China, to educate, convert and care for native women. In addition to teaching scripture, these missionaries educated Indian women about modern conceptions of hygiene, extending both the civilizing mission and the Anglican mission simultaneously.[43] Their work could be characterized as a kind of "Christian therapy," a "blend of medical science, charitable sentiment and evangelical faith that was practiced by the mission healers."[44]

[42] As reported in the annual publication of the zenana missionary society entitled "India's Women." "Zenana" is a controversial term used primarily to refer to the domestic inner space where women were kept segregated from both the outside and from men. While the term is somewhat specific to Muslim households, it was also used more generally to refer to South Asian practices of segregating women within a separate space in the home. For example, the acclaimed Bengali writer Bankimchandra Chattopadhay uses the word to describe the inner space of a Hindu household in his English-language first novel, *Rajmohan's Wife* (1864). In an introduction to this novel, Meenakshi Mukherjee points out that Bankim might have used this term because it would have been more familiar to an English-reading audience. It should also be noted that "zenana" shares some of the semantic burden of the word "harem" with all of its eroticized Orientalist mystique.

[43] As Jean and John Comaroff (1991) argue, the aims of colonial governments and missionary enterprises did not always neatly coincide. This was particularly true in India, where the government, under both East Indian Company and Crown rule, hesitated to allow missionization in British territories, for fear of promoting political instability. This is not to say that linkages did not emerge on occasion, but rather that a neat symmetry cannot be assumed between the methods and goals of church and state.

[44] Hardiman 2006:153

Zenana missionary with women students and patients

Concerns about the zenana that permeated the late nineteenth-century British imagination persuaded many British women that "evangelization must go hand in hand with medical treatment."[45] Both the mortal body and the immortal soul of the Indian woman were thought to be in peril. "Indian women were trapped in the 'sunless, airless,' and allegedly unhygienic Oriental zenana . . . imprisoned and awaiting liberation at the hands of Englishwomen's benevolence."[46] Providing medical care to Indian women was "nothing short of national and, indeed, of imperial obligation."[47] In his speech before the Zenana Missionary Society, Muthu seconded the opinion of Max Muller that "a government which could not protect a woman was unworthy the name."[48]

Medical missionary work was central to the emergence of tuberculosis as a problem in India at the turn of the century. Throughout the nineteenth century, there had been a consensus among colonial medical officials that Indians were not susceptible to tuberculosis. This was variously explained in terms of some combination of racial immunity, climate, geography and a notion of virgin soil. On the other hand, British troops and administrators were seen to be particularly vulnerable to the disease.[49] From the late nineteenth century into the first decade and a half of the twentieth century, there was a slowly-dawning consciousness that tuberculosis was in fact affecting Indians. It was in places where Indian bodies were subject to regular medical supervision – army cantonments, prisons, and zenanas – that medical practitioners first gained experience of tuberculosis in Indians.

Dr. Muthu made an appearance in front of the Zenana Missionary Society as an expert on medical conditions in India, as well as on the status of Indian women. He applauded the zenana missionaries for their tireless efforts. A summation of his speech reports that Muthu:

> corroborated all that had been said of the ruling power of women in the Zenanas, and repeated that until their opposition to Christianity had been overcome only the outskirts of the citadel had been taken. He said that our [missionary] Society was

[45] Burton 1996:378
[46] Burton 1996:369
[47] Burton 1996:369
[48] *India's Women* 1887:195
[49] Rao 2007

> sapping the roots of superstition, and laying the foundation of a building destined to become great and beautiful.[50]

Muthu's remarks operated through a similar logic of the inner and outer worlds that structured many colonial and anti-colonial nationalist discourses.[51] Despite their powerlessness in the outer world of politics, Muthu maintained that women and the traditions that they preserved reigned supreme in the home. For Christianity to make headway on the subcontinent, he argued, it made sense for missionaries to focus their efforts on converting women. In contrast to an inner world of tradition that needed to be protected, Muthu was actually advocating for a conversion of this inner world and the women trapped within it.

Muthu's concern for those Indian women – understood to be trapped in their homes – stretched beyond the question of the most effective means of extending the missionization of Indian society. He was especially critical of the practice of purdah, in which women maintained certain sartorial and spatial strictures. In colonial discourses, purdah was "represented as problematic insofar as it barred women from medical care," but was also "viewed as dangerous to women's health because it kept women away from sunlight and fresh air, and it was blamed for excessive female morbidity and mortality."[52] For Muthu, spiritual uplift and greater physical mobility were necessary parts of improving the bodily condition of Indian women. He emphasized that zenana missionaries should attend to the needs, "physical as well as spiritual, of the women of India."[53]

Zenana missionary teaching women in their homes in Madras City

[50] *India's Women* 1887:195
[51] The argument that Muthu makes here resonates with the way that Chatterjee (1993) describes the inner/outer divide that was employed during the Indian nationalist movement. Men could accede to the modernization of their *habitus* within the public sphere, but the purity of Indian tradition was maintained by women in the home, who supposedly remained untainted by outside influence. Indian men could therefore become modern while women safeguarded tradition, providing a basis for the Indian nation-state.
[52] Van Hollen 2003:43
[53] *India's Women* 1887:195

In a later comment on the sociology of tuberculosis, Muthu would remark that "the smaller the accommodation the greater was the mortality, and the larger the accommodation the smaller was the mortality from tuberculosis."[54] As a small, restricted space within a home, the zenana was understood by Muthu to be particularly conducive to greater tuberculosis-related mortality: "Especially the inner part of the houses where purdah women reside is deficient in light, fresh air, and sanitary conveniences."[55] Muthu also commented on the fact that Indian women, especially those who inhabited zenanas, were more prone to the disease than Indian men, "owing to insufficiency of air and light" to which Indian women were exposed.[56] He noted that the mortality in Calcutta among women of child-bearing age was six times that of men, "owing partly to the badly lighted and ill-ventilated conditions of the zenanas where they live."[57]

Muthu particularly singled out Muslim women as living with and dying from these spatial constrictions. Based on his travels throughout India, Muthu reported in a later journal article that:

> Among Mohammedan women, who were secluded in ill ventilated zenanas, the death rate was nearly three times as high as among men. In fact, the more strictly the purdah system was observed the greater was the morality, as among Mohammedan women; and where it was not enforced, as among the Burmese women, it was even lower than among men.[58]

Muthu would further develop these concerns about Muslim women later on his life. In 1913, he published the first version of a treatise on the history of "Hindu medicine." In 1928, he would enlarge this history in a pair of essays published as a book entitled *The Antiquity of Hindu Medicine and Civilisation*. These essays, meant to parochialize those ancient Greek therapeutics and modern medical discoveries enshrined in the history of medicine, received broad coverage in medical journals and the popular press, and were even read by Gandhi, if we are to believe his letters.[59] *Antiquity* is exemplary of the Ayurvedic Revival Movement of the late nineteenth and early twentieth centuries, when many such works were written describing the long history and many benefits of Indian medical traditions.[60]

Muthu's history located the creation of Ayurveda within a Hindu golden age, a time long past when Indians healers had already grasped fundamental theories of health and disease, and had even developed complicated techniques like surgery. In an interview on the nationalist movement in India, given in 1930 during a trip to the United States, Muthu elaborated on this "golden age," declaring that "women in ancient India enjoyed perfect freedom in every sphere of life -- social, religious and political. They could live their lives in any way they chose . . . daughters enjoy[ed] perfect freedom of thought and action and were as enlightened as they were brave."[61]

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[54] Muthu 1923a:518
[55] Muthu 1923b:119
[56] Muthu 1918:276
[57] Muthu 1927:23
[58] Muthu 1923a:518
[59] "I was delighted to hear from you and to have a copy of the new edition of that excellent book of yours. I am going to read it again." (Letter from Gandhi to David C. Muthu, 5 April 1932; C, xlix, 228).
[60] See Ganeshan's "Medicine and Modernity: the Ayurvedic Revival Movement in India, 1885- 1947" for specific references to Dr. Muthu; for a more general take on the modernization of Ayurveda, see Langford 2002.
[61] *The Day* 1930:13

Muthu went on to argue that this age of liberated women came to an abrupt close after the "Mohammedan conquest of India," when "the custom of the rigid seclusion of women slowly crept in among the princes and the upper ranks of the Hindus, which curtailed much of their liberty."[62] He noted that "purdahs were introduced to protect Hindu women who were placed wholesale in Moslem harems."[63] Muthu contended that Muslim custom – narrowly conceived of in terms of "rigid seclusion" and purdah – was adopted by non-Muslims not only in imitation of their Muslim rulers, but also in order to defend Hindu women from the supposed amorousness of Muslim men.[64]

When Muthu encouraged the Zenana Missionary Society to tear out the "roots of superstition," he was referring to a narrow set of customs whose development he attributed to Muslim communities. Muthu imagined that Christian missionary efforts to liberate women could help return India to a pre-Muslim golden age of freedom. Hinduism could be renewed and restored to this original form through the coming of Christianity to the subcontinent.[65] Having come from Madras, Muthu could not have been unaware of Annie Besant and the Theosophical Society, whose views struck remarkably similar chords. Although Muthu would later in his life explicitly express anti-colonial sentiment, he would never adopt a blanketly anti-western stance. Although he endorsed Christian missionization, he viewed the civilizing process itself as an internally contradictory force.

Muthu was not alone in his concerns about Muslim women as a medical problem. At the All-Indian Sanitary Conference in Bombay, held in 1911, concerns were noted about tuberculosis in Calcutta, especially with regard to "Moslem women."[66] At the next annual meeting, held in Madras in 1912, a resolution was passed calling for research into tuberculosis in India, stating that "statistics appear to show that this disease is rapidly increased in India . . .but it is doubtful whether the increase is real or apparently only due to such causes as more accurate diagnosis and registration."[67] No official inquiries actually took place until a similar resolution was passed in 1914 at the Sanitary Conference in Lucknow, the same year that a heading for cases of tuberculosis among Indians was created in district and municipal returns.[68]

As a result of the Lucknow resolution, an ex-medical missionary and Director of the Medical and Sanitation Department for the Nizam of Hyderabad named Arthur Lankester traveled across Burma and India for eleven months collecting evidence of the prevalence of tuberculosis on the subcontinent. He submitted a report of his findings to the colonial government in 1915. Lankester's report was a clarion call, circulating throughout the various presidencies. Particularly in the Madras Presidency, this report helped to persuade many physicians and colonial health officials that tuberculosis posed a serious problem for the health of the Indian population.[69]

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[62] *The Day* 1930:13
[63] *The Day* 1930:13
[64] As Goswami argues, "The displacement of the degradation of women to the Mughal Empire and the 'arrival' of Islam prepared the metaphorical ground for constructions of Bharat Mata, of the nation-as-mother and mother-as-nation" (2004:183). See "An Elegy for Kamala" for more on this construction.
[65] The renewal of Hinduism through its encounter with Christianity and other forms of rational religion was a task that many undertook – Vivekananda, Rammohan Roy, Aurobindo and Annie Besant's Theosophical Society.
[66] Proceedings of the All-India Sanitary Conference 1912:136
[67] Lankester 1920:2
[68] Harrison and Worboys 2002
[69] Rao 2007:34

Like Muthu, Lankester focused on the zenana as a particularly favorable site for the spread of tuberculosis. In 1920, he wrote that "the disease of consumption has emerged from the quiet of the zenana into the open life of the people."[70] The zenana was not only a site of high prevalence, but a source of contagion, a breeding ground from which tuberculosis spread through the cities and into the outlying areas. He argued that the prevalence of the disease was highest among women in zenanas, who were "averse to leaving their homes in order to obtain medical aid."[71] He bemoaned that "to secure privacy, efficient lighting and ventilation are absolutely disregarded, the zenana or women's apartments being usually the most insanitary part of the house. No wonder that tuberculosis, which thrives in damp, dark, airless corners, plays havoc in the zenanas."[72] The Director of Public Health for the Madras Presidency shared theses concerns, noting in 1923 that "among purdah women conditions are even worse [than among non-purdah women], *tuberculosis* being particularly common."[73]

Lankester drew his information from "informants of every class and kind," who are reported to have declared to him that there was "scarcely a zenana in this quarter of the city which has not some case of tuberculosis"[74] In particular, he drew his information from missionaries, "whose work takes them continually into zenanas," and who therefore seemed to be particularly susceptible to the disease.[75] Undoubtedly, Lankester's concern was not only with the Indian population, but with the effective functioning of mission and empire. Tuberculosis posed a threat not only to those Indians or Europeans involved in medical service, but to those who were involved in the routine operations of colonial governance, such as railway ticket masters, clerks, school teachers, police officers, postal workers and telegraph operators.

Lankester's argument about the zenana drew upon the usual tropes of darkness, seclusion and poor ventilation, but also involved the vitality of human bodies and bacteria.

> The healthy human body has the power to resist the inroads of disease to a very great extent. There are special corpuscles or cells in the blood, lymphatic glands, and other organs, which under conditions of perfect health can deal with the tubercle bacilli, destroying their vitality and their power to multiply . . . But let the exposure to infection be severe or long continued, or the resisting powers of the body weakened, and we have at once the conditions favourable to the development of the disease.[76]

Lankester's view on the relationship between zenanas and bacteria was echoed in official medical circles. In 1923, the Director-General of the IMS C.A. Sprawson wrote that the increased mortality of Muslim women

> . . . is due to the restriction of the zenana which confines women to their rooms and to a narrow courtyard; usually there is no garden. The middle-class Mohammedan woman sees nothing else than this during her life, and within that small and insanitary area are enclosed female relations and children and often one

[70] Lankester 1920:15
[71] Lankester 1920:20
[72] Lankester 1920:141
[73] Cited in Van Hollen 2003:44
[74] Lankester 1920:140
[75] Lankester 1920:71
[76] Lankester 1920:142

> or more servants. I have several times seen tuberculosis run through a zenana and destroy the majority of its inmates in a few years.[77]

Indicative of the vexed relationship of germ theory to older etiologies of diseases, Sprawson argued that the different clinical presentations of tuberculosis in India and Europe were not due to climatic variations, but rather to "racial differences."[78] Following a line of thought that related race to heredity and inheritance, Sprawson argued that "contrasts in clinical manifestations are usually due ultimately to variations in external surroundings acting on a race through several generations." [79] He intentionally titled one of his papers "Tuberculosis in Indians," as opposed to "Tuberculosis in India," in order to emphasize that the "distinction is a racial one and not merely geographical."[80] Although Sprawson admitted the necessity of bacteria for the development of tuberculosis, he attributed increased susceptibility and varied clinical presentation to environmentally-conditioned racial factors. He dismissed climate in order to reintroduce an idea of environment that included built surroundings like the zenana. For Sprawson, this built environment shaped a race over subsequent generations, an idea of racial inheritance that was tied to history and customary practice.

Unlike Lankester and Sprawson, Muthu's problem with the zenana was not related to the threat of increased infection. As he put it, "the social customs and prejudices of centuries, such as the caste system, the purdah system, and child marriage, have helped to undermine the vitality of the people, so that at the very touch of tuberculosis thousands of them fall victims to the disease."[81] For Muthu, the zenana and other "social customs" reduced the vitality of Indian women, leading to a diseased condition without the intervention of bacteria. But Sprawson, Lankester and others added an intermediary step to the equation, arguing that the conditions in the zenana reduced vitality thereby rendering Indian women susceptible to infection by bacteria that caused tuberculosis.

Despite his concerns about Muslim woman, which he understood as a problem of bad customs, Muthu did not place much emphasis on tuberculosis as a disease of racial inheritance. He was however involved in numerous conversations about race in both Britain and the colonies. In the 1890s, he subscribed to the first anti-racism journal in Britain, *Anti-Caste*, before joining the committee behind its successor journal, *Bond of Brotherhood*, in 1894.[82] In 1907, Muthu published a letter in the *Daily Telegraph* thanking the novelist-physician Arthur Conan Doyle "on behalf of England's Indian community" for his dismantling of the racialized case mounted against a British solicitor of Bombay Parsi parentage named George Edalji. Edalji had been convicted for a series of vicious animal slashings involving horses, cows and sheep that drew national attention. [83]

Muthu also engaged with questions of race in a more professional capacity. At a meeting of the British Medical Association in 1900, Muthu engaged with the position of a Bengali physician named Sarat Mullick, who argued that the system of filling academic positions in

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[77] Sprawson 1923:483
[78] Sprawson 1923:481
[79] Sprawson 1923:481; see also Müller-Wille and Rheinberger (2012) on the history of the concept of heredity in its various forms.
[80] Sprawson 1923:481
[81] Muthu 1927:23-4
[82] See Bressey (2010) for more on this fascinating history of Victorian anti-racism movements.
[83] *Daily Telegraph*. December 15, 1907. For more on the racialization of the Edalji case, as well on Doyle's anti-racist defense, see Lahiri 1998, 2000.

Indian medical colleges based on IMS rank was " prejudicial to the interest of medical education and sanitation, and [was] a sinister bar to the advancement of original research in India."[84] Although the IMS was open to Indians beginning in 1855, preferential hiring practices ensured that only a very small handful of Indians had joined the ranks by the turn of the century.

Over the years, Muthu grew even more concerned with the treatment of Indian medical professionals. In 1914, Muthu published a letter in the *British Medical Journal*, calling attention to the racist treatment of Indian medical students in both Britain and the colonies. Reporting on a recent trip to India, he wrote that:

> The general feeling amongst Indians is that they are subjected to indignities and treated as outcasts, not only in different parts of the empire, but in Britain itself. They say in effect that unless the British Empire is a sham, England ought to respect the feelings and protect the interests of her dark sons.[85]

Muthu offered specific remarks on the treatment of Indian medical students in Britain, who were "men of culture and intelligence, of rank, and high capabilities," but were treated "as pariahs in a land which boasts of democracy and freedom."[86] More generally, Muthu criticized the tendency of white British, wherever they were in the Empire, to "make colour a test of intelligence and character."[87] This was precisely what he felt was occurring with medical appointments. During the First World War, while Indian army men and medical officers lay dying on the battlefield in support of the Empire, "the appointment of an Indian to the post of house-surgeon somewhere in Cornwall was cancelled at the very last moment after it had been duly made because of his nationality."[88] Muthu argued that positioning English candidates above Indians was not only racially motivated but politically inept: "A single case like this would do more harm now to the English cause in India than a thousand Indian sedition mongers."[89]

Such a statement was no mere threat or casual warning. The memory of the 1857 rebellion lingered as nationalist fervor gained force in the colonies, especially India. The question of medical administration was not merely technical, but eminently political. It was not just novel sanitary reforms, foreign medical ideologies and new ways of knowing that came to "colonize the body," or alternatively, to incite disorder among the natives.[90] Rather, Muthu was arguing that something as remote and seemingly mundane as informal hiring practices in medical hospitals in Britain could have a serious impact on the political stability of the Empire's colonial holdings. For Muthu, the routine structural conditions of medicine, such as staffing decisions, mattered a great deal to the viability of empire. In the next section, I detail how Muthu navigated these structures, as well as explicate further his theory of the germ and its relation to tuberculosis.

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[84] Mullick 1900:440
[85] Muthu 1914:1098
[86] Muthu 1914:1098
[87] Muthu 1914:1098
[88] Muthu 1915:312
[89] Muthu 1915:312
[90] Arnold 1993; see also Prakash 1999 for a discussion of the controversy surrounding autopsy in India.

Formaldehyde and Fresh Air

"Disease does not differ in principle from life."
From Virchow's *Cellular Pathology*[91]

In 1891, Muthu married his first wife, Margaret Carkeit Fox. Fox was a minor member of the peerage with an enviable pedigree in medicine. Her father, Charles James Fox, had been a highly-esteemed dental surgeon who had died from chloroform overdose in 1895. Her grandfather, of the same name, had been a tuberculosis specialist like Muthu. Her great grandfather, Joseph Fox, was also a physician, a Catholic who had converted on his deathbed from Mormonism. After being married in a Baptist church, Muthu and Margaret would have six children together whom they raised Catholic.

David Muthu and his wife Margaret Fox

Dr. Muthu, his wife and three of his children

After earning the diplomas of M.R.C.P. (Member of the Royal College of Surgeons of England) and L.R.C.P. (Licentiate of the Royal College of Physicians), Muthu began working at Ingle View Hospital in north London. While practicing medicine, Muthu also engaged in research and wrote frequently to various medical journals.[92] In 1897, Muthu became a clinical

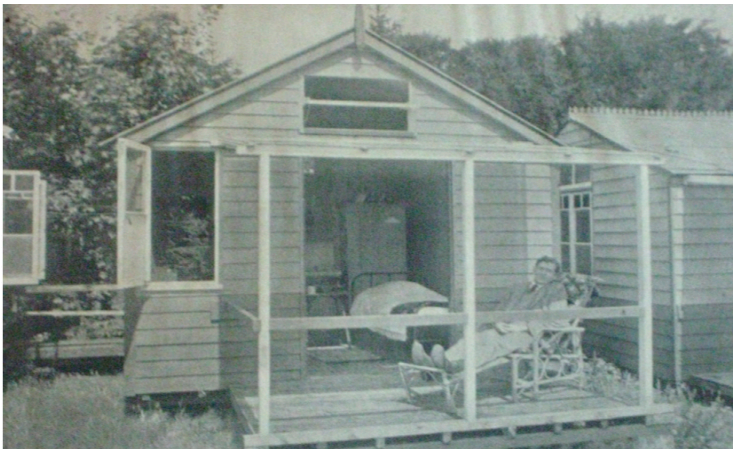
[91] Cited in Muthu 1927:116

[92] On 1891, Muthu co-signed an appeal published in both the *British Medical Journal* and the *Lancet*, on behalf of the widow and four children of a Dr. William Bacon Hodgson, who had committed suicide by ingesting poison. Hodgson was a surgeon and was reputed to have had a drinking problem, and had bankrupted himself a few years earlier. He had threatened to commit suicide many times. This is the first publication that I have located bearing Muthu's name.

assistant at Great Northern Hospital, under Dr. Henry Walter Syers. Muthu published his notes on one of Syers' cases, a 33-year-old railway worker who had spent six years in the army in India, where had had developed enteric fever. In his notes, Muthu described the necropsy of the man and how he had died of an aortic aneurysm.

Syers would die six years later from a streptococcus infection contracted during a post-mortem examination. But by 1899, Muthu, now an "Indian naturalized British subject," had already relocated with his family to the Isle of Wight, off the southern coast of Britain. The Isle of Wight was renowned for the health-inducing property of its air, and was home to some of Britain's first sanatoriums. Muthu ran the Inglewood Sanatorium, where he had the opportunity to further his research on the etiology and treatment of tuberculosis. In a tribute to his longevity published in the *British Medical Journal*, Muthu was described as one of the "early pioneers of the open-air movement" in Britain.[93]

Apparently unsatisfied with the low altitude of the Isle of Wight, Muthu relocated three years later to Mendip Hills, in Somerset, Wells, in the west of England.[94] There, he established his own tuberculosis sanatorium and medical practice. The sanatorium estate, which stretched across three hundred acres of "woodland and meadow, in the heart of the pine-clad Mendip Hills," was at an elevation of about eight hundred fifty feet above the valley of Wells.[95] He would remain attached to this site for the remainder of his life, even during his visits to India and the United States. As one of few Indians in England, and one of very few Indian professionals in England outside of London, Muthu clearly stood out from the general population. It is reported that the patients at his Mendip Hills Sanatorium referred to him as "the black doctor," out of a feeling of affection, writes one scholar.[96]



Man resting in front of chalet at Muthu's Mendip Hills Sanatorium

Unusual for an Indian doctor, Muthu seems to have maintained a lucrative practice. Indian doctors were not able to ask for the same level of remuneration as British doctors – this was equally true in Britain and in the colonies.[97] In Britain, this meant that the majority of

[93] Associations and Institutions 1926:29
[94] Associations and Institutions 1926:29
[95] Singh 1920:531
[96] Berndt and Rankin 2001. Despite these "feelings of affection," it is quite likely that this epithet also had a racial reference.
[97] Harrison 1994; Lahiri 2000

patients who came to Indian doctors were from the working class, such as coal miners. These patients had less to spend on medical care, and Indian doctors charged less, allowing for a partial connection built across perpendicular cleavages of class and race. Given that Mendip Hills is known for a history of mining, particularly of lead extraction, it is not out of the question that Muthu treated miners and other working class people at his sanatorium. But in light of the high cost and long stays involved with sanatorium care, as well as the photographs of seemingly well-to-do men and women at Mendip Hills, it seems unlikely that the majority of Muthu's patients were in fact working class.[98]

Muthu's sanatorium treatment was three-fold: open-air therapy, graduated exercise along the dominant British model developed by Paterson, and what he called "continuous inhalation therapy." Muthu wrote that the doctor-as-supervisor must combine these elements together in proper proportion in order to cure the patient. He remarked that the doctor, "like the commander of any army, arranges the various elements in the battlefield to the best possible advantage to bring about the desired result, namely, the defeat of the enemy. Fresh air, and rest, and feeding in themselves will not effect a cure any more than guns and ammunition will win a battle."[99]

Muthu's inhaler mask

Muthu began writing and speaking about his treatment protocols, especially inhalation, from about 1901. As a medical student at King's College Hospital in London, he had first witnessed the use of inhalation therapy during a clinical lecture by Dr. Burney Yeo.[100] In his own practice, he immediately began experimenting with the efficacy of various drug combinations and inhaler designs. Working from the model of Yeo's metal inhaler mask, Muthu developed his own pyramidal design made of perforated zinc and nickel plating that stretched from the chin to the nose of the patient. As an announcement for his device explained, "the inhaler is light and portable and can be used at all times of the day, whether the patient is reading, writing, or walking."[101] Muthu's design was manufactured by a medical supplier in London and seems to have been widely prescribed by British physicians.[102]

Muthu's aim was that the inhaled substances, which included various combinations of formaldehyde, menthol, iodine, pine oil, eucalyptus oil and chloroform, should reach deep "down the lungs."[103] The number of hours a patient spent using the inhaler tapered up and down over the course of their treatment. "When a patient first comes to the sanatorium . . . he has the inhaler for two hours the first day, four hours the second, six hours the third, and eight hours the fourth and the following days. In this way he is gradually prepared to use the inhaler a great part of the day as well as night."[104] Once a patient showed signs of improvement, Muthu would

[98] We do know that the famous mathematical savant from South India, Ramanujan, was for a short period in 1917 a patient of Muthu at Mendip Hills. Ramanujan and Muthu had travelled together by sea from Madras after one of Muthu's trips to India.
[99] Muthu 1902:1422
[100] Muthu 1911:263
[101] Lancet 1903:562
[102] Robertson 1926:114, Preparation and Appliances 1915:101
[103] Muthu 1905:1305
[104] Muthu 1912:956

gradually decrease the duration of treatment "to six, four, and two hours a day."[105] During the greater part of the treatment course, Muthu insisted that his patients should wear the mask for at least eight to ten hours per day, but preferably at night as well.

As an alternative to direct inhalation through his device, Muthu would on occasion transform his patients' rooms into an "inhalation chamber."[106] After shutting all of the doors and windows in the room as tightly as possible, Muthu would then vaporize formalin tablets and menthol. "For hours the room is charge with formalin vapour, enabling the patient to inhale the impregnated air."[107] Muthu was careful to note that inhalation was not a substitute for open-air therapy, but only a "supplementary method."[108] But in those few hours during which patients were secured in their inhalation chambers, patients inhaled formalin vapor in place of fresh air. Like the zenana that Muthu decried, the inhalation chamber sealed the sufferer away from light and air. But what separated the inhalation chamber from the zenana was the carefully curated air, a specific chemical balance replete with therapeutic efficacy.

Muthu was hard-pressed to explain what exactly it was about inhalation therapy that made it effective. In 1911, he would write that "inhalation has probably no direct or specific action on the tubercle bacillus. Its soothing action would stop the cough, and thus check the small particles of expectoration from being sucked in and infecting new areas of healthy tissue."[109] He added that inhalation therapy generated "increased negative pressure [that] favours the flow of blood into the lungs" and "afforded protection against strong wind and dust."[110] In the following year, Muthu would claim that inhalation therapy "makes an effective attack on pathogenic organisms, inhibiting their growth and activity."[111]

Group of patients at Mendip Hills taking a walk while wearing Muthu's inhalation masks

[105] Muthu 1912:956
[106] Muthu 1908:1305
[107] Muthu 1908:1305
[108] Muthu 1911:525
[109] Muthu 1911:673
[110] Muthu 1911:673
[111] Muthu 1912:955

Although inhalation therapy was only a "supplementary" aspect of Muthu's treatment protocol, it was also the only method that Muthu would claim specifically attacked bacteria. Open-air therapy and graduated exercise were more concerned with the restoration of vitality. Muthu's strict exercise regimen for his patients involved specific activities for carefully measured durations which were gradually lengthened as the patient's health and vital energies increased. Muthu explained that the ratio of rest and exercise was "so adjusted and regulated by the physician that for every toxin generated in the system nature created an immunity which increased the resistance capacity of the patient and made for healing."[112] Too much or too strenuous physical activity could harm a patient's recovery. Developing guidelines based on bodily temperature in the morning and evening, Muthu prescribed a different proportion of rest and exercise. He repeatedly emphasized the importance of constant physician supervision to ensure that the correct balance was struck.

Upon the arrival of a new patient, Muthu would prescribe a week of bed rest, after which the patient would begin walking exercises. "Gradually his walks are increased from 5 to 10 minutes to an hour and an hour and a quarter in the morning and an hour in the evening, all the walks being regulated according to his temperature and the condition of his lungs and general health."[113] These walks took the form of strolls through the woods of the Mendip Hill estate – what Muthu called "tromps" – aided by a walking stick and in the company of fellow patients, all the while sporting Muthu's continuous inhalation masks. Patients were expected to eventually walk for about three hours each day, covering eight to nine miles.

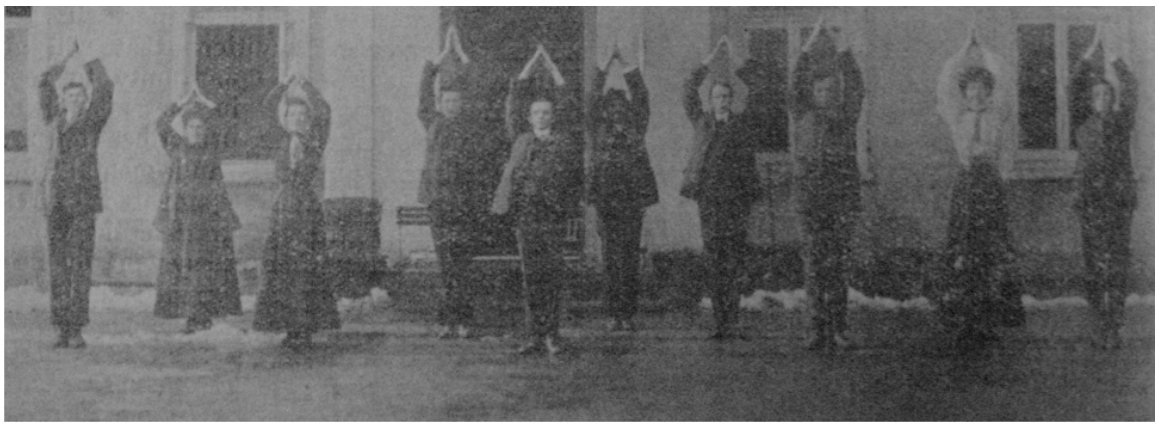
As a patient improved, Muthu would require gradually more strenuous exercise, including weeding, hoeing, raking, planting, chopping, sawing and planing wood, carpentry, painting, digging broken ground, digging unbroken ground and pushing a wheelbarrow.[114] Patients exhibiting good progress were encouraged to camp out on the estate, sleep under the stars, go shooting for game, and even organize "open-air tea-parties."[115]

Male patients sawing logs at Mendip Hills Sanatorium as part of graduated exercise

[112] Muthu 1912:446
[113] Singh 1920:531
[114] Muthu 1910:98, Muthu 1912:446
[115] Muthu 1910:100

In addition to these more labor-intensive activities, Muthu also required that his patients engage in breathing, singing and reading exercises. Breathing exercises involved inhalation and exhalation synchronized with upwards and downwards movements of the arms. To develop a habit of diaphragmatic breathing and chest expansion, patients were required to sing "ah" while maintaining strict breath control. For similar reasons, Muthu had patients slowly read aloud selections of prose or poetry in front of their fellow patients – this activity had the added benefit of relieving the tedium that was an inevitable part of such a long-course treatment. For Muthu, boredom was a threat to a patient's spirit, and to their recovery.

The most critical component of Muthu's sanatorium therapy was open-air treatment. As a treatment for tuberculosis, this approach had only been in use in Britain from about the late 1890s, when Muthu's sanatorium on the Isle of Wight had been one of very few such institutions in Britain. Muthu traced the origins of open-air treatment both to the sanatorium movement that began in Germany and to a longer history of "ancient Yogis in India" who believed that "breath was life, and that fresh atmospheric air, in its freest state, was charged with a universal principle of life, or vital force, called *prana*."[116] Muthu elaborated on this theme: "If the Yogi philosophers of India are right, then, besides its chemical constituents, the atmospheric air contains a vital universal principle called *prana*, through which life manifests itself."[117]



Patients engaged in breathing exercises at Mendip Hills Sanatorium

Rest in the open air was critical to Muthu's treatment program, as he understood rest to "enhance the effects of fresh air."[118] Life in Muthu's sanatorium was organized so that patients had maximum exposure to fresh air. "In the summer [the patient] practically lives out of doors day and night . . . his meals and amusements, and even the Sunday services, are all carried out in the open air. In the winter he spends a great part of the day on the veranada, and even sleeps out there if the weather is favourable."[119] The architecture and furniture of the sanatorium were also constructed to the same purpose, on the model of the chalet. These chalets were "built as to allow the fresh air to flush through every part of the room," each furnished with a bed that could be "wheeled right out."[120]

[116] Muthu 1910:81-2
[117] Muthu 1910:90
[118] Muthu 1910:91
[119] Muthu 1910:90-1
[120] Muthu 1910:91

For Muthu, the efficacy of fresh air was not related to a diffusion of or direct attack against bacteria. He argued that life in the open air "lessens irritability, and calms the nervous system . . . stimulated various physiological activities, increases nutrition, and braces up the nervous system."[121] More than anything, fresh air had a "stimulating and vitalizing influence upon the organism."[122] Along with open air, exercise and inhalation, Muthu maintained a strict schedule and dietary plan for his patients, with set meal times in a common dining hall that included such items as shredded wheat, porridge, bacon, ham, suet-pudding, cheese, biscuits, potatoes and milk. The milk was unsterilized, provided from cows living on the estate, as Muthu felt that "sterilization destroys something 'living' which seems to be essential to the wholesomeness and the nutritive value of the milk."[123]

But open-air sanatorium treatment was not simply a prescription for fresh air. Muthu claimed that the most successful treatment for tuberculosis was a highly-structured, personalized regimen that removed the patient from the pestilence of the city and properly disciplined body and mind, while increasing vital energies. For Muthu, a few weeks in the cool, fresh air of a hill station – the favored retreat of British military men, governors and missionaries – was not only inadequate but positively iatrogenic. A little bit of cure, without the supervision of a doctor, was much more dangerous than no cure at all. As Muthu explained, a visibly broken door is opened and closed much more gently than one that appears intact but has been haphazardly patched-up.

At Mendip Hills, Muthu instituted a strict daily schedule for his patients as follows:

7:30 – Patients take temperature while in bed.
7:35 – Physician goes round.
9:00 – Breakfast.
10:00 – Breathing and singing exercises.
10:15 – Morning walk.
10:30 to 12:30 – Manual exercises, as gardening, carpentering, etc.
12:30 to 1:30 – Silence hour.
1:30 – Dinner.
2:15 to 3:15 – Rest after dinner.
3:15 to 3:45 – Formaldehyde inhalation.
3:45 to 4:00 – Breathing and singing exercises.
4:00 to 6:00 – Tea and evening walk.
6:00 to 7:00 – Silence hour.
7:00 – Supper.
7:45 to 9:00 – Recreation. Patients' own time.
9:00 – Bedtime.
9:30 – Lights put out.[124]

Muthu allowed for variations in this schedule depending upon the specific condition of a patient. "The master-hand of the physician is necessary to take these elements and prescribe them according to the need and requirements of each patient."[125] Muthu noted that the British

[121] Muthu 1910:90
[122] Muthu 1910:90
[123] Muthu 1910:105
[124] Muthu 1910:89
[125] Muthu 1910:108

were not accustomed to the strict discipline of the Germans. As such, the British sanatorium superintendent should not be "rigid and severe as if he were training a band of soldiers," but should instead manifest in *his* personality a "sympathy which does not outrun a certain amount of discipline ."[126] In order to possess these qualities, the ideal sanatorium physician would be "married, above thirty years of age, with a commanding personality."[127] Despite his repeated allusions to army discipline, Muthu claimed that the sanatorium superintendent should not be like an army chief, but instead like a captain of a ship "knowing that in his right steering lie the welfare and the safety of those who are slumbering under his care and protection."[128] At the same time, he should be a teacher, ensuring "patients are educated in right thinking and right living."[129] In addition to increasing the vitality of the patient, this pedagogical function was seen as one of the primary purposes of sanatorium treatment.[130]

Air and Soil

The broad medical framework for understanding tuberculosis, both prior to and in the decades following Koch's isolation of *Mycobacterium tuberculosis*, made use of the horticultural metaphor of seed and soil. The seed referred to external causes that could be "planted" in the soil that was the human body. The metaphor functioned both as a connection and a dividing line between the proponents of various etiological theories. While most physicians and researchers seemed to draw upon some version of this metaphor, which provided a seemingly common conceptual language to discuss disease etiology, the directions in which the metaphor was taken were highly divergent.[131] After Koch, the seed from which tuberculosis sprang was gradually refigured into a bacterium.

What was the aim of Muthu's three-pronged therapeutic agenda? Only inhalation therapy seemed to specifically target bacteria. Open-air treatment and graduated exercise were aimed at something else. From as early as 1902, Muthu was already writing about the priority of soil over seed, a view he continued to hold into the 1930s. Reviews of his books on tuberculosis confirm that there was much sympathy for his views. The physician Arthur Brock, a disciple of the Scottish biologist and town planner Patrick Geddes, cited Muthu's work in support of focusing on "heightening the vital, the defensive, powers of the individual – towards unlocking, that is, his stores of potential energy, and enabling him himself to resist the inroads of disease."[132]

For Muthu, the treatment of tuberculosis should aim to "strengthen the soil and increase the resisting power of the tissues."[133] He maintained that the human or animal soil exhibited a

[126] Muthu 1910:108
[127] Muthu 1910:134
[128] Muthu 1910:109
[129] Muthu 1910:108-9
[130] As Condrau (2010) has noted, historians of tuberculosis have viewed this pedagogic mission cynically, as proof that the sanatorium was less a site of healing and more a site of subject formation and discipline. Worboys (1992) is a prime example, arguing that sanatorium treatment between 1890-1914 was largely oriented towards social and not medical aims.
[131] See Strathern (2005) for a discussion of "divergence" as a means of creating connections between things by first "cutting" them apart. See also Barad (2007) on "cutting together/apart."
[132] Brock 1910:175; Patrick Geddes spent a good portion of his career in India, creating well-known plans for many Indian cities, and engaging in conversations with Tagore and other luminaries. Geddes believed in architectural forms that co-existed with nature, not against it, a principle that he thought was exemplified by Indian cities. See Cantor 2005 on the relationship between Geddes and Brock.
[133] Muthu 1912:446

certain "resisting power," which was necessary to avoid the onset of a pathological condition.[134] In part, the differential vulnerability of individuals and populations could be linked to variations in the soil and its resisting power. Muthu understood the reduction in this resisting power through the weakening of the soil as the proper object of concern, the true pathology. He apprehended the signs and symptoms specific to tuberculosis as "merely the surface indications of a greater and more serious bodily derangement."[135]

For Muthu, "fresh air, food, and rest help to recuperate the patient's failing energies and strengthen the soil, so that Nature may begin her beneficent work."[136] Nature played a pivotal if not dominant role in the therapeutics of the sanatorium. The role of Nature in Muthu's therapeutics, and in the sanatorium movement more generally, can be attributed in part to the lasting influence of German *Naturphilosphie*, which in turn drew upon Romantic conceptions of Indian philosophy and religion.[137] Muthu himself would write that "the Indian fully believes in the real presence of the Divine in nature . . . Behind fancy and fact, sense and spirit, myth and truth, there reigns a sense of mystic Presence brooding over all things and binding man and nature, soul and body into one whole. "[138] "All nature," he claimed, "is alive with a presence that is hidden behind the sensuous and the beautiful."[139]

For Muthu, life depended upon these resisting energies, which he variously spoke of in terms of vitality, vital force, vital powers and vital capacity. Vitalism in medicine has a long history with many incarnations, stretching back at least as far as Aristotle. In general, vitalism held that something separate from matter – understood as a force, power or principle – animated and gave life to matter. This vitality erected the boundary between the living and the non-living, and in some versions of vitalism, the animate and the inanimate.[140] In its most polemic forms, vitalism stood against mechanism as a philosophy that refused to accept that life could be artificially created from non-living substances without the infusion of a vital supplement. Vitalists derided purely mechanistic explanations for causality and the functioning of living organisms. Muthu adhered to such a vitalism, arguing that "Western medical training and temperament, in common with Western thought, tends to view life from a physical standpoint, and base the treatment of disease accordingly. Man is not a machine, but a living personality."[141] He wrote later of vitalist biologists who had discovered that "the phenomena of life cannot be explained in mechanical terms."[142]

Koch's claim that tuberculosis was caused by bacteria was another nail in the coffin of vitalism, offering a mechanistic explanation for a specific disease.[143] Sanatorium treatment was "notable precisely because it marks the persistence of vitalistic understandings of the disease in the face of the advances in medical science that dominate traditional histories."[144] Over the

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[134] Muthu 1902:523
[135] Ott 1996:34-5
[136] Muthu 1912b:955
[137] See Ott 1996:33 and Chakrabarti 2004:207; Muthu also speaks of the "purposefulness of living organisms," an observation he attributes to "biologists with a wider outlook" (1930:11).
[138] Muthu 1930:14
[139] Muthu 1930:23
[140] See Chen 2012 for a linguistically-inspired deconstruction of this boundary. Bennett 2010 attempts something similar, but is too quick to attribute vitality to matter that is traditionally understood to be inanimate for purely methodological purposes.
[141] Muthu 1909:v-vi
[142] Muthu 1930:11
[143] See Ott 1996:34 on microscopy and the microbial cause of disease
[144] Gordon 2007:62-3

course of his life, Muthu's vitalist claims became less and less convincing to his colleagues. Yet, vitalism did not simply vanish. "Vitalist principles, if couched in theology and metaphysics, could not survive within medicine proper."[145] But vitalism did in fact survive, smuggled back in through the metaphor of seed and soil. Lankester, Sprawson and others could still write of the diminished vitality of the soil as long as the necessary causal mechanism was described in terms of bacterial infection, sheered of mystical and metaphysical propositions.

Muthu however continued to speak uncompromisingly about vitality as part of a larger metaphysical and medical project, professing a "spiritual vitalism" that increasingly pushed him "toward the margin of mainstream medical opinion."[146] "The physical does not embrace the whole of man's life and environment," he wrote.[147] "The more we investigate matter," he insisted, "the more it becomes elusive and non-material."[148]

Vitalist rationales of open-air sanatorium treatment stretched back to Brehmner's sanatorium work in the 1850s. Muthu certainly embraced this tradition, as a proponent of the "gospel of fresh air."[149] At the same time, he looked to what might be loosely-termed Indian traditions of vitality, as found in Ayurveda and nature cure. Although nature cure had some of its foundations in Europe, it was taken up with much enthusiasm in India. No less an advocate of nature cure than Gandhi would adopt Muthu's work on nutrition to argue for a vitalist understanding of dietary intake. Suffering from high blood pressure and an upset stomach, Gandhi consulted a series of doctors including Muthu. In an interview with the Associated Press, Muthu is quoted as saying: "I found that he [Gandhi] had injured himself through too much fasting. I put him on a diet which varied goat's milk with salads, vegetables, fruits and nuts . . . but the Mahatma didn't like the salads, so he went back to goat's milk and nuts . . . He continues to do this even in prison." Muthu also prescribed rest for Gandhi: "One of my greatest difficulties was to get the Mahatma to relax . . . the Mahatma agreed to observe daily periods of two or three hours silence, for then he could relax and meditate and his nervous system had a chance to recover."[150]

Despite his antipathy toward salad, Gandhi readily took up Muthu's ideas about food as a source of vitality. In a letter to Satish Chandra Dasgupta, Gandhi wrote: "I see also that you have plunged into the uncooked dietary. I do not mind it so long as you can do it well without injuring the body. I have found that pounding injures the vitality and the electricity as Dr. Muthu calls it."[151] Writing in his Gujrati-language weekly newspaper *Navajivan*, Gandhi explained the "vital essence" as that which "chemists cannot detect by analysis," although "health experts have been able to feel its presence."[152] Gandhi argued that cooking destroyed this vital essence. "If one wants to benefit fully by uncooked food, one must give up cooked food altogether. I have faith in this argument . . . We see support for this view even in the chapter on diets in the book by the T.B. expert, Dr. Muthu."[153] Writing to Mirabehn in 1929 about this diet, Gandhi reported a "loss of weight," but "no loss of vitality," which he took to be of greater importance.[154] Gandhi was of

[145] Ott 1996:34
[146] Gordon 2007:64
[147] Muthu 1930:23
[148] Muthu 1930:23
[149] Muthu 1927:24
[150] *Reading Eagle* 1930:24
[151] Gandhi's Collected Works Vol 46, p. 131 – letter dated June 17, 1929
[152] Navajivan, June 6, 1929, published in Gandhi's Collected Works Vol. 46, p. 124
[153] Navajivan, June 6, 1929, published in Gandhi's Collected Works Vol. 46, p. 126
[154] January 21, 1929. In Gandhi's Collected Works Vol. 44, p. 25

course deeply concerned about questions of vitality and its loss, particular through the ejaculation of semen. But vitality was a serious concern for many practitioners of the Indian nature cure. One of its main proponents, K. Lakshmana Sarma, argued that "By excessive attachments one comes to disregard the rules of hygienic living; and this leads to a loss of vitality."[155] For Gandhi, the question of vitality in its relation to the body was intimately tied up to the health of the nation. In his sanatorium practice, Muthu would not go to the extent of banning cooked food, but we can see how his ideals of nutrition helped to shape Gandhi's endless experiments with eating.

Gandhi's faith in Muthu's philosophy led him to recommend him to friends. Gandhi organized the treatment of the son of a jeweler friend, Revashankar Jagjivan Javeri, having Dr. Muthu travel from Madras to Bombay to examine a tubercular bone.[156] Gandhi also wrote to Rajaji and Nehru about Muthu, advising Nehru to follow the advice of Dr. Muthu in his treatment of Kamala, exposing her to "open air, light food and sun" in India instead of taking her to Switzerland.[157] In a latter to Muthu early in 1928, Gandhi wrote: "As you know I have a horror of drugs and the like. I therefore welcome every honest effort to replace them with drugless and what might be termed natural methods of curing a disease which need never find an abode in this sunny soil of ours."[158]

The concept of *jivanshakti*, or "vital energy of life," was an important aspect of the Indian nature cure.[159] Etymologically, the Sanskrit word *jiva* is related to the Latin *vivus* ("alive"), with *jiva* used in various senses including soul or life. The root *jiv* ("to breathe") ties *jiva* to *prana*, a term which Muthu made much use of in inflecting the vitalism of the open-air sanatorium movement with an Indian pedigree.[160] Although *prana* is not identical to *vayu* (air or wind), it is usually translated in terms of vital force, life force or vital air associated with the act of breathing. As Alter argues, "in the *Yoga Sutra* the word *prana* is used to signify breath and breath alone." [161] He writes that the difference between *prana* as vital life force and "the air we breathe is so subtle as to be almost imperceptible."[162] The distinctions within the term *prana,* which were already being elided within the context of early twentieth-century Ayurvedic revivalism, enabled Muthu to recuperate an Indian history of vitalist thought and medical practice. This allowed Muthu to make claims both about the precocious knowledge of Indian antiquity and to provide deeper and broader roots for open-air therapy. As Muthu put it, the "attempt to revitalize Indian medicine by European thought ought to be welcomed by all well-wishers of India."[163] Of course, the revival of various Indian medical traditions was closely related to the nationalist movement, so there might have been some hesitance to endorse Muthu's view.[164]

The turn of the century period in which Muthu was writing was also a time of an increasing "occultism and mysticism" that "stood at odds against a society newly obsessed with

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[155] Alter 2000:80
[156] February 27, 1928. In Gandhi's Collected Works Vol. 41, p. 238, February 29, 1928, Vol. 41, p. 239, February 25, 1928, Vol. 41, p. 225
[157] January 26, 1929. In Gandhi's Collected Works Vol. 44, p. 55
[158] April 5, 1928. In Gandhi's Collected Works Vol. 41, p. 368
[159] Alter 2000:81
[160] As Alter (2004:59) argues, "There is a sense in which 'breath' and 'soul' are synonymous."
[161] Alter 2004:59
[162] Alter 2004:59
[163] Muthu 1916:1148
[164] Leslie 1976, Ganesan

consumption and production."[165] Vitalism was made popular through these occult organizations, including the Theosophical Society founded by Madame Blavatsky and established in Madras by Annie Besant. Another source of vitalism in India can be found in the work of the Bengali scientist Jagdish Chandra Bose, whose research into metals and plant cells confounded the boundaries between living organisms and non-living matter by applying physiological categories to inert substances.[166] Various forms of vitalism thrived in India, not only making Muthu's ideas more palatable to people like Gandhi but providing theoretical resources for Muthu's own brand of vitalism.

In his later work, Muthu would explicitly argue against the notion of separate spheres of inquiry and truth proper to science and religion. "What is religiously true cannot be scientifically wrong, and vice versa." Muthu proclaimed a vital monism – "life is one" – a claim whose provenance he attributed to the "ancient seers of India."[167] He took this oneness as a sign of the wrongheadedness of racial prejudice. A more "synthetic view," as he put it, would grasp that all of the various truths that have been uttered are partial aspects of the singular truth of reality that admits of all of these aspects. He argued for the oneness of life, oneness of mankind and oneness of truth, experienced through three aspects: "the physical, the sensuous and artistic, and the spiritual."[168] Muthu charted a brief history of the achievements of nineteenth-century science, which he argues has had:

> the effect of creating a mechanical outlook of life in the minds of many scientific men who conceived matter as something solid and real as the sole ultimate of the universe. They held that mind was a kind of emanation of matter and the unseen world an illusion, and fondly believed in the possibility of a mechanical explanation of life and the universe.[169]

He explained that this "materialist outlook" was especially prevalent in the field of physiology, in which "materialists have confidently claimed that the law of mechanics, physics and chemistry were applicable to living matter, that chemical actions and processes would explain vital phenomena and that thought was the by-product of matter."[170]Against this mechanism, Muthu drew upon debates in atomic physics concerning the particle- or wave-like nature of matter, or the inconstancy of time-space, pulling in such heavyweights as Heisenberg, Bohr and Einstein. He also cited the work of the French philosopher Henri Bergson, describing him as one in a "long line of seers who have given a philosophical warrant to the grasping of ultimate reality by the method of intuition."[171] In light of these challenges to mechanistic science, Muthu declared that "the old materialism is dead, and even the electrons, which for a time replaced particles of matter, have become but disembodied spirits, mere wave-forms."[172] If electrons were immaterial spirits, what then were bacteria?

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[165] Jones 2010:74
[166] Nandy 2001, Chatterjee 2009, Visvanathan 2013:45. Patrick Geddes (1920) would write a biography of Bose.
[167] Muthu 1930:5
[168] Muthu 1930:7
[169] Muthu 1930:7
[170] Muthu 1930:11
[171] Muthu 1930:19
[172] Muthu 1930:10

A Model Colony

After arriving in Britain in the 1880s, Muthu seems to have made the long journey back to India on at least four separate occasions. His first or second trip seems to have been in the early 1910s, returning to England in 1914 as a shipmate of the mathematical savant Srinivasa Ramanujan, who would become his patient three years later. By 1920, he was already being referred to as an "increasing important leader in the struggle against tuberculosis . . . in England and India alike."[173]

He made his third trip to India in the early 1920s, travelling "some hundreds of miles visiting many important cities on a tuberculosis mission."[174] Muthu was engaged in a study of tuberculosis in India, interested both in the prevalence of the condition among Indians and the availability of treatment facilities. "My last extensive tour from Bombay to Burma one way and from Nepal to Nilgiris in another has convinced me that tuberculosis is increasing in many parts of India, especially in presidency capitals, great industrial and commercial centres, and the large towns, and it appears also to be extending to rural areas."[175] He argued that migrants into urban areas fell sick and returned to their homes in the village to die. After reviewing the existing statistics for pulmonary conditions and conducting his own examinations, Muthu concluded that "the annual mortality from tuberculosis in India could not be less than one million, that one death in every ten of the total mortality is due to tuberculosis, and that in many Indian cities out of three deaths recorded among adults one dies of consumption."[176] These figures were quite startling at the time, given that tuberculosis as a problem among the Indian population had only recently been given serious consideration by colonial medical officials.

Muthu noted that the incidence of tuberculosis in India was increasing, in contrast to the steady decline observed in Europe and the United States over the previous forty years.[177] Based on his clinical observations, he claimed that tuberculosis ran "an acute course amongst Indians," leading to death within six months to a year.[178] The problem was further compounded by the fact that the vast majority of patients were only seen after reaching an advanced stage of the disease.

With the exception of malaria, Muthu contended that tuberculosis was the "greatest scourge in India."[179] He cited a report by the Health Committee appointed by the Madras Government, which stated that: "tuberculosis is rapidly increasing in Madras and is now a serious menace to the population"[180] He noted that the problem was not uniform throughout India, as crowded cities like Bombay had much higher rate of fatality than a city like Bangalore, renowned at the time for its gardens.[181] By contrast, he visit to Nepal revealed many patients with "quiescent pulmonary disease" who went about "their daily work," made possible by a "primitive but outdoor life" and the consumption of "natural foods." [182]

Muthu reported witnessing the condition among "all classes and races, from the humbler ranks of coolies, mill-hands, and servants, to the educated and well-to-do communities."[183] From

[173] Mukerjee 1920:493
[174] Muthu 1923:518
[175] Muthu 1923b:118
[176] Muthu 1923b:118
[177] Muthu 1927:23
[178] Muthu 1927:23
[179] Muthu 1928:190
[180] Muthu 1928:190
[181] Muthu 1923:518
[182] Muthu 1927:25
[183] Muthu 1927b:xcix

the latter group, he specifically singled out "junior clerks with small and fixed incomes, college students burdened with the strain of long hours and a heavy curriculum, and child-mothers badly nourished with poor stamina."[184] He wrote of "cities like Delhi and Lucknow . . . full of slums, blind alleys, and narrow passages, where the sun never shines and fresh air never penetrates, and which easily outrival any of the slums we have seen in London."[185] Muthu made a "confidential report" on his findings to the Madras government, urging them to take action and establish a sanatorium in the city.[186]

At the time, there were only about three or four sanatoriums in the entirety of the Madras Presidency – an area with a population equivalent to the entirety of Great Britain and Ireland – located in Madanapalle, Conoor and Mysore. In total, Muthu noted that there were about seventeen or eighteen homes and sanatorium devoted to tuberculosis throughout the entire country.[187] The viability of sanatorium treatment for the poor was a matter of much debate. In India, the colonial government decided that sanatorium treatment was too expensive, and therefore inappropriate for the masses.

Prior to the 1920s, leprosy was the disease that had received the greatest financial support and attention in the colonies, especially in India. Muthu criticized this emphasis on leprosy, arguing that tuberculosis was a much greater problem in India. Tuberculosis only began to receive "greater government attention in the colonies from the First World War onwards, yet few tuberculosis patients were put in special sanatoria, as was the practice in Europe and America at that time."[188] Sanatorium treatment was thought to be an expensive affair, as it required the construction of new infrastructure and long treatment periods. The colonial government was hesitant to provide the financial backing for such a massive undertaking, leaving the problem of tuberculosis among the native population primarily in the hands of philanthropic organizations like the Dufferin Fund and medical missionaries.

In India, Muthu argued, "any attempt to treat tuberculosis by drugs or tuberculin will be like administering a pill to cure an earthquake." He especially criticized the "indiscriminate injection of tuberculin by qualified and unqualified men in India," which he argued had "done immense harm by rousing latent disease, thus killing more people than it has cured." The approach to the problem of tuberculosis in India, he argued, "should be based on improving sanitation and increasing the standard of nutrition of the Indian people," as well as establishing sanatoriums as a "curative and educational means" to combatting the disease.

The type of sanatorium therapy that Muthu envisioned for India was more radical than what he had planned and enacted in Britain. Muthu contended that traditional sanatorium therapy as practiced in Britain was inadequate in the Indian context, unless it was part of a broader garden colony:

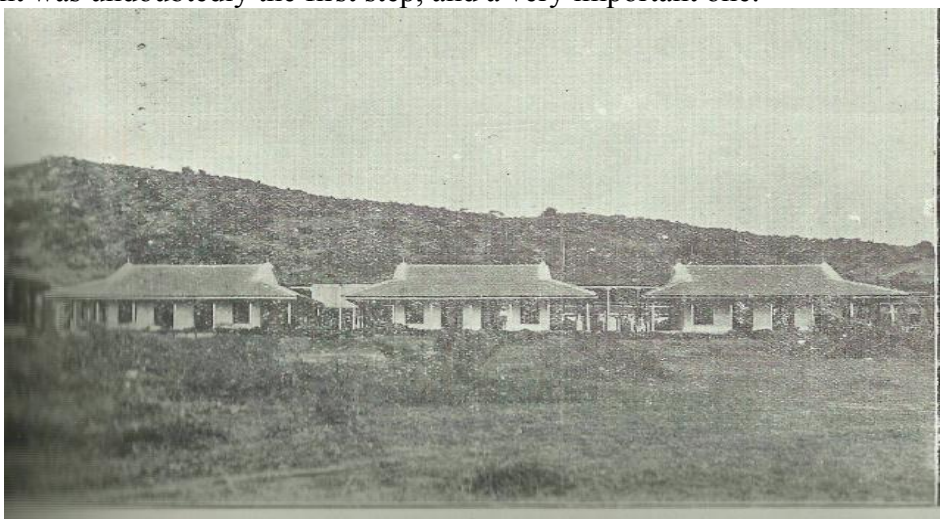
> In the garden settlement there would be a sanatorium for early cases. In another part houses or bungalows would be reserved for those suspected or threatened with tuberculosis. Still in another part children of tuberculous parents or those in the pretuberculous stage would be looked after and placed under the best hygienic conditions and provided with an open-air school. In another place convalescent or

[184] Muthu 1927b:c
[185] Muthu 1927b:cii
[186] Muthu 1926:31
[187] Muthu 1929:192
[188] Hardiman 2006:34

> ex-patients would be accommodated with their families and be kept under medical supervision, and, if necessary, trained in some outdoor occupation. A public hall would be found useful for propaganda work, for giving lectures on hygiene and health subjects, and as a place of recreation and entertainment. A dairy farm with cows kept under ideal sanitary conditions would complete the equipment of the garden colony, whose grounds would be laid out with spacious walks and broad avenues, so as to give the picturesque appearance of a health resort.[189]

Muthu's vision laid bare the utopianism of the open-air movement. As he imagined it, the sanatorium was only one small part of the larger pedagogical and curative space of the garden colony. The sanatorium would be hooked into a network of institutions including city-based dispensaries, rural health villages for ex-patients, and open-air schools. On the other hand, the sanatorium and the broader garden colony were a model for a vitalizing form of living. In contrast to the industrial city, the sanatorium and its bungalows were akin to a small, sparsely-populated village that opened up onto nature. In its pedagogical role, the garden colony was a model for society as it should be, as well as an image of society as it once was, intimately tied to nature.[190] In its curative role, the garden colony exhibited a "mimetic therapeutic logic," seeking to "reproduce the qualities of (an apparently disease free) preindustrial and preurban existence– an existence therefore in accordance with Nature's law."[191]

In order to establish his vision in reality, in 1926 Muthu acquired 250 acres of land from the Madras government, located on a slope of a hill, just south of Madras City. In a talk he gave in India just before returning to England, Muthu declared that "there was a demand now for tuberculosis sanatoriums all over the country, and this demand would become more insistent as time went on. Sanatoriums alone, however, would not get rid of tuberculosis, though their establishment was undoubtedly the first step, and a very important one."[192]



Muthu's sanatorium at Tambaram, at the time of inauguration

[189] Muthu 1929:192
[190] This valorization of nature and rurality in the philosophy of the open-air sanatorium movement, particular in Muthu's version of it, might be productively understood alongside the architectural vision of Patrick Geddes and the importance that Gandhi gave to the village.
[191] Gordon 2007:69
[192] Muthu 1926:1080

Muthu returned to India to begin construction of his sanatorium, which he called Tambaram after the *taluk* in which it was located.[193] The foundation stone for Tambaram Sanatorium was laid in 1927 by C.P. Ramaswami Iyer, a lawyer and prominent member of the Executive Council of the Governor of Madras. Also in attendance was a cross-section of Madras notables, businessmen, politicians, newspapermen and philanthropists.[194] In April of the next year, the twelve-bed sanatorium was inaugurated by the Indian politician and ambassador V.S. Srinivasa Sastri, again with a group of notables in attendance.[195] At the inauguration, four patients had already been admitted to the sanatorium. Muthu asked Gandhi, with whom he had been in correspondence, to compose a note for the occasion, but Gandhi begged off, stating that if he indulged such requests he would never have time for anything else.

Along the lines of his utopian vision, Muthu attempted to craft his Tambaram estate into a garden colony. But he only managed to complete "half the sanatorium, with three wards on each side of the administrative building . . . with verandahs for two patients" and "quarters for medical officers and nurses."[196] His original plans had been more ambitious, as he had envisioned constructing "six wards for men and six wards for women, besides administrations offices, quarters for visitors, for post-graduate courses, etc."[197] Lacking the funds to complete the project, Muthu turned to the Madras government as well as to the Indian public for additional funds, to no avail. Lamenting the lack of financial support, he bemoaned that "private philanthropy alone is too powerless to cope with the gigantic problem . . . [which] should be undertaken by the Government."[198] Muthu's financial woes might have prevented him from realizing the entirety of his ambitious design, but he continued to subject disease and society to critical scrutiny in his writings, drawing links between the microscopic life of bacteria and the increasingly mechanistic life of men.

A Protean Disease

> So subtle is this enemy, so quietly, like a thief in the night, does he carry on his deadly work… like a thief who walks up and down the street for days before he selects his house, and having selected his booty, he waits for a favourable opportunity to enter the house, and even after entering it he hide himself for some time, if the inmates are about, before he commences his nefarious work.[199]

"When is a case said to be tuberculous or non-tuberculous?"[200] Muthu grappled with this question on numerous occasions during his career, spending a good portion of his three volumes

[193] A *taluk* is a geographic unit of administration in India, located between the district- and village-level.
[194] Those present included the businessman Muthiah Chettiar, the former minister Aneppu Parsuramdas Patro, High Court Justices M. David Devadoss and Tiruvenkatachariar, and A. Rangaswami Iyengar, the editor of the *Hindu*.
[195] Muthu 1929:193. Those present at the inauguration included Dewan Bahadur R.N. Arogyaswami Mudaliar, Minister for Development, Dr. P. Subbaroyan, Justice Party member O. Kandaswami Chetty, and Dr. A. Lakshmipathy, a key figure in the Ayurvedic revival in South India, who in 1926 founded a "health village" outside of Madras named Arogya Ashram.
[196] Muthu 1928:193
[197] Muthu 1928:193
[198] Muthu 1927:24
[199] Muthu 1910:59
[200] Muthu 1927:184

on tuberculosis laying out symptoms and signs and critiquing the latest diagnostic fashions.[201] Diagnosing tuberculosis had never been an easy task. Muthu pointed out that in the early days of sanatorium treatment, patients were often diagnosed too late to receive proper care. He worried that more cases were overlooked than misdiagnosed.[202] In Muthu's words, tuberculosis was a "protean disease," making its appearance "in a variety of ways, involving a variety of symptoms in different patients."[203] The signs of tuberculosis, Muthu warned, "closely resemble those of many other respiratory affections," and the variations between patients meant that there was "no recognized standard of physical signs common to all cases of pulmonary tuberculosis."[204]

In 1927, Muthu wrote that the most popular diagnostic methods involved the tuberculin reaction, X-rays, bacterial microscopy and the detection of physical signs and symptoms. Seventeen years earlier, the diagnostic approaches that he had documented had been much broader, including the "opsonic index" and "Calmette's opthalmo-reaction." His position towards tuberculin, however, remained consistently negative. He presented evidence from a study that showed that the vast majority children found to have a positive reaction to tuberculin evinced no other signs of the disease over a two-year follow-up period. "Diagnostic injections are dangerous," he wrote, citing the Swiss professor of medicine Hermann Sahli, cautioning that tuberculin could "rouse into activity a latent tuberculosis."[205]

If the tuberculin reaction was oversensitive, the X-ray image posed the opposite problem. In 1910, Muthu was quite hesitant about the utility of the relatively novel technology of the X-ray. But by 1927, Muthu was ready to admit that X-rays could be useful in conjunction with other clinical signs. The proliferation of "shadows, mottlings, and opacities" were not for Muthu properly "pathognomic" signs – that is, signs that without a doubt pointed to the existence of a condition.[206] Muthu warned that both pathological and healthy structures might present in radiographic images with a similar appearance. He added that incipient lesions in the lungs were often too small to cast a shadow. Most importantly, the X-ray image allowed no way to distinguish between the active lesion and the healed lesion, unless the clinician had access to series of X-rays from the same patient taken over a period of time.[207]

What was of primary importance for Muthu was observing the patient, recording symptoms and eliciting signs. Muthu recommended that the clinician begin by taking a patient history, including both physical conditions (like enlarged glands) and affective concerns (business worries). In the early stages of pulmonary tuberculosis, Muthu described a vast range of symptoms that might occur, ranging from a "general malaise" to "gastric disturbance," "loss of weight," and "disturbed menstruation." Of course, there were clearer signs. Hemoptysis, or the coughing up of blood, was strongly indexical of tuberculosis, as was a fever with night sweats, making necessary the preparation of a chart to monitor the ebbs and flow of temperature. Prolonged pneumonia in the upper lobe of a lung or pleurisy was less definitive but still suggestive.

General observation of the patient would reveal external physiological signs that might predispose toward tuberculosis. These signs included abnormal structures like a deviated septum

[201] Muthu's three books on tuberculosis were published in 1910, 1922 and 1927. Each subsequent volume is an edited and expanded version of the previous one.
[202] Muthu 1922:741
[203] Muthu 1927:183
[204] Muthu 1922:740
[205] Muthu 1927:185
[206] Muthu 1927:185
[207] See "Survivals" on the interpretation of diachronic X-ray series.

or a hare lip but also broader traits like "phthisical complexion, smooth skin, blue eyes, blonde hair, etc., and the phthisical chest of Hippocrates, which includes flat or pigeon chest."[208] This combination of features was typically understood by physicians to be indexical of a tubercular disposition or diathesis. These externally visible features of the body could be linked to an underlying disposition to become tubercular. Although many of these features were seemingly hereditary, Muthu cautioned that disposition was not fate. Careful, disciplined living, as well as a cultivated strength of mind, could effectively guard against the onset of tuberculosis, he maintained.

In the diagnostic process, Muthu placed the most importance on the eliciting of signs by pressing, tapping, and listening to the patient's body. The patient's pulse should be regularly monitored. Palpation could reveal the presence of swollen glands. Percussion and auscultation, however, were the methods that Muthu felt had the greatest diagnostic power. By tapping on the chest, the clinician could listen for "resonance" or "dullness."[209] Although dullness could be an index of tuberculosis, it could also point in other directions. The results of percussion had to be "studied and valued in conjunction with other physical signs."[210] Through stethoscope-mediated auscultation, healthy breath sounds could be distinguished from those that pointed towards disease: "instead of the respiration resembling the gentle sighing of the wind among the branches of the trees, the inspiration becomes rough and cogwheel or weak and cogwheel."[211]

In his 1910 book on tuberculosis, Muthu made clear demarcations between the various stages of the disease, each with its own distinct signs. The discernments that had to be made were extremely varied and required a great deal of skill and clinical experience. It was no simple feat to identify "dry crackling rales, as thorns on fire," much less to distinguish them from "bright clicks."[212] With an additional two decades of experience, Muthu revised his position, conceding that the stages might be indistinct, overlap, or proceed non-linearly. Fresh lesions might co-exist with older ones. Some patients might never exhibit a fever throughout the course of the disease. Symptoms associated with one stage might appear early, late or never at all.

Muthu noted that physicians tended to disagree over the signs specific to particular stages. "What one sees in clinical practice is an apparent irregularity, inconstancy, and confusion in the various periods and stages, and in signs and symptoms . . . Nature does not seem to work in water-tight compartments."[213] Variation in the meaning of signs also took place across peoples and geographies. Muthu reported on cases that he had witnessed in India, in which the only signs of tuberculosis were "a high temperature and rapid pulse and sometimes enlarged glands."[214] He cautioned that "this Indian type" of tuberculosis was " apt to be mistaken for malarial and other fevers."[215] Rather than adhere to a strict typology, Muthu suggested that signs and symptoms should be interpreted "by the condition of [the patient's] health, by his vital capacity and resisting energy."[216] Put differently, "the value of the physical signs should be measured by the man and not man by the signs and symptoms."[217]

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[208] Muthu 1927:187
[209] Muthu 1922:189
[210] Muthu 1922:190
[211] Muthu 1910:62
[212] Muthu 1910:65, Muthu 1922:191
[213] Muthu 1927:194
[214] Muthu 1922:740
[215] Muthu 1922:740
[216] Muthu 1927:194
[217] Muthu 1927:200

Muthu argued that only a well-trained, experienced clinician could properly perform these diagnostic techniques and make the minor discriminations necessary to interpret the resulting signs. The patient's body did not speak for itself. It was only through the clinician's body acting upon the patient's body that signs could be elicited. Different bodies varied in the quality of sounds that they produced, even if exhibiting the same disease. The mere absence or presence of signs could not substantiate a diagnosis. As Muthu put it: "If the trained eye and ear of the physician is necessary to detect the various shades of breath and adventitious sounds, it would require a trained experience as well to interpret correctly their meanings and significance in the diagnosis of disease."[218]

Muthu's diagnostic methods were closely aligned with the approaches of his contemporaries. Although there were debates over the meaning of specific signs and stages, or the utility of particular techniques, Muthu's ideas generally fit within a broader conversation about how best to diagnose tuberculosis. At the same time, a fracture was forming between vitalists like Muthu and those who took a more mechanistic approach to disease. It is useful to understand the semiotics of Muthu's diagnostic approach within this vitalist framework. "The truth, he contended, "is that vital force or vital resistance is too subtle, too complex, to be able to be estimated by any known physical method."[219]

Mechanists, he complained, missed the distinction between matter and reality, as well as misunderstood the relationship between the two. Muthu cited with approval the words of the scientist and historian Sir William Cecil Dampier, who declared that "matter, like all other concepts of science, is only known to us through its effects on the senses. The world of science is the world of appearance and conditioned by our senses and our mind, it is not necessarily the world of reality."[220] For Muthu, the physical world was composed of a "shadowy symbolism."[221] Behind the symbol, he wrote, "lies reality."[222] This highly metaphysical speculation on scientific inquiry was linked to Muthu's vitalism and his diagnostic methods. "Only life can interpret life," he wrote.[223] "The living ear of the physician can detect and interpret correctly the various shades of breath sounds when the dead physical helps are unable to give a decided diagnosis."[224] For Muthu, diagnosis was a vital process because it required a living being to interpret living signs, and to reach beyond the signs towards reality.

Muthu feared that an excessive reliance on laboratory-based evidence would lead to the demise of the clinic, that the clinician would "lose from sheer disuse the faculties of seeing and hearing and those powers of insight and intuition that have been the chief guides to the general practitioner in times past in forming his diagnosis."[225] His critique of "dead physical helps," of a mechanistic or laboratory-based approach to diagnosis, opened up the question of the signifying value of bacteria.

Mutant Microbial Matter

By the 1920s, most of Muthu's colleagues had adopted some form of germ theory, but he insisted against this solidifying consensus that "no theory or treatment of tuberculosis based on

[218] Muthu 1922:192
[219] Muthu 1910:58
[220] Muthu 1930:11-12
[221] Muthu 1930:20
[222] Muthu 1930:4
[223] Muthu 1922:740
[224] Muthu 1922:740
[225] Muthu 1910:59

infection has hitherto proved satisfactory."[226] Muthu's critique of germ theory, especially as these ideas were elaborated by Koch and his colleagues and students like Carl Flügge and Georg Cornet, was premised on a simple observation: "We have found the curious fact that in some cases tubercle bacilli may be found in the sputum and yet the patient may not be tuberculous . . . on the other hand negative sputum does not indicate the absence of tuberculosis."[227] This was a radical shift in Muthu's thinking, as in August of 1901 he had admitted at the British Medical Association's annual meeting at Cheltenham that cases in which bacteria were not found after careful examination could not be classified as tuberculosis despite the presence of tubercular signs and symptoms. Muthu's views on the subject changed substantially, as he later claimed that the "presence of clinical symptoms is a much more true indication of tuberculosis than the absence or presence of tubercle bacilli."[228] The pre-eminence of clinical signs over bacteriological signs was also for Muthu a prioritizing of the clinic over the laboratory.

But throughout his career, Muthu never denied the existence of microbes. In many cases, he could clearly visualize bacteria, including *Mycobacterium tuberculosis*, under a microscope. Koch's elevation of microscopy as the most important method of the new microbiology had ushered bacteria into the realm of the visible. But seeing something, and knowing what that something *was*, were entirely different matters.

"In hundreds of cases," Muthu noted, "there is either no sputum, or tubercle bacilli cannot be demonstrated after the most careful and repeated examination of the sputum."[229] In addition, he found that when bacteria did appear in the sputum of some patients, it often occurred long after they had demonstrated other symptoms and received a diagnosis.

Muthu's observations were corroborated by many other clinicians and researchers. What could Muthu make of these finding? He ruled out the possibility of widespread shoddy microscopy, noting that even the most careful examinations could not reveal bacteria in many cases. "The argument that [bacteria] are there in the body but cannot be demonstrated is simply begging the question, as, if even this be true in some cases, it cannot be true in hundreds of other cases."[230] Instead, he used this observation to argue against Koch's postulate of specificity. If Koch's bacterium was not present in every tubercular case, and if it was not absent in every non-tubercular case, then the bacterium could not be a necessary cause of the disease.[231] "The mere association of a micro-organism with a disease," Muthu wrote, "does not prove that it is the cause of the disease, any more than the presence of eagles near a corpse shows that they are the cause of the dead body."[232] This analogy relies upon an indexical logic to undercut causal claims. Bacteria might be found along with disease, but this observation did not necessitate that bacteria caused disease, anymore than roving scavengers were a cause of death, or that smoke is the cause

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[226] Muthu 1920:644

[227] Muthu 1922:740; Flügge was Koch's colleague who argued for a droplet theory of infection – that speech, singing, or coughing spread bacteria through air-born droplets. Cornet was Koch's student, and hypothesized that bacteria was spread through dust, conflating hygiene with cleanliness. See Tomes 1998:96-7 for more on Flügge and Cornet, as well as Worboys 2000 on the different ways of doing things with germs in the second half of the nineteenth century

[228] Muthu 1927:57

[229] Muthu 1927:68

[230] Muthu 1927:57

[231] Koch would revise his postulates to allow for asymptomatic cases, in which bacterium were present without symptoms of disease. But he maintained that there could be no tuberculosis without bacterium.

[232] Muthu 1927:56

of fire.[233]

Muthu insisted that infection should not be confused with disease, arguing that "pathogenic organisms may invade the tissues without necessarily producing disease."[234] If infection was not equivalent to disease, than the "mere presence of a micro-organism" alongside other symptoms of tuberculosis was not a sign of causality.[235] Muthu offered as proof the continuing good health of his employees in the sanatorium, "medical men, matrons, nurses, attendants who have daily come into contact with patients," among whom "there was no proof that even a single one has been infected by such contact."[236] He also discussed three cases involving working-class men whose wives nursed them back to health without falling ill despite this prolonged exposure.[237]

Muthu cited with approval the research of Emile Roux, who had discovered caseous tubercles without any trace of *Mycobacterium tuberculosis.* If this bacterium caused tuberculosis, then it was expected that such bacterium would be found in sections of the tubercle exposed to staining and microscopic investigation. Furthermore, Roux had found that injecting this tuberculous matter into a healthy animal produced symptoms of disseminated tuberculosis, suggesting that the introduction of pathological tissue, even in the absence of bacteria, could instigate the disease.[238] Producing the disease in laboratory animals through inoculation was one of the means by which Koch had demonstrated the specific relationship between causal agent and disease. Roux's experiments undermined this monocausal logic.

Instead of unilaterally identifying bacteria with disease and death, Muthu wrote extensively about the utility and necessity of bacteria for life itself. Bacteria, he explained, were "very necessary to everyday life, and serve man in countless ways. They act as living ferments in the body, and take part in the physiological functions of digestion, assimilation, and excretion."[239] Muthu roundly criticized the moralizing that he found to be characteristic of the science of bacteriology, which had "so persistently called our attention to [bacteria's] evil ways that we have ignored the fact that myriads of them render priceless service to man, and that life would cease to exist even for a day without their aid and co-operation."[240] The great majority of bacteria, he opined, were either necessary for life or simply harmless.

This did not mean that bacteria could not, in some situations, be pathogenic. Muthu admitted that in a small minority of cases, bacteria could be an instigating cause of tuberculosis. But the bacteria that caused the disease were not necessarily, or not only, those identified by Koch. Muthu recalled twenty-three cases in his sanatorium in which only "some form of cocci were seen in the sputum."[241] Yet, these patients exhibited every other clinical sign of tuberculosis. One case in particular initially registered as influenza, but gradually developed all of the signs of tuberculosis. But to diagnose such a case as influenza and not tuberculosis, he claimed, was a "confession that tuberculosis is not a specific disease, as other organisms can

[233] C.S. Peirce used the relationship between smoke and fire as exemplary of the indexical sign. For Peirce, smoke stands in an indexical relationship to fire, but was not for that reason the cause of fire.
[234] Muthu 1927:15
[235] Muthu 1927:17
[236] Muthu 1927:24
[237] Muthu 1927:19
[238] Muthu 1927:33
[239] Muthu 1927:45
[240] Muthu 1927:46
[241] Muthu 1927:56

cause the same pulmonary symptoms."[242] This was not a simple statement about nominalism and classification in medicine. "It does not matter by what names they are called, the fact will have to be recognized that typical clinical symptoms of pulmonary tuberculosis can be accompanied by an absence of tubercle bacilli."[243] Specificity was thrown into question at two levels: first, *Mycobacterium tuberculosis* was not the only cause of tuberculosis; a series of other microbial and non-microbial causes could produce precisely the same symptoms and clinical signs. Second, in those cases in which *Mycobacterium tuberculosis* was a causative force, it could engender a range of conditions including arthritis, lupus and meningitis.

Muthu further developed his critique of specificity through an observation: "In one of my sanatorium cases," he wrote, "pneumococci were present in the sputum for several months and were gradually replaced by tubercle bacilli."[244] What could account for this phenomenon?

Drawing upon laboratory work being performed by Charlotte Young on bacterial cultures, Muthu argued for a theory of microbial mutation. "In the process of evolution," he maintained, bacteria "have acquired new characters by an alteration in their environment. In fact, all the characters of bacteria . . . can be more or less modified or destroyed by a change of environment."[245] In Young's laboratory, the virulence of various bacteria had been altered through adjustments in temperature, exposure to light, and changes to the culture medium. In itself, this finding was not exceedingly controversial. But Muthu built on Young's findings to argue that bacteria were not inherently virulent. Instead, it was the "environment that gives them every character they possess."[246] Bacteria were for Muthu generally benign, rendered pathogenic and pathological through their presence in a pathogenic environment.

Muthu further argued that "no single property of bacteria can be regarded as specific . . . they adapt themselves to the surrounding in which they are placed."[247] He declared that microbes were beings of the "lowest in the order of life," and could therefore have "little or no personality."[248] As such, they had no innate or specific qualities. Not only virulence, but morphology, were subject to environmental pressures.

This was the point at which Muthu's claims presented as controversial to his medical colleagues. Muthu cited with approval the work of Young, who reportedly transformed cocci into *Mycobacterium tuberculosis* in a laboratory setting, as well as the work of Maher, who turned *Mycobacterium tuberculosis* back into cocci.[249] These acts of scientific transubstantiation posed a threat to the very core of Koch's postulates about specificity. Muthu, Maher and Young, as well as Koch's former student Ferdinand Hueppe, were making use of Koch's own laboratory-based techniques of bacteriology to argue that microbes were ontologically unstable. "If virulent organisms can become avirulent, and avirulent can become virulent, or if cocci can be transformed into bacilli, and *vice versa*, there can be no stability," Muthu wrote.[250] "If the stability and specificity of bacteria become untenable, the very foundations of bacteriology are assailed."[251]

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[242] Muthu 1927:57
[243] Muthu 1927:68
[244] Muthu 1922:740
[245] Muthu 1927:46
[246] Muthu 1927:50
[247] Muthu 1927:50
[248] Muthu 1927:51
[249] Muthu 1927:51
[250] Muthu 1927:49
[251] Muthu 1927:49

Analogizing the culture medium in the laboratory to the human body in its environment, Muthu contended that microbes only became pathological and pathogenic inside of an already diseased body. As Muthu put it, "If we do not know how *Tubercle bacilli* get into the body, it is perhaps because in the majority of cases they do not enter from the outside at all, but are formed within the body."[252] In other words, bacteria were not only mutated forms of benign microbes, but actually mutated forms of body cells. In making what was perhaps his most controversial claim, Muthu waded into the half-century old debate between Antoine Béchamp and Louis Pasteur. Béchamp had insisted against Pasteur that entities called microzymas composed the body. These microzymas, which were the basic building blocks of the body, were inherently unstable. A body that lacked sufficient powers of resistance, when exposed for an extended period of time to a pathogenic environment, itself became a pathogenic environment. "Morbid processes produced in the body by impaired nutrition and metabolism favour the development of pathogenic organisms which therefore follow and do not make pathological conditions."[253] The body itself became a culture medium, providing an environment conducive to the transformation of benign cells into pathogenic bacteria. These pathogenic bacteria were for Muthu a product of disease, not its cause.

As Muthu understood it, cells contained with the pathogenic environment of the body began to mutate into saphrophytes, organisms that derive their nourishment from dead matter. As the bodily environment became increasingly toxic, the cells of the body could not adapt. As support for this view, Muthu cited the cellular pathologist Rudolph Virchow, who declared that "Life is maintained by a continuous adjustment to varying conditions of its surrounding."[254] If life is characterized by this capacity for adjustment, the pathogenic body overcame the vitality of its own cells. In their efforts to adapt, these cells became pathogenic. As shown in the following figure that Muthu borrowed from the work of Charlotte Young, the transformation of a leukocyte (a white blood cell) into a bacillus was conceived of as occurring through a series of intermediate

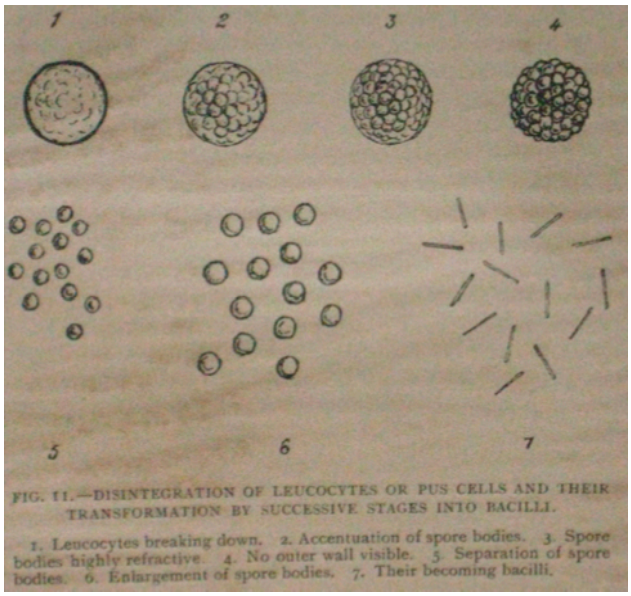

FIG. 11.—DISINTEGRATION OF LEUCOCYTES OR PUS CELLS AND THEIR TRANSFORMATION BY SUCCESSIVE STAGES INTO BACILLI.

1. Leucocytes breaking down. 2. Accentuation of spore bodies. 3. Spore bodies highly refractive. 4. No outer wall visible. 5. Separation of spore bodies. 6. Enlargement of spore bodies. 7. Their becoming bacilli.

Mutation from body cell to bacillus

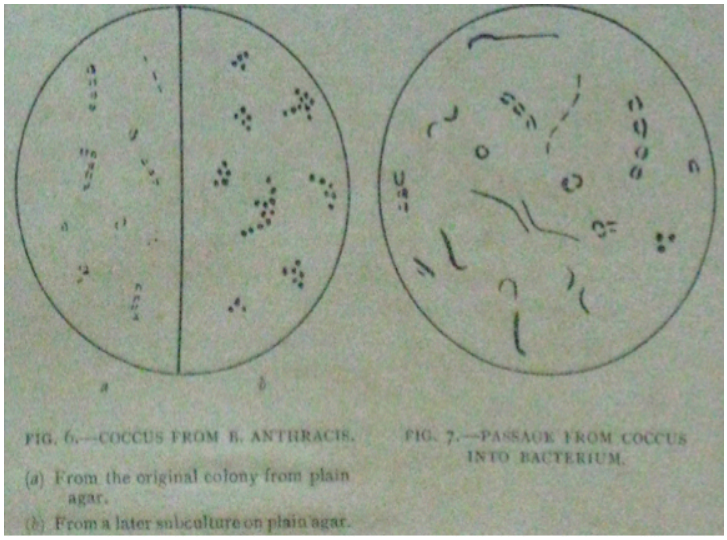
FIG. 6.—COCCUS FROM B. ANTHRACIS.

(*a*) From the original colony from plain agar.

(*b*) From a later subculture on plain agar.

FIG. 7.—PASSAGE FROM COCCUS INTO BACTERIUM.

Bacterial mutations in culture media

[252] Muthu 1922:168
[253] Muthu 1927:13
[254] Muthu 1922:176

forms. Mutation was not just a movement from health to pathology – rather, life itself consisted of continuous mutation or adjustment.

Within Muthu's framework, bacteria were downgraded from the status of necessary cause. In a small number of cases, pathogenic bacteria could be a contributing factor for disease. Just as importantly, Muthu insisted that bacteria were only a weak indexical sign of disease. The presence of bacteria was perhaps a strong index of the diminished vitality of the body, but not of the actual manifestation of disease. For Muthu, the scientist working in the tradition of Koch was inclined to "see infection in every germ and disease in every abnormality, because he surveys life's processes from the artificial surroundings of a laboratory, and judges a living man from the findings of a microscope."[255] Muthu cautioned against this obsessive search for microbes, relating what a patient had once asked him: "I eat well, I sleep well, I feel well, what is this t.b. you are searching for?"[256] Tuberculosis, and illness more generally, were for Muthu much more than the presence or absence of bacteria. Muthu noted that he regularly discharged patients whose sputum harbored bacteria, but that he had also had patients who had never exhibited bacteria in their sputum throughout their entire course of treatment.

The human, he argued, was "more than microbes," and the world itself was "built on larger scale than for microbes."[257] Koch's bacteriological methods were focused at the wrong scale of analysis to produce the kind of knowledge proper to humans and disease, Muthu contended. Such methods and the conclusions wrought through their use depended upon mechanistic understandings of the body, illness and life itself. At the same time, Muthu and his like-minded associates utilized microscopy and culturing in an effort to undermine those very techniques associated with the laboratory. As Muthu put it, "Many of Koch's postulates, which were once the causal test of specific organisms, have become untenable by the light of modern facts, as no single property can be considered specific or constant."[258]

On the causes of evil

In contrast to the condemnatory moralizing discourse of bacteriology, Muthu painted *Mycobacterium tuberculosis* as a victim of its human host. He wrote that the "Tubercle bacillus take their virulence for the soil and are poisoned themselves through it."[259] Muthu drew a moral parallel between the bacillus-as-victim and the human sufferer: "We argue that micro-organisms are not born pathogenic to hurt man, because we believe that man is not born to evil and to sin."[260] Writing against Koch's method of cure by tuberculin, Muthu noted that "the evil of bacterial germs cannot be destroyed by injecting more germs, because we know that evil cannot be exorcised by evil."[261] Humans and microbes, the highest and lowest forms of life within Muthu's vision of the great chain of being, were not born to evil because life itself is not evil. If cells "have no inherent stability or specificity apart from their surroundings," then evil for Muthu was a biomoral production, a product of a pathogenic environment acting upon a body acting upon a cell.[262] "Man himself provides the changing conditions of the environment to the micro-

[255] Muthu 1927:72
[256] Muthu 1927:68
[257] Muthu 1927:73
[258] Muthu 1927:49
[259] Muthu 1922:67
[260] Muthu 1922:140
[261] Muthu 1922:140-1
[262] Muthu 1922:50; I borrow the language of biomorality from Marriott (1976), as well as in its development in relation to Gandhi's body in Alter (2000). Given Muthu's relationship with Gandhi, this connection seems to be

organisms."[263] It was turtles all the way down, a series of nested environments in which the container conditioned what it contained.

Understood in this fashion, causality could not be understood simply in terms of individual instigating agents that produced the constellation of symptoms and signs that composed tuberculosis. "We have made too much of microbes and too little of man in the causation of tuberculosis, which more truly lies within the body than outside."[264] In declaring that causation was more internal to the body than external, Muthu was writing against an infectious theory of disease, the idea that a unique causative agent penetrates the body and incites disease. At the same time, Muthu did not want to isolate the body and close it off. Rather, he was concerned with understanding how in particular the body was both open to and part of the world. "It is man," Muthu wrote, "that through his environment speak the last word in the causation."[265]

Muthu admitted however that there was much uncertainty about the ontological status and cause of tuberculosis. "Tuberculosis is not a definite entity. It is a blood dyscrasia, a deranged metabolic process which at first is physiological and temporary . . . but which if allowed to persist becomes pathological when it manifests clinical symptoms"[266] In spite of the indefiniteness of tuberculosis as a disease entity, the question of etiology was for Muthu unnecessarily muddled. "Much of the confusion, the uncertainty, and the vacillation that exist at the present time in the fight against tuberculosis is due to the profession in not having a clear conviction as to the etiology of the disease."[267] Muthu felt that this uncertainty emerged from an attempt to square two different etiological visions that were better kept separate. Koch and his followers were of a school of thought that focused on specific causes – bacteria – that caused specific conditions – like tuberculosis – by means of infection or contagion. The other school, of which Muthu was a firm adherent, drew upon the metaphor of the soil and the seed. The soil was understood to be the body's constitution or vital power. The seed was conceived of in terms of bacteria. Muthu leaned heavily on the soil, dismissing the causative force of the bacterial seed. While Muthu felt that the contagionist school of thought had opened up some interesting questions and provided a stepping stone for the advance of science, he insisted that this sort of thinking was fundamentally flawed. "Moderates," he claimed, believed that "tubercle bacilli get implanted in a soil already weakened by poor and insanitary conditions."[268] This was the view espoused by Lankester and Sprawson. For Muthu, this intermediate position was both intellectually weak and practically useless. "Either tuberculosis is a disease caused from beginning to end by tubercle bacillus, or it is pre-eminently a constitutional disease."[269] He refused the possibility that scientists could "have it both ways."[270]

As he had already explicated through his discussion of the mutable character of bacteria, and the lack of bacteria in many cases, a specific and singular cause of disease understood in

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well-suited. The historian Projit Mukharji has pointed out that the focus on "biomorality" instead of what Foucault called "biopolitics" is in part a response to the limitations of Foucault's thought in the face of South Asian forms of subjectivity (2011:24-5). Here, the biomoral also serves to diminish the hard line between biology and morality, between science and philosophy, as well as to consider morality and the question of evil beyond the human.

[263] Muthu 1927:49
[264] Muthu 1927:13
[265] Muthu 1927:13
[266] Muthu 1927:13
[267] Muthu 1927:14
[268] Muthu 1927:14
[269] Muthu 1927:14
[270] Muthu 1927:14

terms of the microbe was untenable. For Muthu, the attempt to combine these competing visions resulted from a misinterpretation of shared observations. In his early years in north London, Muthu had worked extensively with working-class families. He noted that when these families faced financial hardships, they tended to move into smaller homes. As they relocated into these smaller spaces, family members were more likely to develop symptoms of tuberculosis. As a parallel to the conditions of the Indian zenana, Muthu noted that many medical professionals had mischaracterized this condition of cramped living as conducive to greater contagion. By contrast, Muthu argued that the important factor was not the greater density of bacteria circulating in a smaller space, but rather the very fact of poverty. The seed, understood in terms of bacteria, did not "create the soil."[271] Families moved to smaller homes because they had less money. When they had less money, the amount and quality of food that they consumed lessened. Smaller spaces also meant less exposure to fresh air. Poverty as it played out through diet and decreased fresh air was the actual originating cause, not increased microbial matter.

Muthu outlined a similar logic of tuberculosis in India as well. Crowding and enclosure were not only concerns in the zenana, but also in cities more generally. "Crowded Bombay presented a higher death rate from tuberculosis than Bangalore with its garden cities."[272] "Even middle-class and humbler Anglo-Indians" he wrote, crammed together "under the joint-family system . . . find their accommodations more and more limited."[273] In regard to India, he wrote that:

> There is no country in the world where poverty and destitution are so appalling as in India, where millions of people are living at the very margin of subsistence . . . besides the tropical heat and dust, overcrowding and insanitation, malaria and other continued fevers – all of which fan the flame of the disease – the social customs and prejudices of centuries, such as the caste system, the purdah system, and child marriage, have helped to undermine the vitality of the people.[274]

At first glance, Muthu's list of contributing factors or "causes" is exceedingly long: not only overcrowding, but lack of sanitation, poverty, heat, dust, malaria, the caste system, purdah and child marriage. Not only lack, but also excess, contributed to tuberculosis – too much food or food that was too rich, as well as a luxurious or sedentary lifestyle, could lead to tuberculosis. "Civilised man," Muthu wrote, "in his pursuit of wealth and comfort, spent half his energy in letting loose the demon of disease, and the other half in trying to catch him."[275] Behind this seemingly interminable roll call of social and environmental ills was a fundamental concern with vitality. Muthu's vitalism worked to "comprehend and synthesize the range of complicating factors" that he described in his writings.[276] Different parts of the world and different groups of people might confront quite different environments, but what unified all of these causal factors was that they worked to deplete vitality. Lack of vitality was in this sense the most proximate cause to tuberculosis. At the same time, tuberculosis itself was merely the outward expression – a constellation of signs – indexing this diminished vitality, which was in a sense the more

[271] Muthu 1927:57
[272] Muthu 1923:418
[273] Muthu 1923b:119
[274] Muthu 1927:23
[275] Muthu 1912:446
[276] Gordon 2007:65

foundational disease that Muthu aimed to address through social reform, garden colonies and sanatoria.

Muthu's task then was to diagnose the specific factors in a given place or among a given people that contributed to the diminishment of vitality. These causal chains stretched across space, from the devitalized body through the social and the environmental, but also across time, incorporating inherited custom and the clash of civilizations. Beyond his diagnosis of India's poverty, overcrowding and lack of sanitation, Muthu related the etiology of tuberculosis to the persistence of tradition and the onset of modernity. The zenana and purdah were two primary examples of pathogenic tradition or customary practice that persisted into Muthu's moment to deleterious effect. For Muthu, these practices and the concomitant loss of freedom for women was the result of the Muslim conquest of Hindu India. Along with the line he drew between the Hindu golden age and the Muslim invasion, Muthu constructed another division, between the primitive state of nature and colonial modernity.

"Tuberculosis is intimately connected with civilized life," he wrote.[277] Civilization, understood in terms of colonial modernity and processes of industrialization, had deprived the colonial subject of "the immunity that he enjoyed while he lived in the open air."[278] Having experienced life in both England and India, and having traveled to mainland Europe and the United States, Muthu felt emboldened to make the claim that "where there was no civilization there was no tuberculosis, but as soon as the savage, living in his primitive way, adopted western civilization and western habits, consumption, cancer, and syphilis ravaged his country and destroyed his people."[279]

At first glance, it would seem that Muthu was trying to have it both ways. On one hand, he tried to locate a cause of tuberculosis in the enervating conditions of the zenana. On the other hand, he wanted to pin the blame on the arrival of western civilization in the colonies. These lines, between the traditional and the modern, between the primitive and civilized, did not just separate – they also connected. Within Muthu's grand historical narrative, it was the bringing of "Muslim custom" to Hindu lands that led to the spread of disease. Similarly, western custom had now come to India. Embellishing on the metaphor of the soil and seed, Muthu wrote that:

> Even the current idea of a virgin soil as being the cause of the rapid spread of tuberculosis among the dark races should be imputed not to an impaired physical soil, but first to a depraved moral environment, brought on by the collusion of two different standards of living and thinking.[280]

Muthu was concerned about what happened to a people's vitality when they were subjected to rapid social change. This was a serious concern among medical officials and administrators at the time, leading to a general understanding of tuberculosis as a disease of civilization.[281] To become civilized was to depart from virgin soil and undergo a necessary process of tubercularization. The spread of this disease was considered to be a necessary step on the path to modernity, the price to be paid for civilization. Arthur Lankester took a slightly different view, contending that tuberculosis in India was the result of the country being

[277] Muthu 1922:6
[278] Muthu 1922:6
[279] Muthu 1912:445-6
[280] Muthu 1922:133-4
[281] Harrison and Worboys 2002

"improperly civilized."[282]

For Muthu, rapid social change caused by a "collusion of two different standards of living and thinking" led to moral disquietude. Living in a state of nature "like children," colonized peoples were ill-prepared for the onslaught of new ideas, norms and ways of being.[283] As the physical and moral environment was reshaped under colonial rule, the colonized were ill-equipped for their new situation. Muthu's figure of the "native" bore an uncanny resemblance to his vision of the benign cell incapable of adjusting to the toxic environment of the body. The rapid rate of change created a misfit between subject bodies and the colonial environment, as well as a misfit between body cells and rapidly-changing subject bodies. Through this chain of influence, mediated by the subject body, the colonial environment acted indirectly upon the body cell.

In Muthu's history of collusions, the loss of freedom suffered by Indian women with the coming of Islam had now become the lot of men as well. Along with this loss of freedom came a diminishment of vitality. With the body, mind and soul of the colonized depleted by poverty and unceasing labor, "the nervous system becomes dulled, the thinking powers lose their brightness and activity, the brain gives way under constant dread of hunger, and the man either becomes insane or ends his unfortunate life by committing suicide."[284] Muthu understood the colonial transformation of the environment as ushering in a mechanistic mode of being, in which "factory life has turned men and women into machines" – their vitality sapped, it was only a matter of time before they were broken beyond repair.[285]

Industrial conditions were not unique to India. Prior to the establishment of his sanatorium in the Mendip Hills, Muthu had treated working-class people in London. His experiences led him to the conclusion that there was a "general resemblance between poverty and sickness," and that "tuberculosis is more an economic than an infectious disease."[286] In England, poverty worked through nutritional deficiencies, overcrowding, poor sanitation and a lack of rest to bring forth a tuberculous condition.

Muthu drew an explicit parallel between early twentieth-century India and England during the industrial revolution. At the same time, what distinguished India and the other colonies from England was the rapid transformation of the environment and ways of living. The situation was exacerbated because colonial subject populations were unprepared for this new way of life. Robbed "of their freedom," tempted by "rifles and drink" and forced to endure the "speculators, planters, gold-diggers, convicts, and the refuse of European communities," the "moral habits" of subject peoples were not "strong enough to stand the strain of such a violent change of environment."[287] Muthu wrote particularly of Parsees and Indian Christians (himself included) who had adopted Western diets and sartorial standards. Muthu wrote that:

> The contact of the East with the West has caused great social, economic, industrial, moral, and spiritual upheavals, as seen in the growth of towns and cities, the expansion of trade and commerce, the depopulation of villages, decay of home industries, migration in towns, high rents and dear food, overcrowding

[282] Harrison and Worboys 2002:115
[283] Muthu 1922:134
[284] Muthu 1905:939
[285] Muthu 1922:7
[286] Muthu 1922:82
[287] Muthu 1922:133

and insanitation, poverty, want, intemperance, and degeneration.[288]

Taken together, these various elements had "lowered the vital powers of the people and widely opened the door to tuberculosis."[289] What was at stake was the capacity to adapt. The environment was for Muthu in a constant state of flux, and life itself was characterized in terms of a constant adaptation to this variation: "There is an inherent law of life by which an organism adjusts itself to various environments."[290] Both healthy and diseased states were a part of this same process of adjustment, a series of "continuous adaptations to maintain harmony and equilibrium."[291] In the early stages of disease, symptoms were actually indexical of continued vitality and resistance. For Muthu, life itself was "manifested by resistance."[292] Tuberculosis, a well as other diseases, was "an adaption to new conditions."[293]

If the sanatorium was governed by the logic of the ship and its captain, Muthu explained the relationship between healthy and diseased states by recourse to a metaphor of a general waging war: "If health can be understood in terms of the ordinary plan of a war campaign which a general follows in the course of war, disease can be likened to his alternate plan which he keeps in this pocket to be used should a crisis arise and the first plan prove unsuccessful."[294] This back-up plan – disease – was still understood to be a route to victory, and made use of the same resources but in a different arrangement. "The symptoms which arise in disease are part of the curative process of nature, and tuberculosis, which in its first phase can be considered physiological, carries with it the cure of the disease in its fever, inflammation, caseation, fibrosis, etc."[295] The logic of the sanatorium was to bolster the vitality of the body in its war efforts, allowing the body to move through a temporary state of disease to return to a healthy condition – a kind of auto-restoration mediated by nature and the sanatorium.

For Muthu, it was only when the body "fails to adjust itself to abnormal conditions that disease takes a pathological character."[296] A failure to adjust often occurred when change was too extreme, or happened too quickly, as he envisioned was the case in the colonies.[297] But failure also occurred "when the stress of war is continued."[298] In such a state of permanent war in which deep and lasting structural changes took place, "the functional adaptive changes pass on to structural changes, and structural to more or less permanent organic changes."[299] When the powers of resistance were depleted, but pathogenic conditions continue unabated, the body was

[288] Muthu 1922:135
[289] Muthu 1922:135
[290] Muthu 1927:110
[291] Muthu 1927:110
[292] Muthu 1922:9
[293] Muthu 1927:100
[294] Muthu 1927:110-11
[295] Muthu 1927:111
[296] Muthu 1922:116
[297] Muthu's concern about rapid social change has an analogue in Henry Louis Maine's political theory. Maine was a colonial administrator in India and his thought was undoubtedly informed by his experience there. For more on Maine's views on social change in India, see Mantena 2010. More generally, the years following the mutiny of 1857 witnessed a more conservative approach to introducing change in India on the part of the colonial government, at least in regards to social and religious custom. At the same time, the sanctioning and stabilizing of certain practices as "custom" undoubtedly produced much change despite the colonial government's avowed conservatism. See for example Dirks 2001 on the colonial production of caste.
[298] Muthu 1927:111
[299] Muthu 1927:111

left unmoored, without an anchor. Colonial modernity not only created a pathogenic situation, but also ensured that the resources necessary to adjust to that situation were unavailable. It was in this state of permanent war – which for Muthu was an analogy for colonial rule - that "disease is ushered in, which is an expression that Nature has failed in her strenuous efforts to maintain an organic order."[300]

For Muthu, the body was open to the world through life, air and morality, but not through bacteria. This openness and adjustment to the environment was the very condition of life. But when the environment became pathogenic, as under rapid industrialization and colonial rule, the body failed to adjust. Openness to the world became openness to tuberculosis, devitalization, and death. For Muthu, colonialism was not just about new rulers, new laws and new customs, but about a new environment that engendered evil at the level of human and microbial biologies.

Conclusion: an Alternative Science

In July of 1928, just a few months after Muthu had inaugurated his sanatorium at Tambaram, his wife Margaret passed away in England. Muthu would not be there for her last days, but her death seems to have motivated him to return to England as soon as possible. In 1930, he requested that the Madras government purchase his sanatorium so that he could return to Britain. Although the general weight of colonial government opinion was against involvement in sanatoriums, the Madras government eventually took over the operation of Tambaram in 1937. Muthu seems to have lost a good deal of money on his Tambaram experiment, leading him to ask his son Philip Leslie – who had become a farmer in England – to make good on a loan that Muthu had made him sometime previously. Philip Leslie sold his farm to repay the loan, and became a bartender, likely to the chagrin of his tee-totaling father.

In the last decade of his life, Muthu turned to more explicitly spiritual and historical matters, publishing his book on the antiquity of Indian medicine and penning an essay on the relationship between science and religion. These later writings seemed to have brought Muthu much international attention. In 1930, his books had just gone into print in the United States, and he went on a speaking tour promoting his ideas and his work. On September 27 of that year, at the age of 66, Muthu boarded the steamship Berengaria in Southampton headed to New York City. Muthu seems to have been something of a sensation among various esoteric organizations, such as the Threefold Society and the Charaka Society, giving lectures on the history of surgery and medicine in ancient India, Gandhi's health, the freedom movement, and the status of Indian women.

On his return to England, Muthu married his second wife Winifred E. Cox in 1931, who was thirteen years his junior. Cox had likely been a nurse at one of Muthu's sanatoriums. In October of 1936, Muthu and Cox departed from Liverpool on the steamship California, headed to Bombay. At the time of his departure, Muthu was 72 years old. The ship's records indicate that he intended to return to England, but it is quite possible that he died while visiting one of his daughters in Bangalore.

In his writings on tuberculosis and the open-air movement, Muthu drew upon his experience diagnosing and treating tuberculosis in England and India to write against a mechanistic view of life, health and disease. For Muthu, tuberculosis was a disease discerned through the reading of signs. But tuberculosis itself was a sign of a pathogenic body – the body of the laborer, the women in the zenana, and the colonized subject - and a pathogenic environment wrought by colonialism and industrialization.

[300] Muthu 1927:111

For Muthu, the body was part of an open cosmology, in which parts and wholes were both conditioned by and paralleled one another. Although the same phenomena of adjustment might occur inside or outside of the body, the particular combination of phenomena that occurred within the body led to life – and life could not be reduced to biochemical mechanisms. The openness of the body made life possible, while simultaneously posing a threat to life when confronted by the adverse and unrelenting conditions of modernity.

Muthu's alternative science, a science of life that reached its heights in the early twentieth century, became increasingly incomprehensible and marginalized as the century trudged forward.[301] Tambaram Sanatorium, which has continued on under government control, might be the only remnant of Muthu's legacy. In 1938, Major-General Sir Frank Connor of the IMS, a surgeon-general with the Government of Madras, announced that "a tuberculosis clinic on up-to-date lines has been started for the examination of contacts as an adjunct to the Tuberculosis Institute, and the Government has taken over Dr. Muthu's sanatorium at Tambaram with the view of providing more accommodation for such cases."[302] Despite this addition, he noted that there was further "need of some thousands more beds for tuberculosis cases in hospitals, sanatoria, and clinics."[303] At the same time, there had been some movement forward in the development of radiological units for diagnostic work: "two new departments were opened in 1935, and more are being established, while several of the older ones are being brought up to date by the addition of new equipment."[304]

In 1946, Tambaram was upgraded with 750 beds. Forty years later, it was renamed as the Government Hospital of Thoracic Medicine, although most people would continue to refer to it as Tambaram Sanatorium. In 1993, Tambaram became the first public facility in India to admit HIV-positive patients. As of 2012, it was the biggest HIV hospital in Asia. Separate wards are dedicated for HIV, TB-HIV and various forms of multiple drug-resistant tuberculosis. In the on-call room, where the doctors take their breaks, a framed picture of Robert Koch hangs on the wall. Muthu is remembered as the founder of Tambaram, but, for better or worse, his vision has been forgotten.

[301] On the idea of an "alternative science," see Uberoi 1978, 1984, 2002. Uberoi focused in particular on the cosmologies of Goethe and Paracelsus. He privileged subterranean currents in the history of science in Europe, in an effort to rethink received conceptions of science and reason, as well as to undermine the assumption that the Other of Europe is necessary external to its geographical boundaries. See also Nandy 2001.
[302] Connor 1938:480
[303] Connor 1938:480
[304] Connor 1938:480

AN ELEGY FOR KAMALA

Illness and the nation, death and life, politics and kinship, meet in what has been broadly understood to be Jawaharlal Nehru's attempt to write the Indian nation into existence, and therefore into history – a task that seems to have been undertaken by the literary elite of every generation of Indian nationalists.[305] While Nehru openly conceded that nationalism suffered from a bad reputation, as a parochial resistance to the emerging internationalism of the time, he insisted on the inevitability, necessity and healthiness of nationalism in India.

Nehru composed his *Discovery of India* over a period of five months in 1944, while imprisoned at Ahmadnagar Fort. His incarceration was iconic of the status of the Indian people under British colonial rule, a bondage that moved Indian colonial subjects to nationalism, to a recognition of the historical roots of the self, to an assumption of a national history, against the denigrating historiographic maneuvers of the British overlords. A country of such individuality and heritage, he wrote in the *Discovery*, could not continue indefinitely in such a condition. For colonial and nationalist historians, both history *and* a historical sensibility were necessary precursors to self-rule. For Nehru, what mattered was that the people experienced a relationship to history in the present, a living relationship and not merely a moribund knowledge of cold facts severed from the contemporary moment by the deep gulf of time.

No less than Gandhi, Nehru's writing is infused with a vitalism that informs both his philosophy of history and the state. Despite his avowed commitment to a rational, secular science, Nehru seemed to have had no trouble enrolling a metaphysical conception of life as a major player in his *Discovery*.[306] Ideas about life were central to the emergence of nationalist discourses and the philosophy of the state in eighteenth-century Europe.[307] These vitalist notions equally suffused anti-colonial rhetoric in the early twentieth century. In the *Discovery*, life "is used as a recursive, imaginative principle for re-inspiriting 'dead' forms."[308] Nehru talks about his time in prison as characterized by "an absence of feeling and sensation which might separate it from the dead past."[309] The past is dead only insofar as it remains merely in the past, a kind of "art for art's sake, without the passion and the urge to action which are the very stuff of life."[310]

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[305] The writing of history has been central to many nationalist projects across South Asia. For example, Daniel (1996) writes of Sinhala and Tamil modes of remembering and making present the past in contemporary Sri Lanka; Hanson (1999) illustrates how the past is painted saffron in the effort to consolidate Hindutva renderings of the nation; Kaviraj (1995) argues that the Bengali writer Bankimchandra Chattopadhyay was among the first to articulate a distinctly Indian past for the nation, although he struggled to determine who would be included within that nation. Many of those who followed, including Nehru, had a much clearer idea of whose past they were writing.

[306] As Baishya writes, scholarly interest in Nehru's *Discovery of India* is largely invested in "the construction of a univocal persona of 'Nehru," who is then used as a marker to map the 'success' or 'failure' of the project of the Indian nation-state" (2009:29). More generally, there is a tendency to paint a much more monolithic picture of Nehru than of Gandhi, whose personality and philosophy seem to be submitted to a radically new assessment every few years. By contrast, Nehru is typically characterized as the rationalist, the liberal, the cosmopolitan, the elite, the secularist, the socialist, the modernizer, and the believer in science. Nehru the rationalist is typically pitted against Gandhi the spiritualist. This characterization is not necessarily incorrect, but it does seem limited and limiting – in particular when it comes to considering how Nehru thought about life and death in relation to the nation.

[307] See Cheah 2003

[308] Baishya 2009:30

[309] Nehru 2004:20

[310] Nehru 2004:20

Without the "vital links" between present and past, both become dead – "We become prisoners of the past and some part of its immobility sticks to us."[311]

Nehru however was not advocating a "blind idolatry of the past," which he understood to be the very reason that Indian progress had decelerated to a slow stutter.[312] Rather, he championed a process of selection, "an attempt to understand and adapt the new and harmonize it with the old, or at any rate with parts of the old which were considered worth preserving."[313] This motivating force, this "urge driving the people in a direction not wholly realized," is what Nehru called the "Indian dream."[314] Like every other nation, he wrote, there was perhaps a dream that had bound India together over the years, sometimes "vivid and full of life or sometimes reduced to the murmurings of troubled sleep."[315] It was this subterranean or perhaps subconscious vitality that Nehru wanted to draw upon, a vitality that was particular to "an old race, or rather an odd mixtures of many races," whose "racial memories go back to the dawn of history."[316] In the *Discovery of India*, Nehru searched through this history to reconnect it to the present, and to the Indian people. He wrote of wandering among the Indian people in search of this vitality, finding it often suppressed. He recounted his desire to "release" these energies and make the Indian people "feel young and vital again."[317]

Nehru's *Discovery* can be read as an attempt at delving into the past in order to bring life back to the present. It was an effort to unmake the prison house of colonialism, in which the mechanism of the state had colonized and deadened both past and present. In other words, the colonial state had muffled the connection between the Indian people and their national dream or urge. The people, once revitalized, had the power to both overthrow the dead state of the colonial government and to found a new state sutured to this lively nation.[318] Nationalism, and the writing of the history of the nation, was an effort to regain vitality for the present by reconnecting it to the past.

But what does Kamala Nehru have to do with this discovery of India, a discovery that her husband Jawaharlal seems to have made while absenting himself from her side, on his frequent journeys around the country or during his prolonged prison stays? Kamala had involved herself in the freedom struggle as a *satygrahi*, like Tagore's Chitra, Nehru tells us. "She became a symbol of Indian women," he wrote, "or of woman herself. Sometimes she grew curiously mixed up with my ideas of India, that land of ours so dear to us, with all her faults and weaknesses, so elusive and so full of mystery."[319] This curious identification led Nehru to question the substance of Kamala's very being, and his understanding of that being, as he asked: "What was Kamala?

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[311] Nehru 2004:20
[312] Nehru 2004:54
[313] Nehru 2004:54
[314] Nehru 2004:55; Following Cheah (2003), Baishya (2009) points out that Nehru's vitalism is organismic, treating the social body as a living, organic being. Nehru's "urge" or "dream" fits neatly with Johann Friedrich Blumenbach's vitalist theory of epigenesis, which posits that all living creatures possess a "particular, innate, lifelong, active, effective force (*Trieb*) that confers a determinate form, afterwards preserves it, and when this is deranged, where possible, restores it" (Blumenbach in Cheah 2003:54). Blumenbach would be a critical influence on Kant's understanding of purposiveness.
[315] Nehru 2004:55
[316] Nehru 2004:55; on the racialization of vitalist discourses, see Jones (2010).
[317] Nehru 2004:56
[318] Baishya makes a similar point: "the re-inspiriting of the *nation-form* is viewed as a panacea to the degradation engendered by colonial subjugation" (2009:30).
[319] Nehru 2004:33

Did I know her? understand her real self?"[320] Nehru seems to have envisaged Kamala as an elusive and mysterious form of *Bharat Mata*, beyond his reckoning.[321] His discovery of India, then, was an attempted discovery of Kamala, a *post mortem* to diagnose not a cause of death, but to determine the grounds for a renewed national life, a form of life that depended upon that which has been exiled from this world. I read Nehru's *Discovery of India* as an elegiac history, but also as a form of elegiac politics – a politics that acknowledged loss but maintained the hope of recovery, even after death, in and for the burgeoning Indian nation.[322] I imagine Nehru as writing an elegy for Kamala and for a forgotten national history that had to be recovered, for the sake of the free Indian state to come.[323]

Seven years before Nehru began writing about his discovery, Kamala Nehru lay dying. She had been sick for many years, alternating between periods of relative health and debilitating symptoms like loss of weight, nausea and vomiting. In 1935, her condition took a significant turn for the worse. On May 23 of that year, while her husband occupied his jail cell in Almora, Kamala set sail from Bombay following medical advice that the German environment and therapeutic institutions would prove more beneficial for her health. Just prior to her departure, Gandhi made the trip to Bombay at Kamala's request for what would prove to be their final meeting. Remarking on the two days that he spent with Kamala in Bombay, Gandhi wrote to Nehru that she seemed to have never experienced

> so much peace of mind as she seemed to enjoy then. Her faith in the benevolence of God, she said, was never so bright as then. Her mental disturbance had vanished and she did not mind what happened to her. She went to Europe because you all wished it; it seemed to be her obvious duty to do so.[324]

In a speech delivered at a Congress-run hospital renamed after Kamala, Gandhi noted that "During my last meeting with Kamala in Bombay while she was leaving for Europe for treatment, she told me that she might not come back and that I should see that the work of the hospital [at Allahbad] went on."[325] Despite Kamala's dire warnings, Gandhi expressed faith that she would recover. "When I said good-bye to her in Bombay," he wrote to Nehru," I did not feel

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[320] Nehru 2004:33

[321] Nehru was not the first to equate the Indian nation with a woman. According to Kaviraj (1995), that distinction belongs to Bankimchandra Chattopadhey, who not only was amongst the first to write the nation into existence, but also performed the operation that sutured together the nation and the feminine. For Bankim, the nation was the ultimate mother, standing above any biological mother. For Nehru, this identity seemed to rely less upon an abstract identification of the nation with the mother, and more upon the specific identity between India and Kamala, as his wife to whom he owed a debt. See also Ramaswamy (1997) on the identification of the ideal women and the Tamil community in the construction of *Tamil Thai*, the goddess of a language and the people who are incorporated within its territorial and cultural reach. In recounting a meeting with an excited crowd, Nehru recalls realizing that "*Bharat Mata*, Mother India, was essentially these millions of people, and victory to her meant victory to these people" (Nehru 2004:60).

[322] Jain (2007) writes of an "elegiac politics" as an explicit acknowledgement of the loss and the hidden costs related to cancer, in opposition to the almost festive anti-politics of cancer marathons and pink ribbon purchases that deny such losses and costs in the name of the survivor.

[323] The constitution of an "imagined community," as Anderson (1991) put it, depends not only on a shared present, but a shared past.

[324] Gandhi's Collected Works Vol. 68, p. 46

[325] Speech at Kamala Nehru Memorial Hospital, Allahbad, November 19, 1939, published in Gandhi's Collected Works Vol. 77, p. 116

that we were parting for all time, and I naturally said: 'We are going to meet again in a year's time' . . . I claim to have that hope still."[326]

Kamala took up residence in a sanatorium in the Black Forest of Germany, the birthplace of the international open-air movement. Gandhi had written to Nehru six years earlier registering his disapproval of the idea that Kamala be removed from the Indian climate:

> I wish you will not listen to doctors when they object to the Indian sun. You have heard of Dr. Muthu. Revashankerbhai's son Dhiru was suffering from tuberculosis of the bone. After having tried sanatorium cure in Solon and all the doctors he could get hold of in Bombay, he sent for Dr. Muthu, paid him a fee of thousand rupees per day. Dr. Muthu had no better advice to offer than to prescribe open air, light food and sun treatment. The affected bone was discharging some time one pound of pus per day. The affected bone had to be exposed to the sun every morning for a few hours and he had to lie in the open air the whole day long. He was not even sent to a sanatorium. He is now completely cured. European sun may be better, but the Indian rival is by no means to be despised.[327]

Kamala had spent years visited doctors and various tuberculosis sanatoriums in Bombay and Calcutta, hoping for relief. When she finally left for Germany, her husband, the future first prime minister of the future India nation, was serving one of his many prison terms at Almora. In August of the same year, just a few months after Kamala had set sail, Gandhi received an express cable from Germany informing of him of a deterioration in her health. The European sun had not proved to be so beneficial after all. Gandhi immediately sent a telegram to the Viceroy, the Governors of Bengal and the United Provinces apprising them of Kamala's situation:

> "CONDITION SERIOUS OWING TO PERSISTENT NAUSEA AND VOMITING." IN VIEW OF THIS SERIOUS NEWS MAY I APPEAL FOR PANDIT JAWAHARLAL NEHRU'S UNCONDITIONAL DISCHARGE ENABLING HIM IF AT ALL POSSIBLE TO CATCH DUTCH AIR MAIL FLYING NEXT TUESDAY?[328]

The colonial government granted Nehru a reprieve from prison on account of Kamala's worsening state. Nehru had been hesitant to accept special treatment during his prison stint, but Kamala's condition was serious enough to warrant an exception to his democratic morality. He left Almora on September 3, 1935, boarding a ship from Allahbad to Germany the very next day. In his *Discovery of India*, he describes how he flew to her, crossing the distance between Almora and Badenweiler in just five days. He writes that Kamala's doctors gave him hope: "I imagined that she was improving and that if she could only survive that crisis she might get well."[329]

You can almost imagine Nehru in the Black Forest, trudging daily from his pension to the sanatorium, to sit at his wife's side, to speak with her gently, to read aloud to her from Pearl S. Buck's nostalgic vision of *The Good Earth,* and to reminisce about the past. Nehru, who was writing of this moment from another in the future, during his confinement in Ahmadnagar Fort,

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[326] Gandhi's Collected Works Vol. 68, p. 106
[327] Gandhi's Collected Works Vol. 44, p. 55, January 26, 1929
[328] Gandhi's Collected Works Vol. 67, p. 374, Telegram to Viceroy, August 30, 1935
[329] Nehru 2004:28

drifts from the scene of the sanatorium to an even earlier moment, the time immediately following their marriage. Driven by nationalist passion, for love of liberty, he writes that he devoted the sum of his energies to the cause, the people around him merely "substantial shadows" in comparison to his Herculean task. Yet, he never forgot Kamala. He returned to her "again and again as a sure haven."[330]

He drew strength from her, to be channeled through him into the making of the nation: "What indeed could I have done," he asked plaintively, "if she had not been there to comfort me and give me strength, and thus enable me to re-charge the exhausted battery of my mind and body?"[331] In a language antithetical to the idiom of Nehruvian modernism, we might say she was his *shakti* – his energy - and through him, *shakti* became *desh seva* – service to the nation.[332] Nehru realized too late that Kamala was tragically finite, that her energy had its limits, as he sat alongside her deathbed.

As Nehru watched, Kamala went from crisis to crisis, but then would suddenly show signs of improvement, renewing hopes of recovery. Through a steady correspondence, Nehru updated Gandhi on Kamala's condition. Gandhi counseled Nehru to remain by her side, that his presence there was "an elixir of life to Kamala."[333] "We have to be prepared for ups and downs in Kamala's health," he wrote to Nehru. [334] "I marvel at the resisting power Kamala is showing and so long as she has got this tremendous reserve of strength and will, we can hope for the best."[335]

At the same time, Gandhi encouraged Nehru to accept re-election to the post of President of the Indian National Congress. When he won the post *in absentia*, Gandhi asked him to return to India as soon as Kamala showed "distinct signs of improvement."[336] Nehru was torn between the call of the nation and the call of his wife, or more precisely, the call of her illness. Kamala and her doctor initially support Nehru's decision to return, but then Kamala showed signs of uncertainty – "Kamala did not at all like the idea of my leaving her. And yet she would not ask me to change my plans."[337] To Nehru, it seemed that "those who are ill, and especially those who have the misfortune to stay in a sanatorium, seem to develop a sixth sense which tells them much that is sought to be hid from them."[338] But it was not just that the sanatorium-ridden had knowledge of what was concealed from them. They also seemed to have knowledge that they hid from the healthy. Kamala did not need to be told of her fate, but Nehru did.

A few days before his impending flight, Kamala's doctor asked him to postpone his flight for about ten days. He wrote that:

> As these last days went by a subtle change seemed to come over Kamala. The physical condition was much the same, so far as we could see, but her mind appeared to pay less attention to her physical environment. She would tell me that

[330] Nehru 2004:30
[331] Nehru 2004:30
[332] This kind of language remains central to contemporary politics in India. See for example Copeman (2009) on blood donation as a giving of s*hakti* in the service (*seva*) of the Indian nation. Gandhi himself made liberal use of this language.
[333] Gandhi's Collected Works Vol. 67, p. 457, written on September 22, 1935
[334] Gandhi's Collected Works Vol. 68, p. 106
[335] Gandhi's Collected Works Vol. 68, p. 106
[336] Gandhi's Collected Works Vol. 68, p. 45
[337] Nehru 2004:36
[338] Nehru 2004:35

someone was calling her, or that she saw some figure or shape enter the room where I saw none.[339]

On February 28, 1936, Kamala succumbed to the call of this spectral presence, making it possible for Nehru to heed the call of Congress. After the cremation of Kamala's body, Nehru returned to India with his wife's remains and scattered them in the Ganga, alongside his daughter Indira. This metonymic movement, from the ashes of the body to the dust of the nation, was complete.

Reflecting on Kamala's life and death, Nehru wrote that he held himself accountable for his failure to make good on Kamala's sacrifice. "I had taken from her what she gave me. What had I given her in exchange during these early years? I had failed evidently and, possibly, she carried the deep impress of those days upon her."[340] She gave her energies, and he took them. But he in turn gave them to the emerging and antique nation. Nehru confessed to having drained Kamala of life, leaving her devitalized and near death. Not only stricken by tuberculosis, Kamala was also stricken by and for the nation and its history.

As medical professionals of the early twentieth century often remarked, tuberculosis was the price of civilization. For Nehru, Kamala seems to have been the price to be paid for the modern Indian nation. But in her death, and through his writing, he could return what he had taken, as he wrote (for) the nation, to recover Kamala through the recovery of the nation. In identifying Kamala Nehru with India, what was taken in life could be returned in death. For Nehru, death wore many guises: the prison, the colonial state, the unconnected past, the isolated present, Kamala. But through her connection with the nation, a connection that was physically incarnated in the return of her ashes to India, Kamala's death signaled the possibility of a new becoming, of a nation reconnected to its past, and to its vitality. As Gandhi wrote in a letter to Nehru dated March 9, 1936, shortly after her death: "So you return leaving Kamala for ever in Europe. And yet her spirit was never out of India and will always be your precious treasure as it will be of many of us."[341]

The Discovery of India represents more than just the writing of a nation. It is also an act of founding based on an attempt to remediate loss through an impossible exchange.[342] Nehru's nation was founded on a loss, and on an effort to make good that loss. Words given to the dead, in the form of the revitalized nation, Nehru's elegiac poetics and politics establish the nation not through the death of the father (Gandhi, or "*Bapu*"), but through the death of his wife (Kamala).[343] As Gandhi put it, Kamala "was going to Europe in search of health. The visit proved to be a search of death."[344]

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[339] Nehru 2004:36
[340] Nehru 2004:30
[341] Gandhi's Collected Works Vol. 68, P. 287
[342] Derrida writes that "The difference between a gift and every other operation of pure and simple exchange is that the gift gives time." He further notes that "The thing must not be restituted *immediately and right* away. There must be time, it must last, there must be waiting—without forgetting [*l'attente-sans oubli*]" (1994:41). Nehru's elegiac poetics are a form of remembering, a remembering that makes possible the future gift of the nation. Kamala's gift is the gift of time, but her morbid condition renders her untimely, like the gift, which is "not *in* time" (1994:41), as Derrida tells us.
[343] Gandhi was given the honorific "Bapu," or father, and he continues to be celebrated as the father of the nation.
[344] Gandhi's Collected Works Vol. 77, p. 88, first printed in *Harijan* on November 25, 1939

CURES

Endings lacking Finality[345]

What does it mean to be cured?

If Kamala Nehru had lived for another decade, she would have witnessed her husband rise to power as the first prime minister of India. If she had lived long enough, she might have been among the first to experience a new way of treating tuberculosis – antibiotics. If Kamala had survived the sanatorium nestled in the Black Forest of Germany, she would have watched as new drugs became available on the market and sanatoriums the world over shut their doors. And maybe she would have been cured.

If Kamala had survived, she might have been around long enough for her chronic condition to become curable. But then, if she had continued to live, she might have experienced the return of her chronic condition. In the history of medicine, there is a powerful idea that an epidemiological transition began during the mid-to-late nineteenth century.[346] Whether due to advances in medical technology (the rise of bacteriology, new diagnostic tools, the development of antibiotics), or to a more general increase in living standards (the emergence of public health and hygiene programs administered on a national and international level), many historians of medicine and public health assert that there was a shift in how people were getting sick and dying. Infectious or communicable diseases decreased, and chronic or lifestyle illnesses increased.

Recently, the thesis of an epidemiological transition has been subject to criticism and heated debate.[347] Drawing upon historical epidemiology and historical demography of Britain, France and, to a lesser extent, the United States, scholars on both sides of the argument have attempted to disaggregate causes of death in a time and place far removed from contemporary notions of infection, chronicity and disease more generally. Putting aside the question of the empirical veracity of the epidemiological transition, this thesis remains "hidebound to a narrative of progress and modernization."[348] Similar to the earlier idea that tubercularization was a necessary phase of development, the price to be paid for civilization, the thesis of transition seems to imply that the movement from infectious to chronic conditions is a sign of progress. In the last few decades, the Indian population has been understood to be paying the price for this progress.[349]

The debate about the epidemiological transition is closely tied to debates about the *real* cause of the apparent decline of tuberculosis from the mid-to-late nineteenth century onwards. The now classic McKeown thesis posits that the decline of tuberculosis (in Europe and America) was the result of improved standards of living, and that this decline can be statistically demonstrated from the 1880s onwards.[350] The role of Koch's germ theory, as well as of the

[345] The inspiration for the idea of an "ending without finality" comes from Naisargi Dave's comments on a paper I presented at the 2013 Annual Meeting of the American Anthropological Association on the topic of queer failures.
[346] The idea of an epidemiological transition was first articulated by Omran (1971) and has since become an article of faith and rallying point for concern in public health.
[347] Condrau and Worboys 2007, 2009, Mooney 2007, Noymer and Jarosz 2008
[348] Mooney 2011:374
[349] For example, see the forthcoming work of Harris Solomon on diabetes and obesity in Mumbai.
[350] McKeown 1976a, 1976b

development of antibiotics in the 1940s-50s, were, in McKeown's view, negligible in this story of transition.

In the last few decades, both scholarly and popular accounts have described the "return" of infectious disease.[351] In the current moment, the story goes, we face not only the emergence of new infectious conditions, like HIV, but older ones, like tuberculosis. The possibility of this return depends upon the periodization of epidemiological transitions. Infectious diseases, including tuberculosis, must have gone away in order to have come back. But colonial officials in India only began keeping records of tuberculosis among Indians beginning in the 1920s. Although there was by this time wide-spread suspicion in the medical community that tuberculosis was a serious problem for the native population, ideas about racial difference and native immunity hindered the establishment of a record of tuberculosis mortality and morbidity among Indians. The limited record of Indian cases of tuberculosis, as well as the indeterminacy of diagnostic signs, makes it hard to know whether tuberculosis in India went away in order to return. Speaking of Haiti, Paul Farmer suggests that "Tuberculosis never went away. The mortality rates globally have not shifted that significantly, although of course there have been massive local shifts. Only from a highly particularistic point of view - that of the Western wealthy - could one speak of tuberculosis as a re-emerging disease."[352]

Beyond the geographical limitations of the available data and the inconsistent forms of disease classification across space and time, there remains a problem of categorization. Infectious diseases and chronic diseases are not always and necessarily distinct. Kamala Nehru seems to have staggered on for years between periods of relative health and severe symptoms. Prior to the development of antibiotics, tuberculosis was often classified as a chronic condition. After the development of antiretroviral drugs, HIV – an infectious and typically fatal condition – became reclassified as chronic. The line between chronic and infectious is both unstable and mutable.

Putting aside the statistical reality of this transition, the movement from communicable to chronic conditions, from infectious to lifestyle diseases, is also a linguistic and economic movement, a change in the ways in which we speak about, imagine and finance sickness, life and death. Chronicity has become the primary temporal framing for drug research, manufacture and consumption. The increasing production and prescription of drugs for life – "more drugs for more people for longer periods of time" – has led huge profits and growth for the pharmaceutical industry.[353] But despite the increase in life-long conditions, side effects and complications that call for sustained pharmaceutical intervention, the possibility of a cure continues to fan the hope that chronicity can come to a non-fatal end.

Even if chronicity is the common characteristic of our many modern conditions, the hope for a cure has maintained a foothold in both medicine and in the popular imagination, as an aspirational structuring of biomedical research, a patient's life and the possibilities that emerge in the space between. There is something exciting, perhaps even invigorating, in the idea that medical researchers are working tirelessly in shiny laboratories and sterile hospitals to put an end to chronic suffering.

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[351] See for example Gandy and Zumla's *The Return of the White Plague* (2003) and Garrett's "The Return of Infectious Disease" (1996), not to mention the myriad newspaper and magazine stories documenting this fearful return.

[352] Farmer 2000

[353] Dumit 2012:5. His point is more specific than the general observation that everyday life has become increasingly medicalized, that normal variation has become pathological and in need of medical surveillance and intervention. Dumit specifically analyzes how taking medication has itself become a chronic condition.

But the hope for a cure is as much a product of research, labor and organizing as the development of any cure itself. Sufferers and sympathizers, the formerly ill and the family of the dead, are called upon to commit themselves affectively, financially, and somatically, to the search for the cure. Each year, thousands of people race for the cure, dripping sweat to the pavement to raise funds and speed up the slow pace of research. The marathon form of fundraising and awareness-raising has spread to India, with the organization of a charity run in support of curing clubfoot in October of 2013.[354] The more prominent and wide-spread cultivation of hope takes place in the many trials that occur in Indian hospitals. Those who are already sick, or at risk of sickness are recruited as subjects of trials that often promise no immediate benefit, but might help others in the future, a mediated giving via the community of scientific researchers.[355] Of course, the hope of such trials is as much for the research subject as for future sufferers. In the HIV hospitals where I conducted research between 2011-12, such studies were the only means that many patients had of getting their hands on otherwise unaffordable or experimental drugs, drugs that might save a life or at least keep it going. These studies created at least temporary access to second and third-line antiretroviral drugs, free of cost. Such studies raise serious questions about compulsion, volition and consent. If your only hope for accessing life-prolonging drugs is through a study, what kind of choice are you free to make? How does the hope of a research trial reframe a very limited set of options as a free choice?[356]

The language of the cure is a language of hype and hope. It is a language used to recruit study populations, popular and political support, and money, into the production of science for the people.[357] Kaushik Sunder Rajan writes about medical hype as an organizing affect for the biotech industry in India and the United States. He notes that "hype cannot be opposed to reality," as the hyped-up unreal counterpart to a more homely reality.[358] Sunder Rajan argues that "hype is not about truth or falsity" but is rather "about credibility or incredibility."[359] Effective hype seems to be that which can envisage a future for which an investment can be made in the present.

I began by thinking about Muthu's sanatorium practice as a non-specific therapeutic form, a treatment modality that was opposed to taking bacteria as the cause and marker of tuberculosis. Within Muthu's vitalist vision of the body, the cure was not targeted at bacteria, but rather at reinvigorating the body so that it regained the capacity to adjust to its environment. His sanatorium cure did not intend a restoration of the body to its pre-disease condition. Both health and illness were the result of normal adjustments to the environment – it was only when an adjustment became permanent, when the body lost the capacity to adjust and became stuck, that the condition became pathological.[360]

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[354] See Jain (2013) for a compelling meditation on the commingling of consumerist and altruistic affects in marathons and other forms of doing good in the name of the cure.

[355] I take this idea of mediated giving from Copeman (2009) on blood donation in India, as well as the extensive literature on kingship and the jajmani system in which the circulation and distribution of goods is often mediated through a dominant caste group.

[356] Still others fight for the cure by adopting a more antagonistic posture, as in the activism of ACT UP and the many other drug access movements that have staged similar activities across the world See Epstein (1996) on the ACT UP movement and the fight for antiretroviral drugs. See also Biehl (2004) on the "activist state."

[357] See Ruha Benjamin 2013

[358] Sunder Rajan 2006:116

[359] Sunder Rajan 2006:115

[360] See Canguilhem (1991) on the relationship between the normal and the pathological.

In the specific cures for tuberculosis that took the presence of Koch's bacteria as an iconic sign of the disease, health and illness were qualitatively different conditions. Illness was now a "positive, innovative experience in the living being and not just a fact of decrease or increase" in vital energies.[361] If the ideal cure is a panacea, a cure for all conditions for all people, I consider how actually-existing cures for specific conditions have been partial, restricted, limited. I argue that hope emerges in the space between the panacea and the series of restricted cures that have been developed since Koch's etiological discovery. If the panacea is an ideal form, then these restricted cures stand as worldly and imperfect instantiations of this ideal. The gap between the restricted cure and the panacea creates a space for striving, for aspiring, for an asymptotic approach to an ideal that is perhaps unreachable. João Biehl has argued that "magic-bullet approaches are increasingly the norm in global health – that is, the delivery of health technologies (usually new drugs or devices) that target one specific disease regardless of myriad societal, political and economic factor that influence health."[362] As medical research becomes more statistical, specific and even "personalized," it becomes increasingly uncertain whether such an ideal is even desirable.

This chapter is a meditation on the form and function of cures that followed upon Koch's discovery, through an examination of historical materials and from the vantage point of biomedical science – physicians, microbiologists, statisticians and clinicians. Many kinds of histories of the cure could be written, histories about specific conditions or particular therapies. Histories of the cure could be written from below, from the perspective of research subjects, patients or their families. Histories of the cure could be written from within non-biomedical traditions of healing, working through Ayurveda, Siddha, Yunani, or even the relatively more recent homeopathic paths to cure.[363]

In many European languages, the words related to cure originally referred to the person being treated, not to the disease or to the healer. To cure was to make a person whole, not to make a disease end. As a noun, the English word "cure" first emerged in the early fourteenth century from the Latin *cura*, "care, concern, trouble," referring not only to healing but also to administration. The specific meaning of "medical care" emerged in the late fourteenth century, as did the verbal form "to cure," from the Latin *curare*, to "take care of." The idea of the cure gradually expanded its reach to include not only the restoration of a particular person to health, but the ending of a particular affliction that could affect many people. More than just curing a disease in a person, a disease could be cured in its abstract entirety.

The concept of the cure is intimately related to the idea of an ending. In the classical shamanic progression, analogous to the becoming of the psychoanalyst, a condition comes to an end and the sufferer is reborn as healer. In more tragic circumstances, where there is no effective therapeutic intervention, the end of the disease is also the end of the sufferer. Death is an all-consuming end. In the Romantic imagination, death is erotically entwined with the consumptive, whose finals words take form in an orgiastic frenzy. In both Verdi's *La Traviata* and Puccini's *La Bohème*, the finale quite literally signals the end for both the consumptive and her condition.

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[361] Canguilhem 1991:186

[362] Biehl 2011:108

[363] In Tamil, for example, the word *gunamakku* means "to cure." The word is derived from *guna*, a Sanskrit term used in various Indian philosophical systems, as well as in Ayurvedic and Siddha medical traditions. *Guna* has been variously translated as quality, humor or tendency. Very generally speaking, there are three *gunas*, and healing requires the balancing of these humors in a proportion specific to a being's constitution. Imbalance results in sickness. See for example Daniel (1984) on Siddha diagnosis of *gunas* through the reading of the various pulses.

With the development of the idea of contagion, which arguably found its earliest moorings in Renaissance Italy, disease did not necessarily end with the sufferer. Morbid conditions spread. The idea of contagion, taken together with the expanded notion of curing a disease in its abstract entirety, required an ending at the level of the population. As in the case of smallpox, inoculation has arguably been one of the most effective modalities for eradicating a disease, and one of the medical interventions in which the most hope and financial support has been invested in recent times.[364] Drawing upon these ideas, campaigns aimed at procuring research funds figure the search for the cure as "putting an end to" a specific disease.

When a disease ends, its history seems to end too. The eradication of smallpox, it seems, also signaled the end of the history of smallpox. But as with the so-called "return" of the dreaded white plague – tuberculosis – a cure is not always an ending, neither for a disease nor for its history. Or if it is an ending, it is only one ending in a string of endings. How can we conceive of such endings that lack finality? I ask this question because cures can work, but cures can also fail. [365] Cures can work for a time, or seem to work for a time, before things go terribly wrong. A cure is anything but transparent. By working through historical cases, I ask how tuberculosis became curable. What sorts of evidence were required to know that tuberculosis had been cured? How did scientists ascertain when and if a cure had failed, that an ending was not final? To think about the complex relationship between cures and endings, I will focus on how cures were found, and found again; how the end was in sight, at least for a while.

"TB is curable." Indian promotional material for World TB Day 2013.

In this advertisement for World TB Day, an image of the Indian hockey player Dhanraj

[364] For the history of smallpox eradication in India, see Bhattacharya et al. 2005 and Bhattacharya 2006. More recently, the Gates Foundation has invested a great deal of money and time in developing new vaccines, turning away from more immediate and low-tech solutions in India.

[365] Endings that lack finality are often characterized as failures in terms of the stated goals of specific therapeutic interventions. Critics such as Illich, Goffman and Foucault have in various ways pointed to how such interventions lead to different ends, such as the production of particular medical subjectivities. See Condrau 2010 for a review of this literature and its impact on the writing of medical and institutional history.

Pillay draws our attention to the fact that "TB is curable." A directly-observed course of treatment – DOTS – is branded as a "sure cure for TB." Similar promotional materials are distributed across India, featuring not only athletes but actors from across the many regional film industries in India. Such advertisements call upon the viewer to place their faith in a cure that is certain, given "regular and complete treatment." How can we think about these kinds of proclamations of certainty in light of endings that lack finality? What can be reasonably expected from a cure in a moment that is, arguably, plagued by chronic conditions? How is a cure known to be a cure? How is a cure achieved? And just as importantly, what can be hoped for in a cure?

Ending 1: A Brownish Transparent Liquid

The history of tuberculosis could be written as an encyclopedia of endings lacking finality. One of the most famous, and perhaps most disappointing, temporary endings in such a history would involve the bacteriologist Robert Koch. On the third day of the International Medical Congress, nearly 6000 physicians thronged the city of Berlin to hear Koch's word, to hear him announce that that he had found a "remedy for tuberculosis."[366]

His "remedy," a secret substance referred to as "Koch's lymph," generated intense excitement, and hype, among both physicians and the general public, in both medical journals and in newspapers around the world. Koch's discovery "triggered one of the bigger euphorias in medical history."[367] As one surgeon put it at the time, "No other event in the world's history ever attracted so much attention, and no discovery in medicine or surgery ever found such ready introduction and universal acceptation." He went even further: "The people and the profession felt that the millennium in medicine had come."[368]

In 1882, Koch published his findings that bacteria were the cause of tuberculosis. Eight years later, Koch proclaimed that he had found the cure. In less than a decade, Koch had revolutionized the history of tuberculosis not once, but twice. The discoverer of the bacteria that causes tuberculosis had now discovered its cure as well. Not only had he revealed to the world the cause of tuberculosis, but he had also identified the causative agents of anthrax and cholera. One such finding would have been enough to make a career. Koch had managed it over and over again. With such an impressive record, he enjoyed massive credibility among both the general public and the international community of scientists. The faith that was placed in Koch only heightened the hope that he would come through once again with a cure. "Koch and his contemporaries took the discovery of the pathogen to be virtually the promise of a cure, and Koch had to meet these expectations."[369]

In his original pronouncement of his findings in the *British Medical Journal*, Koch appears to be quite circumspect, almost coy, about his miraculous discovery. He declared that he had meant to keep the research a secret until he had gained "sufficient experience regarding the application of the remedy in practice and its production on a large scale."[370] But, he mournfully explained, "too many accounts have reached the public . . . in an exaggerated and distorted form, so that it seems imperative in order to prevent all false impressions, to give at once a review" of the present stage of the research.[371] He refused to state what the remedy actually consisted of

[366] Markel 2005:2426.
[367] Gradmann 2004:470
[368] Senn 1891:3
[369] Gradmann 2004:469
[370] Koch 1890:1193
[371] Koch 1890:1193

until he had completed his work, describing it only as a "brownish transparent liquid."[372]

Moving between the language of remedy and cure, Koch stated that "Within four to six weeks patients under treatment for the first stage of phthisis were all free from every symptom of disease, and might be pronounced cured."[373] He admitted to having difficulty treating more advanced cases, in which the lungs contained numerous large cavities, there were other microorganisms involved, and there were large amounts of necrotic tissue. In these cases in particular, he wrote that he was "in favour [*sic*] of applying the remedy in proper sanatoria, as opposed to treatment at home and in the out-patient room."[374] But in those cases detected early, he declared that "phthisis in the beginning can be cured with certainty by this remedy."[375]

The British physician-journalist-novelist Arthur Conan Doyle, best known for his creation of the inquisitive Sherlock Holmes, found himself caught up in the frenzy of Koch's revelation. In November of 1890, just hours after reading about Koch's discovery in the *British Medical Journal*, Doyle boarded a train to London. From there, he took a boat and another train to arrive in Berlin, hoping to witness a clinical demonstration of Koch's miraculous lymph at the University of Berlin.

Accounts of the event – of the lay and professional crowd, of the intense excitement, of the hopes of suffers and their families pinned to Koch's discovery – bring to mind the journeys undertaken by pilgrims to sacred places of healing. The pilgrim hoped for a miraculous sight of the divine on earth, and for an end to their suffering. Koch's demonstration promised just that – the miracle of the cure on display, and the possibility that the spectator might also be healed. Even the mysterious substance – "Koch's lymph" – was named after the fashion of a saint's relic. For the tuberculosis patient, healing pilgrimages were nothing new. For some time, travel to more salubrious surroundings had been a primary means of treatment for those who could afford it.

Allowing other scientific authorities to witness the demonstration of the cure was also critical to its acceptance as scientific truth.[376] Undoubtedly Koch's words held great weight. He had proven himself to be a credible witness to his own genius. But seeing was still believing. Having respected scientists and clinicians present to witness the cure and to attest to its power only underscored Koch's proclamation.

Doyle was by no means a highly-respected physician, nor did he conduct research on tuberculosis. Nonetheless, he might have been in search of a cure, as his wife Louisa Hawkins suffered from the disease. To his disappointment, he was unable to come by tickets for this monumental piece of medical theater. He went to Koch's home hoping to meet him in person, but was turned away at the door by the butler. By a stroke of good fortune, Doyle won the sympathies of a visiting physician from Detroit who shared his notes from the demonstration and secured Doyle entrance into the clinical wards where patients were receiving treatment with Koch's lymph. Upon reviewing the data, Doyle was deeply disappointed. Writing in both the London *Daily Telegraph* and the *Review of Reviews*, Doyle denied the efficacy of Koch's cure. The miracle substance, he explained, left bacteria behind "deep in the invaded country."[377] The methods of the detective had met the methods of the bacteriologist, and the detective had won.

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[372] Koch 1890:1193
[373] Koch 1890:1195
[374] Koch 1890:1195
[375] Koch 1890:1195
[376] Shapin and Schaffer 1985
[377] Markel 2005:2428

As other scientists scrutinized Koch's results, they came to similar conclusions. Credibility and witnessing were no longer enough. The scandal around "Koch's lymph" – renamed tuberculin – opened up questions about what constituted proper evidence of a cure, as well as its failure.[378] As the historian of science Christoph Gradmann has argued, Koch's camp was able to "harmonize" contradictory results to align with their expectations. Adverse reactions to tuberculin, even death, could be explained away as cases that were too far advanced. Such explanations fit neatly with Koch's admission in the *British Medical Journal* that advanced cases were more difficult to treat. The result of testing his miracle substance in both guinea pigs and humans was necrosis in tuberculosis tissue, a result that Koch interpreted as destruction of diseased cells. The highly-esteemed pathologist Rudolph Virchow drew upon autopsy findings to point out that the infection only spread as cells died. The physician Ottomar Rosenbach demanded to know why certain reactions to tuberculin like fever should be interpreted as signs of a cure instead of as dangerous side effects. From other quarters, seemingly cured patients began to relapse. Koch's interpretations were being called into question.[379]

Gradmann demonstrates that the arguments against Koch arrived primarily from pathology and clinical medicine, not from experimental or laboratory-based evidence. The grounds for proving the cure and for refuting it were unstable, which allowed for the admission of multiple methods for producing evidence and contradictory interpretations of such evidence. Put simply, there was no universal standard by which to judge the efficacy of the cure or its failure.

Neither Koch's credibility nor his demonstrations in front of authorized witnesses was enough to withstand these critiques. Whereas his earlier revolutionary pronouncement, on the etiology of tuberculosis, has largely stood its ground for over a century, his second revolutionary statement quickly succumbed to the counterarguments of his critics. Koch's mastery of tuberculosis had come to a limit; he may have found a cause, but he could not find a cure. He could not put an end to tuberculosis. Tuberculin might have some diagnostic value, but it was not a cure for the dreaded tuberculosis.

The story of tuberculin is not only about the failure of a cure. It is a story about hope, about a charismatic scientist and the forms of publicity in which he engaged in order to gather support for his discoveries. For a brief moment, Koch's announcement raised hopes in Berlin, and around the world, that the end of tuberculosis was possible. These hopes even extended beyond the moment of failure. Despite misgivings about Koch's mystery substance, his prior discovery that bacteria caused tuberculosis was for some a sign that the end was near. "It [tuberculosis] is understood, and its mysteries cleared up, and the ways paved for its extermination."[380] The decades proceeding Koch's discovery were a time to look back, to reflect on a history that had more or less to come to an end. "For us, his [Koch's] conquest of tuberculosis is enough!"[381]

Following medieval elaborations of Aristotle, there was a tight relationship between cause and cure. The cure was immanent to the cause, waiting to be expressed. This is precisely what Koch had done, denaturing *Mycobacterium tuberculosis* in order to produce tuberculin. As a living entity, the bacterium was the cause of disease. In its dead form, Koch hoped that it

[378] On the historical roots of modern conceptions of proper evidence as "neutral," see Daston 1991.
[379] The above description draws upon Gradmann 2004.
[380] Dr. Lawrence Flick of the Pennsylvania Society for the Prevention of Tuberculosis wrote these words in 1925. Cited in Bryder, Condrau and Worboys (2010:4).
[381] The Welsh physician S. Lyle Cummins wrote this in 1949. Cited in Bryder, Condrau and Worboys (2010:4).

would be the cure. For Koch, the bacterium was a pharmakon, threatening illness but promising recovery to a pre-disease state. The story of tuberculin is also a story about the forms of evidence that could be marshaled in the name of contending truths. This all changed in the 1940s-50s, with the development of a new form of cure – antibiotics – and a universal evidentiary standard – the randomized controlled trial.

Ending 2: Streptomycin

The development of antibiotics signaled another ending for tuberculosis and the emergence of new standards for scientific evidence. Along with this new cure came a new way of failing – drug resistance.[382] The first effective anti-tuberculosis chemotherapeutic agent, streptomycin, was originally isolated in 1943 at Rutgers University, in the laboratory of Selman Waksman. Waksman and his team first demonstrated the efficacy of this new substance in guinea pigs infected with tuberculosis.[383]

In the same year, a team of researchers at the Mayo Clinic extended these studies, first on guinea pigs and then on humans. By 1947, this team, led by Dr. William Feldman and Dr. H. Corwin Hinshaw, had already demonstrated the existence of streptomycin-resistant strains of tuberculosis after only "weeks or months" of treatment in humans.[384] The newest treatment for tuberculosis had met its limit, and quickly.

In testing the efficacy of streptomycin against tuberculosis in humans, a new way of producing evidence made its first appearance. In 1946-1947, the British Medical Research Council (MRC), eager to test out the power of this new curative agent, conducted what is widely recognized as the first "proper" randomized control trial.[385] The trial was significant not only for legitimizing streptomycin as a specific treatment for tuberculosis in humans, but for solidifying a new evidentiary method for the establishment of truth.

The study, published in 1948, began by expounding on its methods and pointing out the

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[382] The argument has been made that resistance predates antibiotics. The development and broad use of antibiotics starting from the 1940 resulted in an intensification of this evolutionary process, but resistance has a deep natural history. As the microbiologist Rustam Aminov argues, "environmental microbiota, even in apparently antibiotic-free environments, possess an enormous number and variety of antibiotic-resistant genes" (2009:2970). In addition, he points out that antibiotic agents exist outside of the purview of anthropogenic natures at sub-clinical levels, producing a semiotic interaction between such agents, microbes and the border environment. Aminov's argument is that antibiotic force and antibiotic resistance inhere within non-anthropogenic worlds and histories, in a complex semiotic ecology of death, response and adaptation. Distinguishing between micro and macroevolutionary histories, Aminov contends that bacterial mutation and antibiotic resistance are deep historical processes that far predate the emergence of the human. He writes that: "The antibiotic era, in fact, was (and still is) a fairly brief evolutionary experimentation that was conducted during the past 70 years with large-scale production of antibiotics and exertion of a strong selective pressure towards bacteria in various ecosystems."

Christoph Gradmann has developed a more nuanced version of the history of anthropogenic antibiotic resistance, arguing that the first forty years of the twentieth century offer a different trajectory for resistance studies than that which took place beginning in the 1940s. Prior to the 1940s, resistance was a phenomenon that was observed only in the laboratory, not in the clinic. In the lab of Paul Elrich and a few others, the few existing antibiotic chemicals were used primarily to induce resistance in trypanosomes. However, these efforts were not focused on the particular strains of trypanosomes that cause sleeping sickness, nor on other microbes of clinical importance. Instead, this work centered on inducing drug resistance in the laboratory to prove that specific chemical receptors existed on the surface of microbes, in order to understand the mechanisms of drug action.

[383] In 1964, almost twenty years after this discovery, Waksman would write a history that was precociously titled *The Conquest of Tuberculosis*.

[384] Hinshaw et al 1947:434

[385] Teira 2013. Elements of the randomized controlled trial had appeared before, but the MRC trial was broadly considered as the first to bring it all together and frame it in that way.

flaws of earlier studies. The Mayo Clinic studies, for example, were dismissed as "encouraging but inconclusive."[386] The authors wrote that "evidence of improvement or cure following the use of a new drug in a few cases cannot be accepted as proof of the effect of that drug."[387] The grounds for proof had changed.

Other evidentiary procedures, such as those that commanded attention in the controversy surrounding Koch's lymph, were at best only weak indicators, suggestive but not conclusive. The authors cited the example of gold treatment for tuberculosis, a popular option in the 1930s, as a fraudulent therapeutic option buoyed by these older methods. They contended that claims about drug efficacy were only valid "if based on adequately controlled clinical trials."[388] Although the team at the Mayo Clinic might have been the first to treat patients with tuberculosis using streptomycin, the MRC group was the first to provide what counted as real proof on this new evidentiary terrain.

In the case of Koch's lymph, the efficacy of the cure was contested by means of different scientific methods: experiment versus pathology. In the case of streptomycin, both the Mayo Clinic and the MRC agreed on the drug's efficacy. The MRC study did not take issue with the findings of the Mayo Clinic Study. Their concern was with how those findings were made. Even if the finding turned out to be true, it was for the MRC an invalid claim without the proper evidentiary procedures supporting it.

But the game was rigged in favor of the MRC, which had actively produced this new terrain. More than a shift in what was true, the MRC study enacted a dramatic shift in how something came to be counted as true.[389] The anecdotal or clinical could guide the shaping of research, but it was not in itself research. The randomized control trial underwrote truth. When it came down to determining whether a cure was a cure, truth became a question of procedure, of proper methodology.

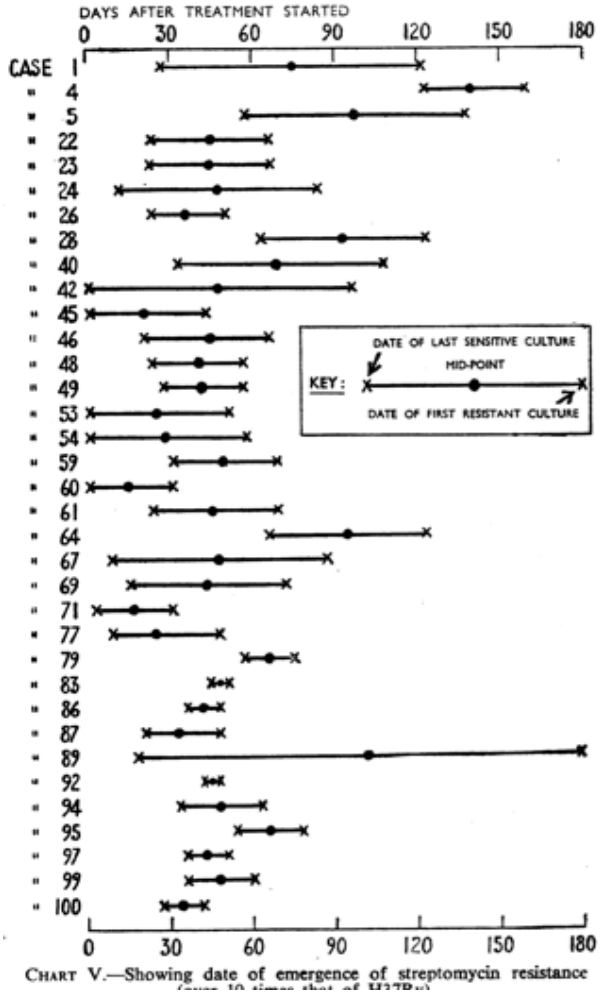
The criteria for subject recruitment for the MRC study were stringent: "acute progressive bilateral pulmonary tuberculosis of presumably recent origin, bacteriologically proved, unsuitable for collapse therapy, age group 15 to 25 (later extended to 30)."[390] In total, 109 subjects were accepted into the MRC trial, two of whom died during the first week of preliminary investigations. The remaining 107 subjects were divided into two groups: 55 in the streptomycin group and 52 in the control group. This division was made by means of sealed envelopes containing either the letter S (for streptomycin) or C (for control). The control group was treated with bed rest, whereas the streptomycin group received the drug along with bed rest. The treatment period of the study lasted six months.

The motivations behind the use of this new methodology have been a subject of debate for historians of medicine. In Britain, the small and quite expensive supply of streptomycin could not meet the high public demand. There was no domestic production of streptomycin at the time, and the MRC had received about fifty kilograms of the drug from U.S. sources – only enough to treat between 150-200 patients.[391] The randomized control model allowed for the allocation of scarce resources in a purportedly unbiased fashion. For the purposes of this chapter, what is

[386] Marshall et al. 1948:769
[387] Marshall et al. 1948:769
[388] Marshall et al. 1948:769
[389] Compare Kuhn 1962, Latour and Woolgar 1979, Abu El-Haj 2001
[390] Marshall et al. 1948:770. Collapse therapy refers to artificial pneumothorax, the deliberate collapsing of a lung so that bacteria could be contained locally and healing could take place. This technique is still in use, especially in cases of multiple drug-resistant tuberculosis.
[391] Streptomycin in Tuberculosis 1947:136

important is that this study established the randomized controlled trial as the new standard for demonstrating drug efficacy. Equally important is the fact that statistical sampling and modeling techniques were critical to this new methodology. With the MRC study, the history of medicine was rewritten as a haphazard and potentially dangerous series of *ad hoc* experimentations lacking both ethical and epistemological grounding.

It is with the MRC study that the notion of the cure gained greater statistical precision. The authors were careful to note that at the end of the six-month period, "no clinical 'cures' were affected, and that only 15% were bacteriologically negative."[392] Although no pathogenic bacteria could be detected in this fifteen percent, there was a risk that these patients harbored bacteria undetectable via sputum microscopy and culturing. Claims for the cure had to be put on hold.



MRC diagram depicting time until emergence of drug resistance[393]

The MRC study also confirmed the finding of the Mayo Clinic study regarding drug resistance. In a section of the MRC study entitled "Time of Emergence of Streptomycin Resistance," the authors explained that of the 35 patients who developed resistance, "the mean date of emergence of resistance is the 53rd day after starting streptomycin therapy."[394] In fact, the

[392] Marshall et al. 1948:781
[393] Marshall et al. 1948:779
[394] Marshall et al. 1948:779-80

majority of improvement in the streptomycin group came during the initial phase of treatment. The authors wrote that "It seems probable that streptomycin resistance is responsible for much of the deterioration seen in S cases after first improvement."[395]

The first case of drug resistance was actually documented four decades prior to the MRC study, in the laboratory of Paul Elrich. Elrich and his colleagues were primarily concerned with inducing resistance in trypanosomes in order to understand the specific mechanisms of drug action. Drug resistance did not emerge as a problem for clinical medicine until the 1930s-40s, when antibiotics became more widely available to the public.[396]

The MRC demonstrated that streptomycin was an effective therapeutic agent in comparison to a control, but streptomycin was not in itself a cure. Resistance occurred too early and too often. Despite these concerns, streptomycin became widely prescribed as monotherapy. An editorial in the journal *Tubercle* noted that recommendations to limit the use of streptomycin to avoid the spread of drug resistance were largely ignored by physicians. The editorial further mentioned that few cases of initial resistance had been documented, and that perhaps the optimism of medical practitioners might take priority over the excessive caution of regulatory committees:

> Clinicians may perhaps be excused if they claim that the present widespread use of streptomycin has been so immediately beneficial as to outweigh theoretical dangers in the future. The dangers may prove to be illusory and the time may come when we shall look back and wonder at our capacity in an anxious world to create new anxieties.[397]

For clinicians at large, the lesson from the streptomycin study was less about the dangers of drug resistance, and more about the efficacy of a new drug against tuberculosis. With the development of antibiotics, the concept of resistance was experiencing a slow semantic shift. In the nineteenth and early twentieth centuries, one of the most important lines of inquiry into tuberculosis concerned why certain racial groups and even animal sub-species had a "native resistance" to tuberculosis, and why other groups achieved an "acquired resistance." The question of racial or individual resistance was gradually replaced by a concern with the resisting power of bacteria. It was only in the 1940s that the term "resistance" in clinical medicine shifted from being a bodily property to being a bacterial one.[398] The first form of resistance was positively valued, the second negatively. Resistance had acquired a new valence.

The randomized clinical trial of streptomycin decisively narrowed the parameters for what counted as a cure and what sorts of evidence were admissible. This study also produced evidence that the development of resistance was an obstacle to anointing streptomycin as the cure for tuberculosis.

After streptomycin, the first drug found to be effective in treating tuberculosis was 4-aminosalicylic acid (PAS). The Swedish chemist Jorgen Lehmann was the first to describe the efficacy of PAS against tuberculosis in a 1946 article in the *Lancet*. Further studies by independent researchers resulted in contradictory results. To answer the question of the efficacy

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[395] Marshall et al. 1948:782
[396] Gradmann 2011:312
[397] Tubercle 1951:209
[398] In experimental medicine, the use of resistance in reference to microbes began slightly earlier, in the 1930s, in the fields of immunology, pharmacology and genetics (Gradmann 2011).

of PAS once and for all, the British Ministry of Health and the British Tuberculosis Association requested that the MRC conduct its own inquiries into the matter. "As a decisive answer had been reached for streptomycin by the method of controlled clinical trial, it was agreed by clinicians in doubt about the value of PAS that the method should be applied to trial of this drug."[399]

This study, published in 1950, consisted of three groups: streptomycin alone, PAS alone, and streptomycin with PAS. During the six months of this study, each of these groups also received bed rest. Although this study carefully avoided the use of the word "cure," it spoke instead of bacteriologically-negative cases – subjects in which no bacteria could be detected at the end of treatment. The study reported that combination therapy was more effective than either of the monotherapies, providing the first proof within this new evidential model of the efficacy of combination therapy. But what the authors found more striking was the significantly decreased levels of streptomycin resistance in the group treated with the combination: resistance was detected in 33 of the 49 streptomycin-only subjects, compared to only 5 out of the 48 subjects treated with combination therapy.

Two years later, the antibiotic pyrazinamide was developed. This was the same year that another antibiotic, isoniazid, became available as a treatment for tuberculosis. Taken alone, these drugs were shown to have some therapeutic efficacy, but the effort to affect a cure and avoid widespread drug resistance necessitated the use of combination therapies. Numerous trials were conducted by the MRC in the proceeding years, testing the efficacy and relative drug resistance of various combinations of these drugs.

But the efficacy of antibiotics, whether individually or in combination, was haunted by the control – bed rest. In a sense, bed rest was metonymic for the entire complex of diet, exercise, rest and discipline associated with the sanatorium. The MRC studies involved admission of subjects for six months along with the administration of antibiotics, an expensive therapeutic pairing. As a review of streptomycin out of the Mayo Clinic declared: "It must always be emphasized that treatment with streptomycin is not a substitute for rest in bed and sanatorium care, which are still fundamental in the treatment of tuberculosis."[400] This was a view held across the United States and Europe, as evidenced by the words of a Swiss sanatorium superintendent who wrote that streptomycin would "never replace therapy by collapse measures or sanatorium treatment."[401] But combination therapy, as opposed to streptomycin alone, offered a chance to change the equation. If bed rest could be eliminated entirely – if drugs were effective on their own – then many more patients could be treated at a much lower cost.

Ending 3: At Home in the Postcolony

In 1965, the vexed question of bed rest was put to the test in the Madras Study. This was the first randomized controlled trial in India, designed to test the hypothesis that these new antibiotics were equally effective without being accompanied by the intensive monitoring, regimentation, and prohibitively high costs of the sanatorium. The idea was not only that this new cure for tuberculosis worked, but worked for the masses outside of the confines of an institution.

I first learned the details of the Madras Study in a warm home in Egmore, an old part of Chennai (formerly Madras) that was heavily trafficked in large part due to its eponymous train

[399] Marshall et al. 1950:1073
[400] Hinshaw et al.1947:433
[401] Mordasini 1948:52

station. I had come to meet Dr. S. Radhakrishna, a statistician who had been deeply involved in the Madras Study. He had instructed me to look for the empty plot where once stood the famed Hotel Dasaprakash. Erected in the 1920s, the hotel had recently been razed to the ground and the prized property sold to a developer who envisioned a luxury apartment complex in its place. The Dasaprakash had history, having hosted dignitaries from Prime Minister Nehru to Madras State Chief Minister Kamaraj.

Dr. Radhakrishna's familial home was nestled on a blind street adjacent to this decimated landmark. Through the double doors and up the rickety spiral staircase, I was welcomed into a sparsely furnished but comfortable sitting room.

Before our meeting, Radhakrishna had sent me numerous messages cautioning me about the haziness of his memory. Yet, he spoke to me in vivid detail. Radhakrishna related his life to me as a fortuitous combination of epiphany and serendipity. He spoke nostalgically of a time past, a time of opportunity, of Congress Rule, of Kamaraj and the Hotel Dasaprakash.

In 1956, Radhakrishna had matriculated with a Masters degree in statistics from Madras Presidency College. His was one of the first cohorts to which a degree course in statistics had been offered. "Statistics was taught with an agricultural background," he told me. He had been expected, he continued, to use his newly-cultivated statistical skills to determine the optimal amount of cow manure required to fertilize an agricultural plot.[402]

Statistics had emerged as a crucial science for rationalizing agriculture, for feeding a developing nation under the auspices of Nehruvian socialist modernization.[403] As a discipline of study, it was tethered to agricultural science, as a means of improving the nation's crop yields scientifically. This option did not appeal to Radhakrishna. Two of his school friends, he remembered, had submitted to the "IAS craze." Then as now, a job in the Indian Administrative Service (IAS) meant lifelong financial security and respect.[404] In the first decade of the new nation, Radhakrishna had surveyed the possibilities for a fresh graduate and found them wanting. He remembered waiting around, listlessly, degree in hand but uncertain what to do with it.

Then he described what was for him a fateful moment, when he happened to come upon an advertisement in *The Hindu*.[405] The Medical Research Council (MRC) of Great Britain was establishing a research center in Madras, and they were seeking a qualified person to assume the post of statistical assistant. Without a word to his family or friends, he sent off his application. Not expecting too much to come of it, he returned to contemplating what he might do with his new degree.

Some days later, Radhakrishna received a call early in the morning. He was requested to come for an interview at Rajaji Hall, in the neighborhood of Triplicane. At that very moment, his entire family had packed up to attend a wedding of a close family friend in Nellore, a few hours across the Andhra Pradesh border. It was quite unthinkable to miss such an event, Radhakrishna explained, but he had a feeling that his "destiny" awaited him. He convinced his parents to allow him to miss the wedding and remain in Madras alone. Putting aside the duties of kinship and

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[402] See Gupta (1998) on the green revolution in India.

[403] See Prakash (1999) for a more detailed discussion of scientific development under Nehruvian-style socialism in the 1950s. The exceptionalism of the Nehruvian moment is often pitted against its limit, with Rajiv Gandhi's embrace of what are now termed "neoliberal" social and economic policies. I suspect that the all-encompassing nature of Nehru's rationalist-socialist position should not be taken for granted (see, for example, Parry 2008), nor should the neoliberal turn in India be understood as a *fait accompli* and total negation of the Nehruvian dream.

[404] See former IAS officer Upamanyu Chatterjee's fictional *English, August: an Indian Story* (2006), a dark comedy about a newly-minted IAS officer, but also about the failures of hope and the passage of time in the civil service.

[405] The most widely read English daily in South India.

sociality, as he had earlier refused the call to national service as a calculator of manure, Radhakrishna headed to the interview.

Radhakrishna recalled the interview with great clarity. Arriving at Rajaji Hall, he was confronted by an interview committee including the British Dr. Wallace Fox, a global expert in tuberculosis and public health. Fox had published numerous case studies on different forms of collapse therapy for the treatment of tuberculosis.[406] He had also been involved in many of the MRC antibiotic trials. Prior to coming to Madras, Fox had been working for the MRC in Kampala, studying the efficacy of antibiotics on East African tuberculosis patients and comparing the results to a similarly-treated British group.[407]

This study was in a sense a capstone on the logic of bacteriological universality inaugurated by Koch. If bacteria could infect anyone, antibiotics should be able to cure anyone. Fox and his colleagues were also slowly inching toward another question: *what else* do you need to cure tuberculosis, other than antibiotics? In Uganda, where socioeconomic conditions were ostensibly worse than in Britain, and where study subjects were generally in worse condition than their British counterparts, were antibiotics still as effective? The Ugandan studies demonstrated that the difference in outcomes was statistically insignificant. Antibiotics, like disease, were not racially or geographically specific, decisively countering a long history of mapping pathologies onto specific peoples and places.

In part, Fox's task in India was to provide further evidence of this conclusion. At the same time, the Madras Study was a critical part of the development of a new internationalism in health. The study was a joint effort of the British MRC, the World Health Organization (WHO), and the Indian government. MRC-led studies in Uganda, India and elsewhere sought to usher these former British colonies into this new international order, while simultaneously aiding in the development of national health programs. For such a collaboration to work, Indians needed to be included in the Madras Study not only as subjects, but also as scientists.

With the development of statistics as a discipline in India, graduates like Radhakrishna were well-suited to join in this endeavor. At the interview, he was asked about his education, and presented with a few statistical problems to solve. Radhakrishna remembered having answered all of these questions quite adequately. Then, Fox turned to him and asked a series of quite different questions: "What do you know about TB? (Nothing.) Would you be scared to work with coughing patients? (No.) Are you married? (Not yet.) Suppose you get married next year, and your wife objects [to you working with TB patients]?" Radhakrishna recalled explaining to Fox that "In India, marriage is all arranged. Only those [women] prepared to accept [this job] will come [for marriage]."

Having finished his interview, Radhakrishna returned home. Two hours later, a messenger from the Madras Public Service Commission appeared at his front door. It seemed that the statistician delegated by the MRC was due to return to London in a week's time. Although the official government order sanctioning his employment would come in "due course," the committee requested that Radhakrishna assume the post immediately.

Radhakrishna related his tale of becoming gainfully employed as an unexpected opportunity that very quickly led him into a prestigious and remarkable career. But as he continued to speak with me, he downplayed his own achievements and focused on the halcyon days of working in the Madras Study under the particularly charismatic leadership of Dr. Fox.

Fox was born in Bristol in 1920. Having completed his medical training in London, he

[406] Fox 1948a, 1948b, 1950a, 1950b
[407] PW Hutton et al. 1956, Fox 1956

worked in a series of sanatoriums and thoracic hospitals, before himself succumbing to tuberculosis and two years of rest-based treatment at the Bristol Royal Infirmary. At that time, prior to the development of antibiotics, regimented rest was the primary mode of treatment. Like the sufferer-turned-shaman, Fox devoted his career to the treatment of tuberculosis.

Dr. Wallace Fox

With his colleagues from the MRC, Fox set off to Madras City in 1956. There, he established the Tuberculosis Chemotherapy Centre (TCC) in May of the same year. Dr. Radhakrishna joined as one of the first Indian employees in October. During the next five years, the two men worked together with a dedicated team including two medical officers, an assistant medical officer, two bacteriologists, an assistant bacteriologist, a laboratory technician and a laboratory research assistant.[408]

Gaye Fox, the wife of Wallace Fox, accompanied him to Madras. She described the conditions of the study as follows:

> These were done in very difficult conditions. It was said that the Indians might not be cooperative, but with a dedicated team the patients were persuaded to cooperate and the studies had very few absconders. The climate was also notoriously hostile, and yet many of the staff worked long hours, and Wallace usually worked an 18-hour day, often bringing colleagues back to chew over the problems in the evening.[409]

The Madras study adopted the model of the randomized control trial to ask about the importance of hospital admission in tuberculosis treatment. In the earlier MRC trials, study subjects were all admitted to hospitals and sanatoriums regardless of whether they were in a control group or a treatment group. In that sense, all study subjects received some treatment. As the original MRC study on streptomycin noted, bed rest was until that time "considered the only suitable form of treatment for such cases."[410] Bed rest stood in for the host of qualities associated with hospitalization and sanatorium treatment prior to the development of antibiotics.

The question posed by the Madras study was less about the efficacy of antibiotics and

[408] TCC 1959:51
[409] Christie and Tansey 2005:46
[410] Marshall 1948:770

more about the utility of the sanatorium. Did patients need to be admitted in order to be treated? Was there a quantitative difference in outcome between patients treated in the sanatorium with antibiotics, and those given antibiotics at home? According to Dr. Radhakrishna, there were 3-4 million active cases of tuberculosis in India at the time, but only 23,000 beds available for tuberculosis patients.[411] If sanatorium-based treatment was critical to curing tuberculosis, then this misfit presented a real problem.

Prior to the end of the nineteenth century, there was serious doubt as to whether Indians where vulnerable to tuberculosis at all. It was only in the late nineteenth and early twentieth centuries that colonial medical officials began to argue that Indians were not immune to the disease. This growing consciousness did not correspond to a proportional response from the colonial government. Sanatoriums were expensive to build and maintain. Additionally, the responsibility for public health had for a long time been devolving into the hands of local officials and committees at the taluk and village levels.[412]

Much of the burden of constructing and running sanatoriums fell upon medical missionaries. Among the available beds, a percentage were devoted exclusively to European patients. Such policies were controversial, but the argument was made that Europeans had special dietary and cultural needs, and could not be cared for alongside Indians. This was the case at the Madanapalle Sanatorium in Andhra Pradesh, set up as a conjoint effort between numerous Indian missions. Each of these missions was given access to a certain number of beds proportionate to their financial investment. The equalizing force of illness was also blunted by the emergence of special hospitals for caste Hindus and Muslims, called gosha hospitals.[413]

As another alternative, philanthropic trusts, often organized by the wives of British administrators living in India, offered support for the establishment of educational programs and dispensaries. These trusts required a much lower investment, for which the colonial government was able to offer some funding. The brunt of the responsibility was also shifted from the colonial government onto local officials and individual sufferers. Among the medical community, however, sanatorium treatment was still understood to be the best therapeutic option.

Given this history of government inaction, the Madras Study was not only an examination of treatment efficacy, but an inquiry into economics. This trial, Dr. Radhakrishna explained, would see if a combination of drugs taken at home could be as effective as the same drug regimen taken in the "salubrious environment" of the sanatorium, understood to include isolation, a nutritious diet and rest. Drugs had become a necessary part of treatment, but what of the additional qualities of the sanatorium? Were they also necessary?

Patients, primarily poor inhabitants of slums, came to the Centre, lured by the promise of white science. As Dr. Radhakrishna put it, there was a racial charisma surrounding the group of eight white doctors and staff, deputed by the WHO and the British MRC – perhaps they had brought something special with them, something that could truly affect a cure. He admitted that their success in recruitment was partially due to this fact of whiteness. "People felt that this place was very superior, as there were foreigners here, that something special was being given here," he explained. The hope invested in the trial was not only about new drugs, but also about a certain racial quality of medicine.

Part of the historical gleam of this study comes from it being the first randomized

[411] The 1959 Madras study report concurs with Dr. Radhakrishna on the number of beds available, but estimates that there were only 2.5 million active cases.
[412] See Harrison (1994) for a discussion of the devolution of public health.
[413] See Van Hollen (2003) for a discussion of the gosha hospital in Madras.

controlled trial in India. Dr. Radhakrishna explained to me that the very "concept of a randomized control trial" was hard to instill in both patients and the research staff. "Everyone wanted sanatorium treatment," he explained, even other doctors. There was great resistance to the concept of randomized trials from within the medical community. "[Doctors] said you can't do trials on human beings, it's unethical. The doctor knows best, you can't experiment [on people]." But in the absence of tested and validated protocol, "every time a doctor gives medicine to a patient, he is experimenting," Radhakrishna abjured. Radhakrishna himself admitted that randomization would be "extremely unethical" in the course of regular medical practice. Deciding a patient's fate randomly was only acceptable, and in fact mandatory, within the context of the randomized control trial.[414]

The ethical dubiousness of medical research was shifted onto the everyday practice of clinical medicine. In Radhakrishna's argument, the randomized controlled trial is an exceptional event in which the normally unethical becomes not only ethical but imperative. In the absence of such trials, everyday prescriptions became suspect as idiosyncratic experimentations by individual physicians. It was these everyday experimentations that Radhakrishna deemed ethically unacceptable. Similar to the way in which the original MRC trial of streptomycin rendered the results of all previous streptomycin research inadmissible, Radhakrishna was arguing for the epistemological and ethical uncertainty of all medical practice without the backing of this new form of evidence.

Through a "flip of a coin," as Radhakrishna put it, the study team divided patients into the home-based and sanatorium-based arms of the study. In fact, the groups were divided using the same method of sealed envelopes as used by the MRC in the original streptomycin study. Randomization was a technically difficult procedure. As Gaye Fox explained:

> There was no air conditioning at all for the first two years, no machines for sorting out statistical cards, hence the statistical cards were sorted out by hand, in their thousands without even the benefits of a fan to cool the room. Fans would have blown the cards about![415]

In total, 193 patients were admitted into the study: 96 in the home-based group and 97 in the sanatorium. Radhakrishna noted that it was "hard to sell this concept to patients," that their fate would be decided arbitrarily. Patronage networks, gifts, status, clout, none of these mattered in the face of randomization. Again, the charisma of white medicine helped to smooth over the arbitrariness of the coin - "many people agreed because they were keen to be treated by these [foreign] people."[416] But chance could not be allowed to determine the outcome of the study. Patients were vetted before being allowed to enter the study. Home visits were made and neighbors were consulted to confirm that potential study participants really lived where they said that they did.

Both arms of the trial received isoniazid and PAS. In case of an adverse physical reaction, or when the treatment seemed to be failing, patients were switched to streptomycin and pyrazinamide. While some medical experts were arguing for life-long treatment for tuberculosis, the research team in Madras decided to treat for one year. During the study, health visitors

[414] See Hacking (1975, 1990) for a history of the emergence of the concept of probability and its relation to statistics.
[415] Christie and Tansey 2005:46
[416] See Anderson (2006, 2008) on the complex charisma of whiteness in relation to colonial scientific and medical expeditions.

regularly visited homes to retain patients in the study, and to urge them to adhere to the strict therapeutic regime. Surprise urine tests were administered, as drug levels were seen as a more reliable index of adherence than a patient's testimony. If the health visitor failed in their task, then a doctor would go. If all else failed, Dr. Fox himself would make a home visit. The level of involvement of the research team in the lives of the home-based study participants suggests that a quality of sanatorium treatment – supervision – extended, at least in part, to the home. In the way in which the Madras study operated, supervision had become decentralized and mobile.[417]

Considerable effort was exerted to keep patients in the sanatorium, as well. These patients were housed at the Tambaram Sanatorium, located just outside of the city limits. The Madras Government had made about 100 beds available for the study. "Nobody wanted to go to the sanatorium for twelve months," Dr. Radhakrishna explained, "but everybody wanted to go" when they were experiencing symptoms. Twelve months was a long time, and symptoms often receded after a few months. To stem the desire to leave, Dr. Fox, Dr. Radhakrishna and a public health nurse would visit the sanatorium every Saturday and speak with patients. Special accommodations were made to keep patients enrolled in the study – for example, patients were permitted to take a few days leave from the sanatorium to attend family weddings, like "prisoners on parole," as Radhakrishna put it.

But Radhakrishna noted that there were other, less obvious problems with sanatorium treatment. Part of the issue was that patients in the sanatorium-based wing of the study were unable to earn money during the trial, whereas patients in the home-based wing were free to continue working. A social worker involved in the study had been tasked with collecting twenty case histories about the families of patients in the sanatorium-based wing of the study. Radhakrishna explained that it had been Fox's ideas to ask: "What happens when the bread winner of the family goes away?" Did sanatorium treatment have unintended socioeconomic effects on kinship? The social worker found that a side effect of sanatorium treatment was infidelity. "Wives ran off with neighbors," as Radhakrishna put it. Infidelity was found to be a survival strategy, a means for married women to make money while their husbands were in the sanatorium. Survival, then, entailed something much broader than strictly medical intervention, and involved more than just the patient.

Other strategies were employed to keep patients in the study and adherent to the drug regimens. Milk powder, provided by the American Cooperative for American Relief Everywhere (CARE), was given to the children of patients. Radhakrishna explained that "people appreciate it more if you give to their kids, they [patients] are more likely to cooperate." Founded in 1945 as the Cooperative for American Remittances to Europe, the organization's original intent was to facilitate Americans who wanted to send CARE packages to Europe in the midst of reconstruction. The research team also established a fund to provide assistance to families "when this was considered essential."[418] In addition, some home-based patients received funds to subsidize their transportation to the clinic.

Fox was heavily criticized by his Danish colleague at the Madanapalle Sanatorium, Dr. Johannes Frimodt-Moller, for allowing the scientificity of his results to be endangered by "humanitarian" feeling. For Frimodt-Moller, strictly controlled science had to be separated from humanitarian efforts. A similar critique was issued to Fox by Johs Holm, the head of the WHO's Communicable Disease Division:

[417] See Deleuze (1992) on mobile forms of surveillance
[418] TCC 1959:53

> You wish to do everything possible for each one of your patients . . . including those who, for the purposes of the trial, can be described as failures and thereafter can be of little or no scientific interest. I realize that this is from humanitarian, or if your prefer it, clinical considerations and feelings.[419]

The historian of science Helen Valier has argued that Holm's irritation with Fox exemplifies a fundamental divide between the aims of the WHO and the MRC. Whereas the WHO was interested in halting the spread of infection, the MRC as represented by Fox was focused on curing patients.[420] The criticisms levied by both Frimodt-Moller and Holm suggest to me that the concern ran deeper. Fox's efforts at securing a cure for study subjects at all costs threatened to muddy the difference between the two wings of the trial. If a randomized controlled trial was the ultimate arbiter of the curative power of a drug, Fox's *ad hoc* modifications could diminish the validity of the results.

The published results of the Madras Study demonstrated that the biggest difference in treatment outcomes was not between the two groups, but between men and women. In both wings of the study, 90% of men showed no bacteria in their sputum at the end of the twelve-month treatment period. In the sanatorium wing of the study, 97% of women were bacteriologically negative, compared to only 76% on the home-based side of the study. The divergence among women in the two groups was explained away as a result of unusual pre-treatment differences between the two groups, despite randomization.

The study concluded by declaring that "The results of domiciliary chemotherapy, as carried out in this study, approach sufficiently closely the results of sanatorium treatment to suggest that it is appropriate to treat the majority of patients at home."[421] Through this claim, the Madras Study undermined not only the centrality of bed rest to tuberculosis treatment, but the very reason for being of the sanatorium. In regards to antibiotic treatment, the historian Flurin Condrau argues that, "Against this 'gold standard' of tuberculosis treatment, no previous treatment stands any chance."[422] In fact, bed rest as part of sanatorium treatment was still understood to be of therapeutic value after the initial trials of antibiotics in the 1940s-50s. It was only with the Madras Study that the sanatorium was proven, by means of the randomized controlled trial, to offer no significant added benefit to the treatment of tuberculosis.

In addition to the main study, numerous follow-up and parallel studies were conducted by the research team. Some studies tested different chemotherapeutic combinations for different durations and intermittencies in order to determine the optimal treatment protocol, understood as short, minimal and effective. The results of these studies paved the way for the development of the globally-recognized "Directly-Observed Treatment, Short-Course" (DOTS).

From the beginning of the study, there was also a worry that treating subjects at home might have put their family members at greater risk of infection. Radhakrishna explained that "there was follow-up of close family contacts for at least a year, and preferably for five years, to see if [home-based] treatment had endangered contacts." Follow-up studies after one, two and five years showed that the family of the home-based wing was at no greater risk of infection than those of the sanatorium-based subjects.[423] If anything, treatment reduced the infectivity of

[419] Cited in Amrith 2004:124 and Valier 2010:223
[420] Valier 2010:223
[421] TCC 1959:128
[422] Condrau 2010:76
[423] Andrews et al. 1960, Ramakrishna et al. 1961, Kamat et al. 1966

subjects. This had been the primary goal for the WHO, as articulated by Holm in his letter to Fox.

For the Madras-based research team, an equally important concern was relapse. Although the reduction of clinical symptoms and the improvement in radiological results were important measures in the Madras Study, the most important sign of therapeutic success was bacteriological. Since Koch's etiological discovery in 1882, no cure for tuberculosis would be worthy of the name unless it eradicated the cause of the disease. If bacteria survived the treatment, even in minute quantities below the threshold of detection, there was a danger that they could repopulate. This was a threat on the level of the individual, but there was an even greater risk at the level of the population. In discussing those patients who developed drug-resistant strains during the initial study, the 1959 report repeatedly described them as a "source of danger to the public health" and a "public health risk."[424]

Follow-up studies were conducted in order to determine whether the cure truly stuck. Were these patients really bacteriologically negative, or were the bacteria in hiding? Of the 130 study subjects who showed no bacteria at the end of the first year, 90% remained clear throughout the four years of follow-up. The relapse rate was about equal between subjects from both wings of the study. The majority of these relapses occurred in the first year following treatment. Relapse has become a critical term in the language of tuberculosis treatment. According to Azhar, about 24% of all patients treated under India's current Revised National Treatment Control Program (RNTCP) are being *re*treated. Reviewing studies from across India, Azhar concludes that about 10% of all patients treated by RNTCP go on to relapse, primarily within the first year. In the absence of widely-available and affordable molecular diagnostic tools, it remains an open question as to what proportion of cases classified as relapse might be caused by new infections, as well as what proportion of new cases might be caused by the repopulation of old bacteria.

In spite of criticisms of methodology or outcome, the Madras study was lauded as providing the first evidence from a randomized controlled trial that sanatorium treatment was an unnecessary and expensive addition to the treatment of tuberculosis. In what was conceived of as the worst of conditions – abject poverty, tiny dwellings with limited air circulation, little rest, hard labor and perennial malnutrition – the majority of patients not only became clear of the pathogenic bacteria but remained clear of it over five years. The broader implication of the study was clear to the many observers involved in tuberculosis control around the world: if antibiotic therapy could work in India, it could work anywhere.

The longer that patients lived without relapsing, the greater the confidence in the curative power of antibiotics. While Fox was careful to describe patient improvement in terms of clinical, radiological and bacteriological signs in the Madras Study and its sequelae, he eventually became more comfortable describing the results in terms of a cure. Non-relapse stood as a kind of negative proof that tuberculosis had been cured. Although the possibility of relapse or even re-infection always haunted the security of the cure, particularly in the first year after treatment, this possibility diminished significantly over time. In 1962, Fox recommended offering free treatment as a way to encourage patients to come to the clinic earlier, arguing that this would lead to "improved prospects of cure."[425] In 1971, Fox wrote that "standard regimens given for 18 months or more … should cure nearly all patients."[426] In 1979, Fox published an article in which

[424] TCC 1959:91, 93, 126
[425] Fox 1964:137
[426] Fox 1971:569

he described the various cure rates of different drug combinations. He argued that shorter therapeutic courses offered patients a "quicker cure."[427] In a 1982 lecture at the Royal College of Physicians in London, Fox spoke at greater length about these differential rates of cure in relation to the duration of the treatment.[428]

The results of the Madras Study and other similar randomized controlled trials lodged the antibiotic cure of tuberculosis somewhere between the two meanings of the word described at the beginning of this chapter. The antibiotic cure was not a cure for a singular sufferer, but rather a cure for a disease held in common by many sufferers. At the same time, the antibiotic cure was not quite a cure for all of these sufferers. Taken together, the concepts of "relapse" and "cure rate" placed a limit on the universality of the cure. Antibiotics, either alone or in combination, could not cure everyone of tuberculosis. The science of statistics taken together with the randomized controlled trial made it possible to speak in terms of percentages. The threat of relapse, however small, also put a temporal stricture on the cure. The longer a subject avoided relapse, the more likely it is that they were cured. If the sanatorium was a cure for the few, antibiotics without the sanatorium promised to be a cure for the masses.

Or at least for a percentage of them.

[427] Fox 1979:793-4
[428] Fox 1983:102, 103

BERLIN, AGAIN

It if it true that tuberculosis had at some point declined in India, the dramatic return of the disease in the last few decades has been helped along in no small part by the emergence of HIV. In India, tuberculosis is the most common "secondary" infection of people living with HIV. This retrovirus is understood to compromise the immune system, greatly increasing the risk that infection with *Mycobacterium tuberculosis* will progress to a symptomatic state.

HIV was first detected in 1986. In that year, a microbiologist named Suniti Solomon read about the spread of HIV in Europe and the United States. Curious about whether HIV had made its way to India, she grabbed one of her research assistants at Madras Medical College and scrambled over to a government lock-up in Mylapore (a neighborhood in Chennai) into which female sex workers were rounded up every evening and released in the morning. Taking advantage of this unfortunate window of opportunity, Solomon drew blood samples from these women and sent them off for testing to a laboratory with greater diagnostic capacities than she had available at her college. These laboratory results indicated that HIV had in fact arrived in India. These cases would signal the beginning of an epidemic that would spread throughout the country.

Taking early retirement, Solomon began a hospital dedicated to caring for people with HIV. Twenty-five years later, the hospital continues its work in Chennai. Since those early days of purely palliative care, much has changed – the introduction of antiretroviral drugs, the development of generic medicines and free government treatment. Until 2004, antiretroviral drugs were available in India only at high cost, when the Indian government initiated a slow roll-out of these drugs at selected medical facilities – including at the hospital founded by Dr. Muthu. Media campaigns and medical professionals throughout India regularly make claims about the curability of tuberculosis with the use of antibiotics. But the availability of antiretroviral drugs in India, and elsewhere, has only transformed HIV/AIDS into a chronic condition, not a curable one.

In 2011, I was conducting research in Solomon's hospital, speaking with doctors, patients, laboratory technicians and nurses about HIV and tuberculosis treatments. One morning, I heard a patient telling his doctor that he has seen an article in the paper about a cure for HIV. The patient wondered whether the cure was available at that clinic. The doctor responded quite simply that there was no cure, but that the existing medications would keep the patient healthy. He later explained to me that there was a cure – in a sense. He explained that the procedure was dangerous, and unfeasible in an "Indian setting." Later, I overheard a counselor at the hospital also being asked about the cure. He evaded the question, noting that the moment there was a cure, it would be provided to the patients at the hospitals.

What does it mean that there is a cure for HIV, but only "in a sense?"

To begin to think about this question, I turn to an article published in 2011 in the journal *Blood*, entitled "Evidence for the cure of HIV infection by CCR5Δ32/Δ32 stem cell transplantation." In effect, the authors of the study claim to have cured AIDS in a single patient.

Timothy Ray Brown, the "Berlin Patient." Photo by Peter Rigaud.

After a period of hesitation, many eminent scientific authorities have come out in support of the finding that Timothy Ray Brown – better known as the "Berlin patient" – is in fact cured. Brown was diagnosed with HIV in 1995. He began taking antiretroviral drugs about six years after his initial diagnosis, in order to suppress the replication of the virus in his body. Brown had moved to Berlin and experienced none of the opportunistic infections associated with HIV. But in 2006, he was suddenly diagnosed with acute myeloid leukemia. He was referred to Gero Hütter, a hematologist at Charité Medical University.

Brown was initially treated with chemotherapy, suffering severe liver toxicity and kidney failure partially due to the interaction of the two drug regimens. Several months after treatment, the leukemia relapsed. This time, Brown received a bone marrow transplant. Radiation and chemotherapy were used to destroy malignant cells and suppress Brown's existing immune system so that the transplant would not be rejected. But after the transplant, the leukemia relapsed yet again. The doctors once more performed a bone marrow transplant. In both cases, stem cells were drawn from the same donor.[429]

Brown's leukemia continues to be in remission. Surprisingly, so does his HIV.

This development is the result of a pair of mutations. The CCR5 gene typically codes for the CCR5 protein, which is found on the surface of the white blood cells that HIV tends to infect. The protein envelope of the virus interacts with the CCR5 protein, using it as a receptor site to bind with and infect the white blood cell.

The donated bone marrow had a pair of the CCR5-Δ32 alleles, presumably found in 5-12% of people of European descent. The CCR5-Δ32 variation of the gene, however, is a deletion mutation. It codes for the *absence* of the CCR5 protein. No protein, no infection.

In the popular media, the story of Timothy Brown and Gero Hütter has been recounted as the tale of a normal patient and a normal doctor who had a moment of inspiration. Hütter had no expertise in HIV, but was able to piece together standard practice (bone marrow transplant) and existing knowledge (Δ32 mutation) into something radically new.

Although the consensus seems to be that Timothy Brown is cured, there have been no claims that HIV is curable. More specifically, Brown has been described by many medical experts as "functionally cured."[430] The idea of "functionality" points to the fact that the virus

[429] The details of these procedures are drawn from Hütter et al. 2009.

[430] Robert Gallo, one of the co-discovers of the HIV virus, has used this description. Anthony Fauci, the director of the U.S. National Institute of Allergy and Infectious Diseases and a prominent voice in HIV research, prefers to more cautiously refer to the phenomenon of the Berlin Patient as a "sustained remission that doesn't require therapy."

may return, but for the time being, Brown is "as if" cured.[431] Although the virus cannot be found in his body, it may exist at extremely low levels below the threshold of detection. But Brown no longer requires antiretroviral drugs to keep him alive, to suppress the viral levels in his body. In that sense, he is "functional" without the supplement of these drugs.

A "functional cure" is pitted against a "sterilizing cure," in which the virus is completely purged from the body and there is no chance of a return. It is between these two poles that the question of relapse comes into play, both for HIV and for tuberculosis, as I described in the previous section. If small amounts of the virus remain in Brown's body, there is a chance that they may begin to replicate and mutate to take advantage of receptor sites other than CCR5.

For this reason, the language of remission has also become prominent for describing this new cure. More recently, two other patients were cured in a similar fashion, but the bone marrow was not from donors with the Δ32 mutation. In those cases, the idea was that the pre-transplant radiation would destroy or "weaken" the existing white blood cells and the HIV harbored within them. The doctors expected that the transplant would lead to graft-versus-host disease, a condition in which the newly introduced white blood cells would destroy the recipient's now-weakened original cells. During this conflagration between rival immunities, antiretroviral drugs would be administered to keep the virus from replicating any further and infecting the donor white blood cells. Eventually, the new cells would destroy and replace the old ones, and the antiretroviral drugs could be stopped. For many months, these patients were considered functionally cured, like the Berlin Patient. The hope was that this modification of the cure would make unnecessary the screening process for the rare Δ32 mutation.

In December 2013, researchers announced that the virus had returned in these two patients, infecting the donated cells. The patients were back on antiretroviral drugs. This cure was found to be temporary, and these patients had been returned to a state of chronicity. Instead of being cured, they were now figured as having been in remission, from which they had relapsed. Timothy Ray Brown remains alone. The cure for HIV is, for now, a cure for one.

Brown's "functional cure" has provided researchers and patients with a glimmer of hope, as well as increased public and private funding for cure research. In the scholarly literature, the Berlin Patient is repeatedly referred to as a living "proof of concept." Although the cure has been demonstrated, questions of technicality and scale remain to be resolved.

In the fourteenth century, the notion of cure expanded to include not only the cure of an individual sufferer, but the cure of a disease. In this case, the Berlin Patient was cured, but HIV was not. A single person was cured, but not a disease. Given the risks inherent to performing a bone marrow transplant, the difficulty of finding suitable donors and the existence of alternative treatment, there have been no attempts to perform a randomized controlled trial of this new cure. This new cure for HIV, developed in Berlin, sparked the hopes of these patients in a small South Indian clinic – similar to the way in which an old cure for tuberculosis, also developed in Berlin, but over a century ago, drew attention from around the world.

[431] Compare to Cohen (2004) on the project of mass sterilization in India, in which a seemingly non-modern population that lacked the will to self-regulate pregnancy and birth was (often forcibly) provided with a supplement, the sterilization surgery, in order to yield an "as if modern" subject.

SURVIVALS

In a time, but not of it

Some things perish. Others persist, or mutate into new forms, as was the case with *Mycobacterium Tuberculosis* after the introduction of antibiotics in the mid-twentieth century. Something that has not endured, at least in the discipline of anthropology, is the Victorian anthropologist Edward Burnett Tylor's notion of the survival. For Tylor, survivals were ideas, artifacts, affects and practices that lingered on past their time – a time in which they had made meaningful and functional sense. Survivals were powerful relics that quietly gestured to a past that no longer existed. But unlike museum pieces, survivals lived out in the open, taking part in worlds foreign to their origins. In Tylor's framing, survivals were lifeboats on the tides of social evolution, swept forward in time while everything around them changed.

Societies, it was found, did not progress on a trajectory through already-known stages. After social evolutionism and its predecessors fell out of fashion, the question of something "fitting" in with a particular time and place seemed to be the wrong kind of question. The search for origins that marked evolutionist and diffusionist thought gave way to a focus on function and structure. Within these modes of analysis, the survival offered a convenient way of explaining away inconvenient data. Lévi-Strauss, for example, chided his colleagues for mistakenly labeling certain practices or kinship formations as survivals, while at the same time identifying survivals of his own.

In the deeply historicist anthropology of the current moment, and in the even more pervasive historicism that characterizes South Asian studies, artifacts that at first glance appear to be from an earlier time – such as caste – are often found after careful ethnographic and historical study to be quintessentially modern.[432] Once focused on the timeless past of traditional societies, the discipline of anthropology has in recent decades survived its critique and turned to the new, the emergent, the virtual and the cutting-edge. In part, this is due to the challenge posed by postcolonial studies and the influence of science and technology studies, of Bateson and Foucault, and more recently, Bergson and Deleuze.

In this chapter, I focus on the has-been that continues to be. How does that which was once understood to be innovative and meaningful come to be taken as anything but, not just ordinary but hopelessly passé? I think of the survival as an orphan, a sort of thing that lives on long after the social relations originally proper to it have faded away. Although it is important to ask about how new things emerge, it remains equally important to ask about how old things persist.

Without subscribing to Tylor's evolutionism, I ask in a Tylorian vein about various kinds of survivals in relation to tuberculosis in India. What can be made of the persistence of century-old technologies and techniques – like x-rays and sputum microscopy – for diagnosing tuberculosis in hospitals across India? How are such technologies, once understood to be innovative, transformed in the present moment into old things? To begin to answer these questions, I turn to a tuberculosis hospital in Chennai.

[432] Dirks 2001

Diagnosing Immune Reactions

The facility once known as the King Edward VII Memorial Tuberculosis Institute is comprised of a large domed building that must have shone a brilliant white before becoming encrusted in dirt. Despite its fading exterior, the ground floor of the hospital continues to be in use during the mornings, as an outpatient clinic for tuberculosis patients, neatly divided into special areas for men and women. At the top of the grand staircase that swings up the center of the building, an atrium houses a few offices and an enclave of bats clinging to the high ceiling.

When this hospital was first established in the area of Madras known as Chetpet, the neighbors on Spur Tank Road put up quite a protest. Fearing some manner of contagion, the denizens of this densely-populated locale complained that carting in sick patients from around the city would put them at risk. Their concerns were summarily overruled by the Madras Legislative Assembly and the hospital was built with support from the King Edward Hospital Fund, a benevolent organization that survives into the present but no longer builds hospitals. Then, as now, such gifts do not often go unmarked. On the ground floor, a foundation stone laid in 1917 by Lord Pentland, the Governor of Madras, commemorates not only the generosity of the Fund, but the relationship between medical infrastructure and colonial power.[433]

In the 1950s, the Indian government constructed a facility in the shadow of the hospital, in an adjoining plot behind the hospital grounds. While the King Edward VII Institute served primarily as a treatment facility, this new building was a space of research, the operating center for the Madras Study. The Tuberculosis Research Center has been recently renovated, rendering it both minimalist and quite shiny, in stark contrast to the older facility, which is quite literally an Edwardian relic. Patients from the old hospital who fit specific criteria are recruited from the old hospital into various studies at the newer center, which is regarded as a cutting-edge medical research facility.

In early 2012, I spent some time at this older hospital, to learn about how tuberculosis is diagnosed in contemporary India. In the present moment, the methods of diagnosing tuberculosis are multiple. One of the most commonly used exams around the world is alternatively referred to as the Mantoux or PPD (purified protein derivative) test. This diagnostic method makes use of tuberculin, a glycerol extract of *Mycobacterium Tuberculosis* that was pioneered by Robert Koch in 1890.[434] Koch was the first to describe the reaction produced on the skin at the site of injection. Although Koch's dream that tuberculin could act as a cure was short-lived, his "brownish transparent liquid" became the basis of one of the most widely used tests for tuberculosis.

In contemporary practice, tuberculin is injected between the layers of the skin. Within seventy-two hours, patients who have been previously exposed to *Mycobacterium Tuberculosis* are expected to exhibit an immune reaction in the form of a raised hardened mass at the site of injection. The diameter of the induration is measured, in millimeters. In the various clinics in which I worked in India, I only saw this test performed once: for a visiting physician from the

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[433] The foundation stone is inscribed with the following words:
King Edwards VII Memorial Tuberculosis Institute
[Foundation stone] Laid by Lord. Pentland P.C.G.C.I.E.
Governor of Madras
on 16th July 1917
Opened May 8, 1921
By Lord Willingdon
Governor of Madras

[434] See the chapter entitled "Cures" for more on Koch's tuberculin.

United States who was required to take the test as per the stipulations of her Fulbright grant. The Indian government no longer includes the Mantoux test as part of its official diagnostic procedure. As a doctor at the Chepet hospital named Subash put it, the Mantoux test was tantamount to "a coin toss." This was perhaps even more the case in India due to mass vaccination campaigns with the Bacillus Calmette-Guérin (BCG) vaccine that began in the middle of the twentieth century. The BCG vaccine was rolled-out to much of Europe in the years following the Second World War, as part of reconstruction aid. Shortly thereafter, vaccination campaigns were extended into former colonies like India.[435] Numerous studies have demonstrated that the BCG vaccine is largely ineffective over a ten-year period, although it does confer limited immunity to children by preventing tuberculous meningitis –infection of the brain – and miliary tuberculosis – a disseminated form of the disease.[436] Despite the limited efficacy of the vaccine, it enjoyed and continues to enjoy much popularity among both clinicians and the public.

Prior inoculation with the BCG vaccine, however, as well any earlier infection with *Mycobacterium Tuberculosis* that has since resolved, can result in false positives on the Mantoux test. These tests still proliferate in private clinics and hospitals throughout India. During one of my visits to the hospital in Chepet, a woman named Kausalya came with her young daughter, a cheerful child wearing earrings shaped like bells and a beautiful flower *pottu* on her forehead. Kausalya anxiously clutched the results of her daughter's Mantoux test in her hands. Dr. Subash took a look at the paper and shook his head. On the left arm of Kausalya's daughter, a raised scar revealed that she had received the BCG vaccination when she was younger.

"According to the WHO, it's useless," Dr. Subash said, speaking both pedagogically and out of annoyance to the junior doctor next to him. "Some other hospital must have done this test," he said to Kausalya. She explained to Dr. Subash that she had taken her daughter to "private" first (i.e. a private hospital), where the exam had been performed.

"Even if I took the test, I'd have it [a positive result], but it doesn't mean that I have the disease," Dr. Subash explained to Kausalya. "You need an x-ray and sputum test to find out," he said. He wrote out a prescription for these tests and handed them to Kausalya.

The logic of immunity was also central to tuberculosis diagnostics based on blood. Although the bloody cough has been a well-recognized sign of tuberculosis since at least the Romantic period, contemporary blood-based diagnostics detect antibodies in the body. On-site rapid serology tests were in use among many private practitioners in India, both in large hospitals and in small practices. The problems of serological testing were presented to me during a meeting in Delhi with Dr. Peter Small, a former professor at Stanford and the head of the Gates Foundation's tuberculosis program in India. Similar to how I had heard the Mantoux test characterized, Small described serological testing as "flipping a coin." Review studies of the use of serology for diagnosing tuberculosis had concluded that these tests were oversensitive, inaccurate and not cost-effective.[437]

Small had recently been on a tour across India, visiting hospitals and clinics to learn about their diagnostic practices. He pulled out a handful of testing kits that he had collected, souvenirs of his travels, and threw them on the table in front of me in disgust. He pointed to a particular kit, explaining that he had retrieved it from a clinic in Karnataka. The test itself was

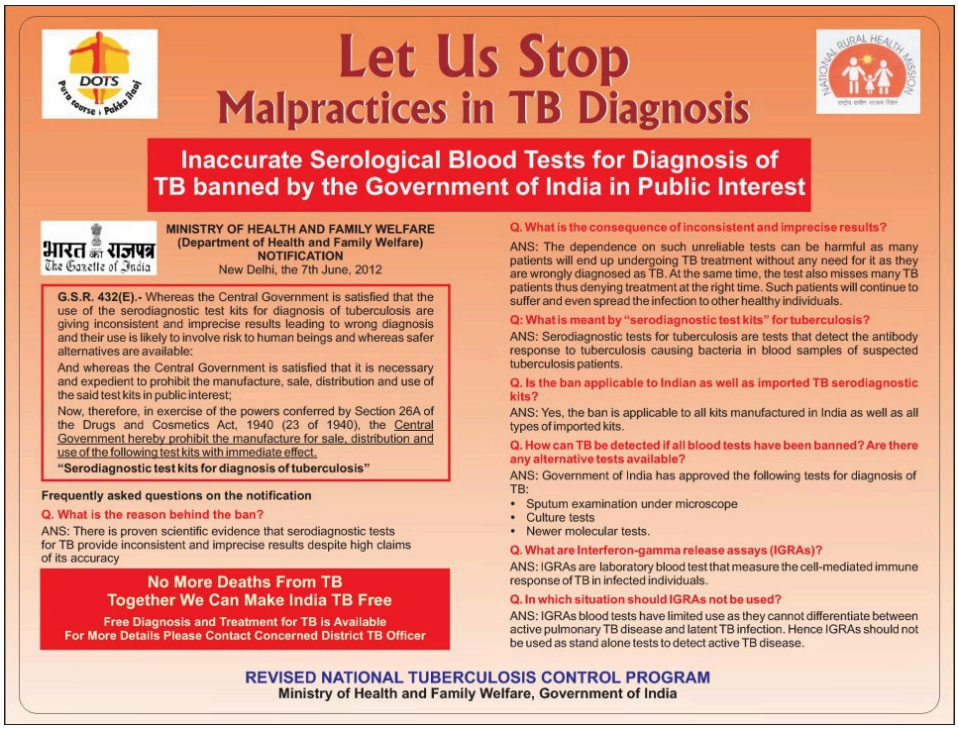
[435] See Brimnes (2006, 2007) for a history of the BCG vaccination campaigns in India.
[436] Mankodi and van der Veen 1985
[437] For more on the problems of serological testing, see Steingart et al. 2007, 2011, Dowdy et al. 2011, Jaroslawski et al. 2012, Grenier et al. 2012

owned by a San Diego-based company but manufactured in China. Patients were typically charged about Rs. 150 per test, Small explained. He speculated that Rs. 50 went to the doctor, Rs. 50 went to the San Diego-based firm and the remainder went to the manufacturer, Beijing-based CTK Biotech.

CTK Biotech's line of serological tests for tuberculosis

Small was deeply upset that these tests were in such wide circulation. "There should be legal ramifications for using this test," he insisted. His irritation was aimed at the owners and manufacturers of these serological testing kits, but also at doctors who continued to make use of these tests. "Why do unqualified people use these idiosyncratic techniques?" he asked me. Was it for financial reasons, he mused? Or perhaps doctors in India lacked proper education and training? Or maybe Indian doctors had an "I know best" attitude and were unwilling to change their ways? I shrugged in response, uncomfortable with the kind of motive-driven models of behavior that Small seemed to be presenting.

Small was not alone in his indictment of serological testing. In response to a series of studies demonstrating problems with serological testing, the Government of India issued a ban on the use of such tests in the middle of 2012, terming such forms of diagnosis "malpractice." It remains unclear, however, whether the government has the means to enforce this ban. To my knowledge, serological testing was not typically performed in government facilities. At the hospital at Chetpet, physicians followed government diagnostic protocols, making extensive use of both X-ray imaging and sputum microscopy. But as I learned, even these diagnostic forms were far from transparent.



Government of India announcement of ban on serological tests for tuberculosis, issued in June 2012

Shadows

One of the clinics in which I worked was to the side of the main dome of the Chetpet hospital, a box-like building made of concrete. Reminiscent of the design of the sanatorium, the room was open to the elements with only three walls and a pair of windows cut out from the back. A couple of fans hung on the ceiling, offering a steady buzz as background to the bustle of the clinic.

This room was one of the hospital's male outpatient clinics. The waiting area was just a narrow space adjacent to the clinic room. A few patients sat, but many stood attentively peering in through the doorway, awaiting their turn to see a doctor. A few of the patients wore facemasks, while others clutched bandanas or handkerchiefs to their mouths. Many of the patients wore the telltale grayish-brown button-up uniforms of auto rickshaw drivers. As a government facility, diagnosis and treatment at this clinic was technically free. As such, the majority of the patients seemed to be poor or working-class. Visible through the open wall, a group of patients stood outside in an attempt to escape the heat. Some leaned against trees, waving recently developed X-ray images in the air like yesteryear polaroid photos.

It was a March morning, and the air flowed easily through the room in the absence of any serious obstruction. Four rough-hewn wooden tables were arranged throughout the room, each covered by a flower-patterned cloth. That morning, only two were in use. I sat at one of the tables with Dr. Amutha and Dr. Prabha. Taking advantage of lulls in the flow of patients, Dr. Prabha and Dr. Amutha would discuss everyday matters – one day, for example, Dr. Prabha spoke critically of a nurses' strike taking place at the other hospital where she worked, considerably adding to her already cumbersome workload.

Dr. Amuthu was in the middle of asking a patient a litany of questions that I would hear repeated with each new patient: "Trouble breathing? Cough? Phlegm? What color? Anyone in

your family with tuberculosis? Have you taken medicine for TB before? Sleeping okay? Fever? Any pain in the face? Diabetes? Are you taking your medications regularly? Do you smoke cigarettes? How about *bidis*? For how long? Since when?"

The questions came quickly in Tamil, in a flurry of incomplete sentences. With so many patients waiting to be seen, the doctors attempted to diagnose and prescribe either medications or further tests as rapidly as possible. It was only when a patient or their caretaker answered one of the questions in the affirmative that Dr. Amutha would pause and make a more thorough inquiry. She explained to me that there were certain symptoms that were strongly suggestive of tuberculosis. You check for a cough of two weeks or longer with expectoration, she said, especially if accompanied by blood. You ask whether a fever becomes more severe in the evenings. You find out if the patient experiences night sweats. If these signs are present, she explained, then you suspect tuberculosis.

As one of the primary government-operated hospitals in Chennai that offered tuberculosis care, patients came from all over the state to be seen by the doctors there. Similar to other hospitals where I had worked, patients were seen in the morning, so that there was adequate time to get X-rays taken. Patients also lined up in the mornings to give sputum samples, coughing into plastic containers that would be processed over a period of two days.

Before or after moving through this stream of questions, Dr. Amutha would look over the notebooks, records and other files that many of the patients carried with them. Long-term patients, who had been coming to the clinic for months, or even years, tended to carry ruled notebooks, the kind that could be purchased at many street-side shops in Chennai, and the same kind that children carried to school. Dr. Amuthu and the other doctors would record their findings in these notebooks and return them to the patients.

That morning, an old man named Murugesan arrived complaining of a cough that had been bothering him for the past month. He explained to Dr. Amutha that he had been diagnosed with tuberculosis ten years earlier, but that his condition had been cured with treatment. Murugesan spoke without waiting for Dr. Amutha's standard repertoire of questions, and began telling her about his business endeavors. He then pulled a large sheaf of documents out of the cloth bag that he carried with him and handed them to Dr. Amutha. Amid these papers were reports from prior laboratory examinations and old prescriptions, the vestiges of medical diagnoses and treatments over the years. The papers were of different sizes, bearing the names and logos of various hospitals, physicians and private diagnostic laboratories. Dr. Amutha halfheartedly leafed through these documents before removing her stethoscope from around her neck. She pressed it against various points on Murugesan's chest and back, squinting her eyes in concentration.

Removing the stethoscope, Dr. Amuthu grabbed one of the small pre-printed forms in front of her and made out a prescription for sputum and blood analyses, as well as for a chest X-ray. Only certain approved tests, listed on the form in Tamil and English, could be performed at this hospital. Anything else would require the patient to go elsewhere, limiting the forms of diagnosis that were possible at the hospital and setting the stage for outside referrals. Dr. Amutha pushed the form across the table to Murugesan, who picked it up and walked slowly out of the clinic, peering at the small sheet of paper in his hand. This small square of paper, like most referral letters, X-ray images and laboratory results produced at the hospital, would never make it into an official file. If a patient was suspected of having non-pulmonary tuberculosis – an infection located outside of the lungs, for example in the lymph nodes or the spinal cord – then Dr. Amutha would refer that patient to one of the larger general hospitals for a biopsy or to have

a sample of cerebrospinal fluid drawn. In order to receive treatment, the patient would then have to return to this hospital, or to another government-designated tuberculosis treatment center, carrying proof of their diagnosis.

In the constant play of referrals and deferrals, the "go elsewhere" or "come back next week," patients were saddled with an ever-growing quantity of documents. These papers became part of the mobile archive that patients were required to cart around and preserve for the future. Patients often lost track of the many medical documents and images that they were expected to self-archive. For migrant workers subject to frequent displacement, maintaining such records was no easy task.

In many cases, these documents would warrant only a cursory glance from a clinician. But in other situations, having the right documentation could mean the difference between receiving treatment and becoming caught in another cycle of referrals and deferrals. If accepted for treatment and enrolled in an official DOTS program – "directly-observed treatment, short course" – then a standardized chart would be kept at the clinic to record that the patient had received each of the doses at the proper time. This sort of limited record keeping was tethered to the framework for DOTS that was in use around the world, in an effort to ensure patient adherence to treatment and minimize the chances of drug resistance.

On another morning, I observed Dr. Prabha as she consulted with a male patient on the other side of the table. Earlier in the day, he had come in complaining of a blocked nose. He returned with the X-ray prescribed by Dr. Prabha. Without conversation, she unceremoniously snatched the small X-ray from his hand – no bigger than three inches by three inches – and held it up against the open wall to get a bit more sunlight. Unlike other private hospitals and even the government research facility next door, the clinic had not installed backlit light boxes to illuminate X-rays – instead, sunlight served this purpose. "His X-ray is good," Dr. Prabha commented to no one in particular. Ruling out pulmonary tuberculosis, she wrote out a referral for him to see an ear-and-throat specialist at the general hospital.

As soon as the patient left Dr. Prabha's side, another took his place. He too had come in earlier and been sent to get an X-ray. Dr. Prabha once more took the image in her hand and held it to the light. She pointed to a dark ovaloid shape in the right upper portion of the lung. The lighting was uneven, the entire right side darker than the left. But Dr. Prabha appeared to have no difficulty with this variation in brightness. "It's definitely there," she remarked, ordering the patient to go to another part of the hospital and give a sample of sputum. Dr. Prabha explained to the patient that he would have to take medication for six months, after which his condition would resolve. Even before seeing the results of the sputum examination, Dr. Prabha seemed certain of the patient's diagnosis and prognosis. All it had taken was a glance. She explained to him that he needed the medication because he had tuberculosis, but if he followed the dosing schedule, he would be cured at the end of six months. At the same time, she did not pursue treatment on the *presumption* that he had tuberculosis – she still followed government protocol by ordering the sputum test. If the results of the sputum analysis came back negative for *Mycobacterium Tuberculosi*s, it was likely that Dr. Prabha would either ask for a re-test (deferral) or send the patient elsewhere (referral).

Later that day, a pair of grey-bearded men came to our table. The older man was missing most of his teeth. The younger man did most of the talking, speaking with Dr. Prabha about the older man's condition. He handed her the older man's X-ray, a standard size image quite a bit larger than the three-by-three inch images that were generally used in the hospital. Dr. Prabha took the X-ray hesitantly and held it to the light, peering at it intently. After about a minute, she

let out a sigh of frustration and handed the image to Dr. Amutha, asking her for her opinion. Dr. Amutha made an attempt at examining the image, before passing it back with a shrug. Dr. Prabha turned to the younger man.

"It's hard," she began to explain. "The X-ray is too big. It's hard to see on the big X-rays after you get used to the small ones." She instructed the younger man to take his companion to get a smaller X-ray – an MMR – from the hospital lab. The image would be processed in two days, she explained. They would have to come back then to receive a diagnosis.

Developed in 1935 and used as a screening tool for tuberculosis across the world, the mass miniature radiogram, or MMR, is a smaller, cheaper version of a normal-sized X-ray. Although I had seen regular-sized X-rays used in private hospitals, the staff at the Chetpet hospital largely depended upon MMR images. Dr. Prabha and Dr. Amutha had received much of their tuberculosis-specific training at the Chetpet hospital. Having learned to read radiographic images of the chest at a particular size, they seemed unable to transpose their fluency across scales. Patients would often show up with different size X-rays, at different exposures, usually from private clinics or diagnostic centers. For the doctors, who were trained with and accustomed to the MMR images produced in their own hospital, such images posed a serious problem of interpretation.

The grey-bearded men were clearly concerned about Dr. Prabha's instructions. The two of them worked in Kanchipuram, about seventy-five kilometers from the hospital. To cover the distance and arrive during the clinic hours, the men had taken the day off work. When confronted with deferral or referral, patients often spoke anxiously about missing work. Patients feared that taking time off to visit the clinic would put their employment into jeopardy. Many of the patients were migratory laborers, coming from the neighboring state of Andhra Pradesh to find temporary employment in Tamil Nadu. Employment was difficult to come by and often intermittent – to take time off was to take the serious risk of losing already precarious employment opportunities. Patients also feared that co-workers or employers would suspect that their reason for missing work was related to illness. With or without a sound basis, rumors of illness could also lead to losing a job. Practices of deferral and referral forced patients into a dicey calculus – continue going back to this clinic, or another, in the hope of diagnosis and treatment, and risk unemployment; or continue to work without treatment, and risk even greater illness.

In this particular government hospital, diagnosing tuberculosis was an affair that extended across multiple spaces and many days. In another hospital located across town, a private hospital for HIV patients, time and space were more compressed as I witnessed patient after patient diagnosed with tuberculosis. I asked a friend at the hospital, a doctor named Shanta, why tuberculosis seemed to be so ubiquitous among the HIV patients there. Motioning around her, she explained it this way: "Everyone has TB. Either they've had TB, they have TB or they will have TB." Tuberculosis is the most common co-infection related to HIV, in India and across the world. *Mycobacterium Tuberculosis* is understood to take advantage of the weakened immunity of an HIV-positive person and move quickly from infection to symptomatic disease. As an "opportunistic infection," tuberculosis was particularly effective, manifesting in HIV patients who were still deemed too healthy to receive antiretroviral drugs by the then-standards for white blood cell count.[438]

The HIV hospital had made use of regular-sized X-rays, pressed against wall-mounted

[438] At the time, patients had to have a CD4 white blood cell count of less than 200/mm3 to begin treatment, or manifest an opportunistic infection. Patients would quite often show signs of tuberculosis well above this threshold.

light boxes to be exposed to the interpretative powers of the clinician. I remember Dr. Vijay in particular, who would quite confidently profess the existence of lesions after looking at an x-ray. He would point them out to me, tracing his finger along the image where the shadows swerved and the darkness congealed to indicate a pathological formation. Often times, treatment began before the results of a sputum exam on the basis of what was called a presumptive diagnosis. But even when the bacteriological results came back negative – when the laboratory technician was unable to find bacteria in the sputum – Dr. Vijay would begin what is called empirical treatment, arguing that the X-ray image suggested tuberculosis even if the bacteriological result showed otherwise.

Both the analysis of X-ray images and sputum results elicited a great deal of uncertainty among clinicians. In those quiet moments in the clinic, when the rush of patients receded, I heard clinicians express their doubts. On one of my first visits to the HIV clinic, I asked an intern what he looked for in an X-ray when he was looking for tuberculosis. He was taught, he said, that tuberculosis looked like cotton candy near the middle sternum, which is located at the center of the front of the chest. I began searching for cotton candy in each of the X-rays presented to the doctors. When I asked Dr. Shanta to re-examine an X-ray image that Dr. Vijay had already pronounced as suggestive of tuberculosis, she expressed her doubts to me. "I just don't see it," she said. A suggestive image could all too easily turn out to be a play of shadow and light, an over- or underexposure, a technological chiaroscuro.

Numerous studies have demonstrated the high rates of inter- and intra-rater variation in the interpretation of X-rays. These inconstancies are often framed in terms of observer bias, a problem of a subject who cannot remain the same over time, and of a collective subject that is perhaps unclear on what can be made of a play of shadow and light. There is no doubt that X-ray images can elicit uncertainty. But in the early years of radiography, X-ray images seemed to do the opposite, by making it possible to see into the living body without cutting it open.

The history of X-ray imaging has been largely written in terms of a history of discoveries, both deliberate and inadvertent. These histories typically begin with the German physician and physicist William Konrad Roentgen, who developed the X-ray in November of 1895 while experimenting with various vacuum tubes. Roentgen immediately publicized his results, exhibiting what he called "shadow pictures" of his wife's hand in a talk before the Wiirzburg Physical and Medical Society.[439] From there, various thinkers and tinkerers adopted and adapted the X-ray, rendering it a tool of diagnosis and eventually treatment. Along the way, the X-ray was discovered to be a pharmakon, with both therapeutic powers and malignant capacities. Cancer, amputation and death plagued those early X-ray technicians who had too eagerly embraced this new technology.

The first use of X-ray technology in India was likely during the military campaigns at the Northwest Frontier of India, in 1897. A Surgeon-Major in the British army named W.C. Beevor had taken the X-ray apparatus with him into the midst of war. Beevor praised the value of these "Roentgen rays," as X-rays were called, for guiding surgical intervention. The radiographic image, he declared, had provided surgeons with "the power of investigating, by ocular demonstration, the condition of the interior of the body."[440] For the first time, the body's interior spaces could be made visible to the eye of the expert surgeon or physician, without first cutting the patient open.

[439] Roentgen 1895
[440] Beevor 1898:1152

Through the images produced by this technology, surgeons could identify not only damage done to bones, joints and organs, but also localize bullets, shrapnel and other foreign objects that penetrated into the body during the course of battle. Beevor bemoaned in particular the difficulty of dealing with bullets, which often went missing within the bodies of wounded soldiers. In regard to one patient, an Indian soldier who was part of the Gurkha regiment, he wrote: "The bullet had entered the thigh about its middle-third, and had simply been lost."[441] Beevor describes the Gurkha patient as recalcitrant, unwilling to have surgery until his condition worsened considerably. This unwillingness to be cut open could be circumvented, at least at the diagnostic stage, through the use of X-ray imaging.

During Beevor's time at the Northwest Frontier, bullets seemed to go missing quite often. Even with the use of a probe, there were cases in which Beevor lamented that "no evidence of the bullet could be got."[442] In regard to another case, he noted that a bullet had entered into the liver, but "where it had gone afterwards was a mystery."[443] In such instances, there "existed only the probability of a foreign body."[444] Beevor explained that most surgeons would be extremely hesitant to conduct repeated surgical examinations for a bullet that may or may not exist. After the bullet entered the body, it could compress, move, splinter or become overgrown by tissue. Like the bullet or the probe, the X-ray could efficiently pierce the body to produce an image of the bullet, but seemingly without harming the patient.

The military patients about whom Beevor reported were likely among the first Indians to experience this new technology. In addition to the Gurkha patient, Beevor remarked on a "native solider" who had been shot, although "no trace of the bullet could be made out."[445] The wound eventually healed and the Indian soldier went away for two months of convalescence. On his return, he applied for a pension in order to take permanent leave, complaining that he could no longer fully extend his arm. Beevor recounted that this Indian soldier "was suspected of what we call 'piling on the agony' a bit to get a pension and go home and be married."[446] After submitting the soldier's arm to an X-ray, Beevor learned, much to his surprise, that the man was not "humbugging" at all.[447] The bullet was located and removed.

Beevor also reported on the condition of various Sikh soldiers, two of whom were shot while "bravely defending their regimental transport mules at the point of the bayonet."[448] "Night had overtaken them," Beevor related, "and they were rushed at close quarters when in a river bed."[449] Several attempts were made to remove the bullets, but there was much swelling and loss of tissue. Beevor feared that at least one of the soldiers would have to face amputation. But with the aid of an X-ray image, a bullet was found neatly wrapped in a covering of skin and hair torn from the jacket of the soldier at the bullet's point of entry.

[441] Beevor 1898:1152
[442] Beevor 1898:1153
[443] Beevoer 1898:1159
[444] Beevor 1898:1159
[445] Beevor 1898:1153
[446] Beevor 1898:1154
[447] Beevor 1898:1154
[448] Beevor 1898:1154
[449] Beevor 1898:1154

Case VIII (Case IX. mislaid).

X-ray image of Sikh soldier's hand with bullet wound through middle finger[450]

In another case of Indian valor, a Sikh soldier had aimed his rifle toward a group of Afridis. In a stunning display of quickdraw and marksmanship, one of the Afridi combatants shot him first. The bullet had traversed the line of fire and passed through both of the Sikh's hands, entering via the middle finger. Again, Beevor had feared that amputation would be necessary. But by producing a series of X-ray images over time, Beevor was able to determine the extent of the injury and track the course of the healing process. The diachronic series of X-rays afforded surgeons like Beevor "the pleasure of watching" an internal injury heal over time, a process that was previously hidden from view.[451]

Beevor spoke passionately about the humanitarian value of X-ray technology in battle: "even in savage warfare, where the Geneva Convention is unknown, the X ray [*sic*] can be brought under control, and an immensity of human suffering obviated."[452] At the same time, creating an X-ray apparatus that was light enough to transport, sturdy enough to resist the elements, and simple enough to allow for makeshift repairs with available parts, was a serious challenge. Beevor related how a strong gust of wind had entered into his tent and smashed one of the X-ray tubes, and how the hot sun had melted the wax on the coils. The glass radiographic plates used for taking X-rays tended to break during transport, and Eastman's X-ray paper proved to be a poor substitute.

The X-ray apparatus itself weighed between eighty to one hundred pounds. In the Indian Northwest Frontier campaign, Beevor had hired four coolie laborers, who had previously worked as dhoolie bearers, to carry the apparatus across the treacherous terrain. As he put it: "After trying every kind of transport in India – mules, camels, wheeled vehicles, etc. – I came to the conclusion that by far the safest and most satisfactory in every respect is human transport."[453]

In light of the Surgeon-Major's success with X-ray technology at the Northwest Frontier, additional X-ray units were sent to the Egyptian colony and to research facilities across England. In the first few years after Roentgen's discovery of this technology, the entirety of the human body was quickly subjected to imaging by X-ray enthusiasts. The X-ray was put to almost

[450] The second image of the Sikh soldier's hand, taken some time after healing had begun, was mislaid during publication of Beevor's remarks.
[451] Beevor 1898:1158
[452] Beevor 1898:1161
[453] Beevor 1898:1161

immediate diagnostic use, especially in the effort to image pulmonary tuberculosis. Those early radiologists expressed much concern about seeing through the shadows of muscles and organs to distinguish those shadows proper to tuberculosis. They experimented not only with the positioning of the body in relation to the X-ray apparatus, but also with the strength of the X-ray, in order to achieve the ideal degree of penetration.

The problem of shadows in diagnosing tuberculosis was never fully resolved. In 1995, the ex-director of the Tuberculosis Research Centre, Dr. R. Prabhakar, gave a talk on the X-ray at a symposium dedicated to the radiographic diagnosis of tuberculosis. Prabhakar rehashed Roentgen's discovery of 1895, and claimed that X-ray technology had arrived in Madras within a period of five years. But ninety-five years later, he lamented, the same technology remained central to diagnosing tuberculosis. "In the diagnosis and management of pulmonary and extra-pulmonary tuberculosis," he wrote, "a great deal of emphasis (sometimes unduly) is laid on imaging and important clinical decisions are made on the basis of 'shadows'." Shadows could only tell you so much, he explained. "These technologies," he noted, "can never be considered as substitutes for eliciting signs and symptoms of the disease."

In spite of the very many doubts about the utility of interpreting shadows, X-ray imaging endures as a ubiquitous technology in India and enjoys a critical role in the Government of India's tuberculosis diagnostic protocol. X-rays persist as an imperfect means of seeing into the body, of diagnosing illness and gauging progress, of correlating external signs to internal physiological variations.

Roadside diagnostic laboratories across Chennai prominently advertise X-ray services, available for a relatively small fee. Many smaller hospitals without X-ray equipment refer their patients to particular laboratories with which they have established a relationship premised on trust and financial incentive. In many of the doctors' offices that I visited, calendars and other paraphernalia were emblazoned with the name of a particular diagnostic laboratory and the smiling faces of the technicians who worked there.

The X-ray is not simply ubiquitous – it has also been denigrated. In her work on the neighboring state of Kerala, Caroline Wilson describes how new medical imaging technologies became exceedingly popular in the 1990s, particularly in what are termed super-speciality hospitals. The Keralan doctors with whom she worked took X-ray imaging to be part of any basic investigation, and X-ray images to be legible to any clinician. The services of a radiologist were only required for the newer imaging technologies, which were both more expensive but also enjoyed a heightened technological aura.[454]

Although the production of X-ray images continues to require technical expertise and specialized equipment, X-ray technology has for the most part descended to the level of an ordinary, everyday tool. Supplanted by newer forms of technological visualization like CT scans and ultrasounds, X-rays have been refigured as crude and imprecise. Where once this technology afforded the entirely novel possibility of seeing inside the body without cutting into it, the X-ray is now treated as a clumsy screening tool.

The X-ray was one of many means through which a logic of waiting, of detours, of elsewheres, operated in the government hospital. In the private hospital, by contrast, time and space contracted – although referrals were still common even there, treatment could begin empirically, or on the basis of a presumptive diagnosis. Government protocol was only one possible reference

[454] Wilson 2010

point, and diagnosis was more likely to be grounded on clinical experience.

Both deferral and referral operated through the logic of postponing diagnosis into a point in the future. It was for this future that patients carried around all of the scraps of paper and X-ray images that constituted a patchwork medical record, a portable archive that might tell a story about the course of an illness that makes medical care possible the next time around.

The importance of preserving such a mobile archive and producing it upon request was made clear to me by the arrival to the Chetpet hospital of a middle-aged man named Sanjiv and his wife Bhavna. Sanjiv had tied a red-and-white checkered bandana around his head, instead of clutching it to his mouth like many of the other patients. He had been coming to the hospital to receive treatment for some time and seemed to be doing much better. Sanjiv had come to the clinic a few days earlier for a follow-up, and had been sent to get a chest X-ray. He handed the miniature X-ray, what he referred to as a photo, to Dr. Amutha. She looked at it for a moment, but then put it down on the table. "Do you have the old X-rays?" she asked. Looking at her sheepishly, he responded that the older photos were at home. Dr. Amutha was visibly irritated and sent Sanjiv and his wife away, declaring that she could say nothing of his condition without his previous X-rays.

After Sanjiv and Bhavna left, Dr. Amutha turned to me and explained that assessing a patient's progress was different than making the initial diagnosis. It was important, she said, to interpret X-ray images as part of a series, in order to detect changes – the growth, decomposition and hardening of tissue – in the architecture of the lungs. In the absence of a series of images taken at different points in time, it was quite difficult to say whether a patient's condition was getting better or worse. Over the course of treatment, which can stretch from six months to many years, multiple X-rays are taken in order to track changes in the architecture of the lungs. Whenever possible, Dr. Amutha would try to understand the significance of an X-ray image in relation to this diachronic series of images. Instead of comparing an X-ray image to an ideal image of the lungs that she could imagine – the kind of comparison that she might make when initially diagnosing a patient – she was attempting to see in a series of images the unfolding of the therapeutic process, similar to what Dr. Beevor had attempted to do with his wounded soldiers on the Northwest Frontier.

In the government hospital at Chetpet, initial X-ray images of the chest were often taken as suggestive signs, to be followed up with analysis of sputum samples. X-ray images could also serve as corroborative signs, making visible what other signs merely implied. Towards the end of the clinic hours, a group of doctors had decided to collectively see a patient, a young auto driver named Siva. The most senior of the group asked Siva to remove his shirt. He unbuttoned his uniform and peeled off his visibly-stained banyan. Siva traced an arc along the right side of his chest – "there's pain here," he said to the doctors. He drew his hand to his stomach, explaining that the pain travelled down when he was hungry. One of the doctors asked Siva if the pain increased when he slept on a particular side. In response, Siva brought his right hand to his cheek and tilted his head – whether this meant that the pain increased when he slept on this side was unclear, and none of the doctors inquired any further. Siva made his pain visible to the doctors by means of indexical gestures, using his hands to draw attention to where and how he felt pain in his body.[455]

Forgetting to tell Siva that he could put his banyan and uniform back on, the doctors huddled around Siva's X-ray image. They had turned their attention away from his bared chest, and were now staring at an image of the inside of his chest, the body bared inside-out. The

[455] See Cohen (1999) for a similar discussion of demonstrating pain indexically.

doctors took turns examining the image, passing it back and forth, and then looking together. Although Siva had already gestured toward where it hurt on the surface of his body, the doctors wanted to localize structural abnormality within his body. Pain was just a sign of that abnormality, and an imprecise one at that. The X-ray image was a means of giving form to pathology, of visualizing the underlying structure that was understood to be provoking Siva's pain. Siva's gestural mode of showing pain to the doctors was a suggestion in need of corroboration via X-ray, what was for the doctors a more reliable way of showing and seeing.

Such corroborations were not always possible. Bala was a tailor by profession, sporting a smart polka-dot dhoti and salt-and-pepper hair. His X-ray revealed what appeared to be either a chest infection or a tumor. Dr. Subash began palpating his neck. A few other doctors, who had spent much of the morning studying for an upcoming exam, jumped at the chance to escape from their tedium. They took turns placing a stethoscope on Bala's back and listening. As they listened, Dr. Subash directed Bala to repeat the word "one," and then the sound "ee."[456] A fourth doctor came into the room and joined in the listening, while Bala himself stood awkwardly, arms by his side, repeating the syllables that might help to reveal telltale "notes," as Dr. Chandraswami put it. Dr. Chandraswami, who was watching with me, explained that they would try to correlate Bala's X-rays with his chest sounds and other clinical findings. The signs elicited by the doctors through auscultation and palpation would ideally match up with the X-ray image of the inside of the patient.

Auscultation – a technique of listening to the sounds of the body – has been an important component of diagnostic practice since at least 1816, with the invention of the stethoscope. Before the stethoscope, auscultation required an uncomfortable proximity between physician and patient, putting the ear directly on the chest – this was referred to as immediate auscultation. The discomfort with proximity was not about contagion, but rather concerned with inappropriate bodily contact between men of science and lower-class patient bodies. The intervention of the stethoscope made it possible to listen over a safe distance, what was referred to as mediate auscultation. The stethoscope not only made possible a respectable space between bodies, but also rendered the inside of the body audible to the outside world, much in the way the X-ray would eventually make the bodily interior visible.

When the doctors had finished their examination, Bala asked what they had found. Dr. Subash calmly informed him that despite the X-ray findings, nothing was wrong. Perhaps it was just some congestion of the chest, one doctor mused. Bala went away, puzzled, neither deferred nor referred. In his case, the significance of the radiographic image had been restricted by signs produced through the other senses. The play of shadow and light had revealed an irregularity without determining its precise nature. When these non-visual signs came into play, the more severe interpretations of the X-ray image were left without support.

Stains

Next to the x-ray, the most commonly prescribed examination at the hospital was sputum microscopy. A patient suspected of having tuberculosis was required to give two sputum samples, the first of which was given immediately. Patients congregated in a small courtyard on the hospital grounds, sparsely covered by a few patches of dry grass, waiting to give sputum. They were given small plastic bottles into which they were asked to cough. "You're supposed to cough from your chest," Dr. Subash told me, although I observed that no one bothered to give this instruction to the patients. After handing the sputum-filled bottles to a hospital administrator

[456] Dr. Subash said "ondru," the Tamil word for one. "Ee" comes fourth in the usual order of Tamil vowels.

through a small window, patients were handed yet another bottle. "You have more sputum in the mornings," Dr. Subash explained, so patients were directed to generate another sample the following morning at home.

From the courtyard, Dr. Subash escorted me upstairs to the sputum microscopy laboratory. It was a two-room setup, a bit messy but very airy like the male outpatient clinic. The laboratory technician, a wiry man named Chandran, seemed to have a great deal of energy. He explained that he handled about forty-five samples per day, and agreed to demonstrate the process for me. Chandran was following the Ziehl-Neelsen staining process. This process was an elaboration on Koch's original bacteriological techniques, developed in the two years following his announcement of a bacterial etiology of tuberculosis in 1882.[457]

Chandran took a fresh slide from a box and marked it with a patient ID number. He then shook a bottle containing a patient's sputum and used a thin broom-like stick to extract a bit, which he smeared onto the slide. He explained to me that this bit should come from the thick part of the sample. After allowing the slide to air dry for about five minutes, Chandran took it to another table, on which were set up a gas canister and a burner. In order to fix the slide, he repeatedly passed it over the gas flame.

I followed Chandran into the other room, where he poured purple dye (Carbol Fuchsin) on the slide. He heated the slide once more, to "break down the waxy cell walls of bacilli," he explained. When these cell walls broke down, the purple dye would rush into the bacilli, the rod-shaped structures that he would be looking for under the microscope. Chandran washed off the excess dye with tap water, and then poured hydrochloric acid over the slide to de-color the bacteria that were not acid-fast. That way, only acid-fast bacteria, like *Mycobacterium Tuberculosis*, would appear purple under the microscope. Chandran then applied a blue dye (Methylene Blue) to the slide to cover everything else, making it easier to distinguish bacilli from background. He set the finished slide under the microscope.

Chandran turned to me and explained to me that he would count the bacilli by viewing the slide one hundred times, which would take him between ten to fifteen minutes. The presence of even a single bacillus would warrant a diagnosis of tuberculosis. After adjusting the microscope, Chandran invited me to take a look. Peering through the lens, I saw four rod-shaped bacilli, specks of purple in a sea of blue.

The number of bacilli you see is important, Chandran explained. As Dr. Amutha had pointed out to me earlier, the microscope reaches the limit of its sensitivity at about ten thousand bacilli per milliliter of sputum. Anything less, and the bacteria would likely remain invisible, even to the technologically-augmented and highly-trained eye. The quantity of visible bacilli was also suggestive of the efficacy of a patient's treatment. As treatment progressed, there should be fewer and fewer visible bacilli. If there was no visible decrease in the number of visible bacilli after four months of treatment, Chandran told me, then the patient would be moved into Category 2, which meant a further six months of treatment on a more aggressive regimen.

If there was still no improvement after an additional three months – in other words, if there was no reduction in the number of visible bacilli – then the patient was shifted to empirical or presumptive treatment for multiple-drug resistant (MDR) tuberculosis. A sample of their sputum would be cultured in a petri dish for three months, after which it could be tested for resistance and susceptibility to various drugs.

In the other direction, a sample from a patient deemed "cured" should reveal no bacilli for a period of six months after completion of treatment. If bacilli were discovered within that

[457] For more on this history, see Bishop and Neumann 1970.

window, then the patient would be classified as a relapse case. If bacilli were discovered after that window, the patient would be classified as a case of re-infection.[458]

When I expressed to Chandran that his work seemed quite exhausting – looking at the same slide one hundred times, and repeating that procedure for each slide –he explained to me that there was a faster and perhaps more accurate way: fluorescent microscopy. With this technology, bacilli glowed fluorescent under the lens, making them easier to spot. But fluorescent microscopy required additional training and the equipment was expensive. Moreover, this technology necessitated an uninterrupted power supply. At that time, the power supply was cut throughout Chennai for at least two hours per day, under the rationale of "load-shedding." These scheduled power cuts, along with the unpredictable outages that occurred on a regular basis, made it difficult to rely upon technology that needed a steady stream of electricity. I had only seen fluorescent microscopy used in Chennai at research facilities, where electrical generators provided a back-up to the inconsistent power supply.

The fact that sputum microscopy is a technique dating back over a century has been repeatedly remarked upon as a sign of the lack of progress in tuberculosis diagnostics. At the same time, microscopy has its defenders as well. In 1995, Dr. N.K. Shah, the WHO Representative to India, reflected on the utility of sputum microscopy:

> True to the simplicity of the common man, what is relevant in the health for all context, is not always high technology and high cost diagnostics, but tests that are simple, sure and easy. For instance, in our revised National Tuberculosis Program . . . the time old, simple, cheap, sputum smear microscopy, is the surest bet both for diagnosis as well as for prognosis.[459]

Shah's commentary on the simplicity of the common man aside, his argument in favor of sputum microscopy was based on criteria of efficacy, simplicity and cost-effectiveness. Despite its age, sputum microscopy was for Shah the best means of providing diagnosis to the masses. He drew a line between high technology, which had its place "especially when the disease appears vague or complicated, clandestine or deceptive and when localization and research needs are paramount," and "age old" technology like sputum microscopy.[460] For Shah, antiquity was not in itself a good enough reason to discount the value of technology. Rather, the very simplicity and affordability of sputum microscopy made it perfect for a situation in which price was an issue but the goal remained "health for all."[461]

At the level of national health policy, the question must be asked as to whether cost-effectiveness and simplicity are adequate criteria for deciding how to diagnose a population. This argument cropped up again and again: in a country where tuberculosis and other conditions like HIV are arguably endemic, high-end diagnostics and drugs were both too expensive and over-complicated. Cost-efficiency operated as both an economic and an *ethical* argument – to offer diagnosis for all, a moral imperative for the state when it comes to such diseases, technology must be cheap. Although government health policy rarely invoked an explicit logic of triage, the discourse of cost-effectiveness reproduced such a logic at a structural level, as well-to-do Indians and non-Indians could still access

[458] See more on the logic of cure, relapse and re-infection in the chapter on "Cures."
[459] Shah 1995
[460] Shah 1995
[461] Shah 1995

"high technology" through private means. Additionally, those among the poor who volunteered their bodies to research studies routinely gained access to these technologies and treatments, at least for the duration of the study. Research subjects also enjoyed greater access to doctors, as I witnessed numerous times in clinics where "study patients" were permitted to cut the line to see a doctor. In different ways, both research trials and national health programs in India operated through such logics of triage.

A Poisonous Gift

In 2012, I attended a presentation by Dr. Small at the Delhi headquarters of the Public Health Foundation of India on the state-of-the-art in tuberculosis diagnostics. Around a large table, both Indian and non-Indian scientists, doctors and students had assembled to hear what Small had to say. He began with a simple observation: drug resistance, he explained, looked very different in the laboratory and in actual patients. In the laboratory, he contended, about half of the bacterial samples taken from patients with tuberculosis exhibited resistance to more than one antibiotic. But out in the world, he claimed, only about one-tenth of patients treated with those same drugs seemed to demonstrate resistance. This difference had to do with the specific qualities of human-bacteria interaction and the pharmokinetics of the drugs in the human body, conditions that could not be replicated in a petri dish. In other words, he explained, there was a difference between bacteria *in vivo* and *in vitro*.

After Dr. Small had finished his presentation, the conversation drifted to the subject of Gene Xpert, a new technology that could diagnose tuberculosis with much greater sensitivity and specificity than sputum microscopy. Gene Xpert worked at a molecular scale, searching out and amplifying sequences specific to *Mycobacterium Tuberculosis* by means of rapid polymerase chain reaction (PCR). This technology also has the capacity to ascertain resistance to rifampicin, one of the major drugs regularly used to treat tuberculosis. To minimize the knowledge and skills required to utilize this technology, Gene Xpert makes use of disposable cartridges that contain all of the necessary reagents for performing the test. I have heard these cartridges repeatedly described as being similar to pre-packaged coffee pods that can be popped into an espresso machine. Gene Xpert is also rapid, producing results in under two hours. In describing Gene Xpert, the WHO makes explicit reference to its superiority over the "125 year-old sputum smear microscopy test."[462]

Since the time of Koch, health officials and physicians have agreed that the majority of people infected by *Mycobacterium Tuberculosis* never exhibit symptoms. Estimates from that time, based on autopsy reports and tuberculin skin tests, posited that ninety percent of people get infected with the bacteria at some point in their lives, but only ten percent go on to develop symptoms. The majority of these cases tend to self-resolve without the intervention of medical treatment.

In the winter of 2013, I had a conversation with Dr. Elias, a public health expert at Columbia University's Earth Institute, about the promise of Gene Xpert. I had heard this technology described as revolutionary, as a game-changer. Dr. Elias admitted that Gene Xpert was a useful tool, but he had his reservations. He described Gene Xpert as the Gates Foundation's "poisonous gift," referring to the philanthropic organization's promotion of the technology in tuberculosis-endemic countries. Gene Xpert, he said, should be "neither the beginning nor the end, neither alpha nor omega." Dr. Elias insisted that other screening processes

[462] WHO Frequently Asked Questions on Xpert MTB/RIF assay

based on clinical signs should be used before hauling out Gene Xpert, and that the diagnosis provided by this technology should not be regarded as definitive. Positive cases should be further tested through culturing to determine drug susceptibility, he argued. He feared that Gene Xpert, with the force of the Gates Foundation behind it, was being taken up as a magic bullet approach to diagnostics.

At the meeting in Delhi, Gene Xpert also had its detractors, although for very different reasons. After Dr. Small's presentation, the dignified assembly of experts erupted into a heated verbal brawl. Another American, Dr. MacArthur, had presumably spent a good deal of time "in the field" and felt entitled to voice his dissent. Gene Xpert was a dangerous technology for India, he loudly proclaimed. Dr. McArthur pointed out that this technology would diagnose not only those infectious and symptomatic cases, but also those "cases that would in all likelihood self-resolve." The coffers of the Indian government had already been exhausted by offering free treatment for tuberculosis cases diagnosed by sputum microscopy, Dr. MacArthur argued. He contended that additionally diagnosing and treating those cases below the sensitivity of microscopy would break the already ailing health capacities of the country. If such cases were diagnosed, the Indian government would be stretched too thin.

Dr. MacArthur argued that limited government resources should be focused on providing treatment to those patients with more severe cases of tuberculosis, cases that could be diagnosed by means of the "traditional" technology of sputum microscopy. He worried that the new mass of patients diagnosed with Gene Xpert would be left to fend for themselves. "Should people know about a condition that they can't treat?" Dr. McArthur asked. His argument was pragmatic – relying upon a logic of scarcity, cost-effectiveness and triage – but also ethical: "You can't use people as bioassays," he said to his colleagues. For Dr. MacArthur, offering diagnosis without treatment would transform humans into living, breathing laboratory cultures. Although diagnosing such patients would offer a more detailed epidemiological picture of tuberculosis in India, Dr. MacArthur feared that knowledge without the possibility of treatment was tantamount to dehumanization – to making humans into laboratory cultures.

Dr. Small was visibly irritated by Dr. MacArthur's line of argument. He retorted that, as a new transplant to India, he still retained his optimism. At the time, Dr. Small had only been in India for a few weeks. "You think," he said to Dr. McArthur, "that this country shouldn't treat people like anywhere else in the world? They have Formula One racing and a space program," he said, as evidence of India's comparability to any western country. "And if you treated people like that in a western country," he barked impatiently, "you'd be sued for malpractice."

Dr. Small's counter-claim was premised on a logic of high-tech universality, the hallmark of the Gates Foundation and other similar organizations that focus on providing novel, technological solutions for persistent problems in poor areas of the world. His statement was also an indictment of the seemingly "local" ethics that informed Dr. MacArthur's position. I furiously scribbled down notes during this heated debate, reminded of colonial-era arguments between so-called "old India hands" and those who were deemed to be new-comers. Then, as now, disputes focused on the "harsh realities" of life in India and the suitability or unsuitability of foreign ideas, customs and technologies. The history of public health in India is rife with such debates about ground realities. As in the field of anthropology, experience seemed to count a great deal in conversations about national health policy. The kind of experience that mattered in this debate was not the same kind of experience required to properly interpret X-ray images. Rather, it was about "field" experience. In the colonial era, experience in the field meant understanding how

India was epidemiologically exceptional and politically unstable. In the present moment, field experience made possible knowledge about finance, governance and medical ethics in India. I watched this argument unfold, imagining those similar arguments of the past, but knowing that history was not particularly important to this esteemed gathering.

For Dr. Small, there was an ethical imperative to perform a diagnosis if the technology was available – even if the diagnosis in question was of a condition that might self-resolve. This is not, however, just another story of increasing medicalization, of ever-larger populations being caught in the lure of biomedicine. Instead, I think that the debates around Gene Xpert suggest something about the difficulty of distinguishing between health and illness in our present moment, about the complex relationship between diagnosis and treatment, and about the ways in which race and nation endure in the making of public health.

LETHAL EXCHANGES

The Dangers of Milk

Racial lines are not the only limits that are transgressed by tuberculosis. The relationship between tuberculosis in non-human animal species and tuberculosis in humans has been of great importance to researchers since at least the mid-nineteenth century. This question was of particular concern to tuberculosis specialists, veterinarians, farmers and public health officials, who had spilled much ink debating whether the consumption of cow milk and meat could be a possible vector for transmitting tuberculosis to humans, especially to children.

No less an authority than Robert Koch weighed in on this question. In 1901, Koch spoke from his pulpit at the International Tuberculosis Congress in London, proclaiming that bovine tuberculosis did not pose a threat to humans. The bacteria that caused bovine tuberculosis, he argued, were not identical to those that caused tuberculosis in humans. Unlike many of his previous statements, this one succeeded in setting off a maelstrom of disbelief and a flurry of epidemiological and laboratory studies to prove him wrong. In Britain and the United States, major public health and agricultural policy changes were implemented on the basis of this anxiety around tuberculous milk and meat, leading to widespread cow cullings, animal testing and pasteurization.[463]

In India, a cow protection movement took shape between 1880-1920 as part of an incipient Hindu nationalist agenda.[464] The Brahmanical image of the cow as "the mother of all things" and in particular the "mother of the Hindu nation" ensured that cow culling was never a real possibility for tuberculosis control on the subcontinent.[465] Even with culling off the table, the possibility that ingesting bovine products led to tuberculosis in humans remained a serious concern.[466]

As pasteurization became more common, tuberculous cows became less of an issue. The question of bacterial specificity, however, remained a problem well into the mid-twentieth century. Was the tuberculosis present in cows different than the tuberculosis that affected humans? Or was the disease always the same? Even if the disease was the same, were different groups affected differently? These questions still mattered into the 1950s and early 1960s, when the Tuberculosis Research Centre at Chetpet maintained an animal house for the purpose of identifying "mammalian, non-mammalian, and human types of the bacteria." The virulence of various strains of bacteria were measured by infecting guineas pigs and mice and measuring their time until death – with the proper adjustments made for the varying susceptibilities of Indian and British breeds.[467] Similar to racial groups, non-human animal breeds were understood to enjoy different levels of vulnerability to tuberculosis. In fact, animal breeds were often described in terms of nationalized races – such as the Indian and British breeds of cow, or the Indian and

[463] Jones 2004
[464] Van der veer 1994:86
[465] Corbridge and Harriss 2000:181
[466] Dr. Muthu, who was discussed in detail in the chapter entitled "The Black Doctor," agreed with Koch that tuberculous cows were not the source of tuberculosis in humans, citing as proof the widespread drinking of milk among Indians.
[467] Indian Council of Medical Research's (ICMR) published review of research activities between 1956-1966

American breeds of mice.[468]

Anxiety about tuberculous cows has recently resurfaced in India amid concerns about adulterated milk and animal rights. Maneka Gandhi, the controversial daughter-in-law of former Indian Prime Minister Indira Gandhi, and a politician in her own right, has emerged as one of the most prominent animal rights activists in India.[469] Gandhi has publicly argued that milk taken from tuberculous cows in India presents a danger to the human population. She has claimed that it is not only humans who drink "milk produced in unsanitary conditions" who are at risk, but also farm workers "who get it from lesions in the udders of cows racked with bovine tuberculosis." Gandhi has recommended that people living in India, the largest milk producing country in the world, should stop consuming all dairy products.

Gandhi marshals quite a bit of evidence for her claims. She explains that the majority of cows currently used in India for dairy production are not native Indian cows with immunity to disease, but rather "foreign breeds" and "hybrid cows" unsuited to Indian conditions. Beyond this nativist biology of immunity and susceptibility – one that parallels nineteenth- and early twentieth-century ideas about variable racial immunities among humans – Gandhi's scope of vision stretches both to things that are much smaller, and across a much grander historical scope.

Adopting the role of a historical epidemiologist, Gandhi tells a story about the exchange of bacteria by linking tuberculosis to human and cows – not only through contemporary production and consumption practices, but also in terms of a longer history of bacterial exchange, of anthroponosis followed by zoonosis. "Humans infected their cows 10-15,000 years ago," she writes, "and are being infected right back by them," but with a critical difference. Over the intervening years, the human form of the bacteria – *Mycobacterium tuberculosis* – has, according to Gandhi, mutated into the bovine form – *Mycobacterium bovis*. For Gandhi, bacteria are both mobile and mutable over the long course of history. Her argument is that bacteria that cause tuberculosis are capable of ontological transformation along species-lines. Gandhi contends that the difference between humans and cows, and human and bovine bacterial strains, is not enough to hamper the inter-special exchange of bacteria. Although widespread pasteurization has rendered infection through cow milk a negligible problem in Europe and the United States, she claims that uncertainties about the uniformity of pasteurization in India make milk a potential vector for infection.

Human, bovine, bacterium – in the history offered by Gandhi, these are companion species that relate through infection, a lethal back-and-forth exchange of microbial matter between cows and humans that has spanned millennia. Through her writings, Gandhi resurrects an older set of concerns but locates them within contemporary investments in human health and animal rights. At the same time, Gandhi offers a biophilosophy that situates the problem of bovine tuberculosis in terms of both local biologies – the native and non-native cow – and local cultural norms – the fact that tuberculous cows are rarely culled, due to their revered status among high-caste Hindus. This preference against culling extends beyond cows to other species

[468] An important example of this racial logic as understood in terms of non-human animals can be found in the work of Dr. Arnold R. Rich's *The Pathogenesis of Tuberculosis*. Originally published in 1944 and re-issued in 1951 and 1957, Rich's text served as a standard and was cited in many other medical textbooks and histories of tuberculosis and immunology. Rich regarded an 1884 study by Robert Koch – in which Koch demonstrated that field mice were more susceptible to tuberculosis infection than white mice – as "the first experimental indication of the existence of differences in *racial* resistance in tuberculosis" (Rich 1957:125, emphasis added). Rich extended his logic from animals to human races. I found Rich's book tucked away in the library of the Tuberculosis Research Centre in Chetpet.

[469] See Dave forthcoming in *Cultural Anthropology*

that have engaged in very different histories of companionship with humans. But in these relationships, as well, the interspecies exchange of tuberculous matter is a serious concern.

A Final Performance

In early 2012, Indian media outlets began reporting on a tuberculosis epidemic that was laying waste to a population of sloth bears at the Bannerghatta Wildlife Sanctuary, just a few hours south of the bustling metropolis of Bangalore. Sloth bears are odd creatures, a meeting of species made flesh. The first British explorers to lay eyes on this creature, with its sickle-shaped claws and strange teeth, were uncertain whether they were facing a sloth or a bear. Until the 1960s-70s, sloth bears across the subcontinent had been captured and trained as dancers by Qalandars, a historically peripatetic and economically marginalized group that depended on these animals for a living. The Prevention of Cruelty to Animals Act (1960) and the Wildlife Protection Act (1972) made ownership and use of bears as street performers and dancers illegal in India.[470]

As anthropologist Naisargi Dave tells us, the Prevention of Cruelty to Animals Act (PCA) was deeply entangled with the Nehru-Gandhi family and with the city of Chennai (then Madras). The first draft of the PCA was composed by Rukmini Devi Arundale, a major figure in the revival of the dance form of Bharatnatyam and a prominent member of parliament. In arguing for the bill, Arundale was deeply influenced by the Theosophical vision of Annie Besant, a vision that held much force both for the Madras elite and for many in the nationalist movement. Nehru offered to introduce Arundale's bill to Parliament, but in the process he made some major revisions. As Dave writes:

> The central points of Devi's version of the PCA were to prevent animal experimentation and slaughter for food; Nehru's version—the one ultimately passed and still in effect—made animal experimentation and food the two major *exceptions* to cruelty law, concerned as he and his advisers were with modernity and development.

Sloth bears, neither subject to experimentation nor presumably very appetizing, were saved from Nehru's brand of environmentalism. Over the last decade or so, most if not all of the remaining bears in captivity have been "rescued" and brought to the Bannerghatta Wildlife Sanctuary, to what is arguably a new but different form of captivity.

In December of 2012, I spoke with Dr. Arun, a veterinarian at the Sanctuary. He explained that a research study had shown that, as of 1992, there were about 1200 dancing bears "on the road." In the twelve years since the Sanctuary had been established, almost six hundred of these bears had been rescued. Now, he told me "not even one dancing bear can be found in our country," except those at the Sanctuary or the few that remained in zoos.

Arun's calculations, however, left an unaccounted for remainder. "In twelve years," he explained, "the population of twelve hundred has become six hundred, so what happened to the other six hundred? Six hundred must have died." Although no thoroughgoing investigation had been undertaken in regard to the status of these missing bears, Dr. Arun conducted his own research into this mystery.

He explained that the Sanctuary started providing a rehabilitation package to Qalandar families on the death of a sloth bear, to help them transition into other kinds of work. Dr. Arun

[470] Radhakrishna 2007:4223

recounted how Qalandar families would approach the Sanctuary: “Please take our dead bear into account and provide my family the rehabilitation package,” these families would say to him. The government had not provided any support to the Qalandars, Dr. Arun explained to me, despite having enacted the law that deprived them of their means of subsistence.

“I've personally gone and conducted post-mortems, and they've all died from tuberculosis,” he told me, in reference to the sloth bears. “We wouldn't have known if they hadn't called us. Almost fifty percent of the population is gone. Where is the record? How many have undergone postmortem?” he asked. After conducting these post-mortem examinations, Dr. Arun discovered that the sloth bear deaths at the sanctuary were in no way exceptional. Sloth bears had already been dying from tuberculosis, both in zoos and in the homes of Qalandars. “It's not a new problem,” Arun said. “It's there's already [but] nobody has recorded it.”

As a veterinarian at the Sanctuary, Dr. Arun had been the target of much criticism from the Indian media and local officials for the sloth bears deaths. As such, he was particularly concerned with establishing that the sloth bears had been infected before arriving at the Sanctuary, as his postmortem examinations indicated. He suggested that the recent focus on the sloth bears dying under his care was due to the fact that a greater number of the bears were dying from tuberculosis as the sanctuary population aged. “If six or seven bears die, it's not an issue for the media,” he claimed. “This year, we lost almost twenty-one bears out of 140. The numbers look big, so these people,” he said, referring to members of the media, as well as to local officials and politicians, “are getting agitated.”

Dr. Arun contended that the bears were not infected at the Sanctuary, but rather by their Qalandar handlers and owners before they were rescued. He blamed the bears’ current condition on the poor condition under which they had lived with Qalandars, who had used the sloth bears “as their livelihood,” Arun explained. The sloth bears, he said, “were poached from the forest after killing their mothers.” After capturing them, Arun claimed that their handlers “would torture the animals, castrate the males, put on muzzles, [and] break the canines.”

In addition to these specific traumas, Dr. Arun pointed to the more general conditions in which sloth bears lived “under terrible stress.” The bears did not “have the proper environment and freedom, their entire body got upset,” he said. “In the wild they are basically nocturnal,” he explained, but their owners forced them to “work during the day and rest during the night.” The bears were made to “walk on the tar roads, in bad weather, with lots of dogs around. All the people and dogs and unusual species interactions are stress for any wild animal,” Dr. Arun said to me in exasperation.

In Dr. Arun’s veterinary vision, unwanted interspecies sociality became a source of stress, the kind of stress that made the bodies of sloth bears vulnerable to another kind of undesired sociality, with bacteria. In light of the “torture they gave, and the level of nutrition, the bears tend to catch a lot of diseases. Leptospirosis, cancer, vital organs functionality and quality will be much much lower than the normal bear,” he explained. For Dr. Arun, the “normal bear” was the one in the wild, living nocturnally and avoiding other species like dogs and humans.

At the Sanctuary, the best that the staff could do was to try to replicate normal. Although the staff worked to keep individual animals alive, the animals were not bred. The work at the Sanctuary was about providing palliative care, I was told, not about the survival of the species. “We rescue and rehabilitate them until they die,” Arun told me. “We provide round-the-clock veterinary care; it’s like a hospital. We’re extending their life. We’re trying our level best to give a better veterinary service.” All they could do, he explained, was try to extend the life of the bears.

This task – ensuring the survival of individual sloth bears – was made quite challenging by the fact that tuberculosis in sloth bears was almost impossible to detect. Dr. Arun laid out the difficulties involved in diagnosing the sloth bears with tuberculosis. “We’ve tried a lot of procedures to diagnose the problem in these bears,” he said. There seemed to be no signs specific to tuberculosis in sloth bears. “There won't be discharge, coughing, cold, drooling saliva or mucus from the nostril,” he said. In spite of this dearth of signs, Dr. Arun felt that he had enough experience to determine when a bear might be on the verge of getting sick. “For almost ten years, I've been working with bears,” he told me. “I can find out the symptoms.”

The primary symptom that Arun had noticed was “off-feeding,” a lack of appetite typically due to illness. He had also on occasion noticed that some of the sloth bears exhibited gastroenteritis, “loose motion” (diarrhea), vomiting and weight loss. Although these indications were far from definitive, Dr. Arun immediately isolated animals that demonstrated any of these symptoms. Once the sloth bears started showing these symptoms, their condition tended to deteriorate rapidly. This made early diagnosis of critical importance.

Despite these diagnostic difficulties, Dr. Arun and his team were busily collecting samples of various bodily materials – lung wash, fecal samples, urine and sputum – in the hopes of finding a reliable diagnostic sign. But as Dr. Arun explained, simply collecting samples proved to be a challenge. You could not ask a bear to spit into a cup, or stand still for an X-ray. “It's not that animals are spitting out sputum; they're swallowing it, so it might come out through feces,” he told me.

Dr. Arun had also tried out various tuberculosis diagnostic tools on the sloth bears. He reported that many of the animals tested negative up until just a few days before death. “None of the regular diagnostic kits are showing proper results,” he said. Instead, these tests only exhibited what Arun referred to as “false positives or false negatives” when compared with actual cases of sloth bear death and post-mortem autopsies. “Eventually,” he explained, “the animal dies from respiratory arrest.”

“The primary problem is the diagnostic,” Dr. Arun told me. To date, there have been no diagnostic tools developed specifically for detecting tuberculosis in sloth bears. So instead, his team had turned to serological or blood-based test kits developed for deer and elephants, but these gave mostly erratic results. Dr. Arun held out hope for one test in particular, a rapid serological test manufactured by U.S.-based Chembio. Although the test was not recommended for sloth bears, Dr. Arun claimed that nearly ninety percent of the cases were accurately diagnosed using this test. The Chembio serology test also produced two or three false negative findings in cases where it appeared that the animal did in fact die from tuberculosis. “In the present scenario, I almost feel [that it is] better to screen all animals with that kit,” Dr. Arun said. “But it's not [currently] available in India,” he informed me. “Another set is only coming in January.”

Dr. Arun lamented that a conclusive diagnosis of tuberculosis was not possible “until the bear dies.” Postmortem samples from dead animals were collected and cultured in Trivandrum, in the state of Kerala, at the Rajiv Gandhi Centre for Biotechnology. All of the sloth bears seem to have died from the pulmonary form of the disease, allowing for a localized autopsy. “In the postmortem, in the lungs, everywhere pus, everywhere nodules,” Arun told me.

Similar to human sputum, sloth bear lung smears were cultured, stained and examined under a microscope in Trivandrum. It was confirmed in the laboratory that the sloth bears had been infected with *Mycobacterium Tuberculosis*, the strain of the bacteria most associated with tuberculosis in humans.

Dr. Arun was relieved to have a diagnosis at the species level, even if it came too late for the bears. He described to me the poor conditions of many Indian zoos, from which the sanctuary has rescued many of their bears. “We shifted close to twenty-two animals from West Bengal. When those lot came, we started getting this problem [tuberculosis] a little more, it was a little exaggerated. I found that out of these last few deaths, more than fifty percent are there from the West Bengal group. I personally suspect that the whole of the region might have more of a tuberculosis problem.” Based on the death of these bears, Dr. Arun argued for the possibility of a regionally-centered tuberculosis epidemic among humans. “Bears must have contracted these strains from the people,” he told me, suggesting an anthroponotic route of infection. “I don’t know the statistics for that state,” he continued, “but that could be a reason. The four-year-old bear [who recently died] is also from that lot.”

He told me that the bears that were not relocated most likely died from tuberculosis in the concrete blocks that constituted their habitats in these poorly maintained zoos. Most of the sloth bears that were not rescued, he explained, remained undiagnosed even after death. Even when it was suspected that the animal died from tuberculosis, the bacterial strain remained a mystery. “They won't even go to the species level, to see if it's *M. TB* [*Mycobacterium Tuberculosis*] or *M. Bovus* [*Mycobacterium Bovus*]. We're going to that level, trying to do a strain identification.” Species keep meeting: a bovine or human bacilli inside of a bear that resembled a sloth.

Determining the cause of death down to the level of bacterial strain seemed to be for Arun a mark of due diligence, a sign that he had carried out his duties fully and properly. Identifying the human strain of the bacteria as the culprit also strengthened Arun’s case that sloth bears had been infected by their Qalandar handlers, especially as none of the Sanctuary staff had tested positive for tuberculosis.

Treating sick animals proved to be as difficult as diagnosing them in the first place. A sloth bear thought to have tuberculosis as well as those other animals that were part of the same “friends group” as the suspected animal were given presumptive treatment. Since one of the first symptoms that Dr. Arun noticed was off-feeding, it was very difficult at that point to coax the bears into swallowing antibiotic tablets. Even non-symptomatic sloth bears would only consume the tablets for about two days. After that, Dr. Arun explained, these bears would stop eating and go into “stress mode.” He noted that a few of the animals had succeeded in taking the medicine for about fifteen days. But at this point, they too had stopped eating. After taking medications, the sloth bears “became very drowsy and were unable to walk, with no coordination of limbs,” Dr. Arun said. The medicated bears also showed evidence of hepatotoxicity – liver damage – an effect of antibiotics observed in humans as well. “Invariably we have to stop the drugs, otherwise we have to lose the animals,” he said.

Our conversation drifted from the subject of treatment to that of culling. Dr. Arun lamented that sick animals were forced to endure, to suffer, when there was currently no hope for a cure. As Dr. Arun explained, culling was “not against the law, but the interpretations are at a different level.” He noted that the Sanctuary was not permitted to euthanize sick animals without permission from a government committee that confirmed that “this problem is not correctable and cumulatively agree that the animal can be put to sleep.” Dr. Arun sighed. “That's the bureaucratic system of our country. By the time that they agree, the animal will be dead. [For] every animal, this must be done.” Approval could not be obtained for an entire population of sick bears. Each sick animal had to be approved for culling individually. As Dr. Arun pointed out, the process to gain an approval for culling was quite lengthy. “The big guy has to find the members

[and] verify all the records. Otherwise they'll say why don't you try this, why don't you try that? They won't get convinced that easily."

He explained that some of the resistance to culling, both among the members of the government committee and in the general public, was due to a misplaced empathy. "Some personally feel that we don't have the right to kill these animals," he said. "They don't understand the suffering of the animals. Why," he asked, "do we unnecessarily make them suffer for a few extra months or years?" He argued that there was no environmental benefit to keeping such animals alive, as they were not being bred. "Captive animals won't help the ecosystem," he argued.

When it comes to diagnosing tuberculosis in sloth bears, the signs came too late. When the signs became clear, they pointed towards death. The antibiotic miracle that was supposed to save humans was even less of a miracle for sloth bears, who experienced potentially lethal side effects in ingesting the drugs that were meant to save them. Dr. Arun held out hope that some advance would be made soon – a technology that would elicit more reliable signs, and elicit them earlier.

For Maneka Gandhi, the difference between Indian and foreign cows, and between bovine and human bacteria, made possible a critique of an interspecies relationship – a relationship premised both on consumption and the exchange of microbial matter. The inadvertent exchange of bodily substance under less-than-ideal conditions is what led Dr. Arun to pin the blame for sloth bear deaths on the Qalandars, neglecting the fact that if Qalandars had spread germs that killed, then they were also being killed by those very germs. Humans, cows, sloth bears, and bacteria – might these be understood as companion species that interact through infection, a relationship that opens onto the possibility of sickness and death?

THE AGES OF THE BODY

Natural Histories

Before the development of antibiotics, many patients found their way to sanatoriums in the hope of finding a cure. But as Gandhi had noted in his speech at the Congress-run Hospital in Allahabad, Kamala Nehru's search for health at a German sanatorium turned out to be "a search of death."[471] As the historian Flurin Condrau has pointed out, tuberculosis patients in England were often discharged on the brink of death when their condition had progressed beyond the power of sanatorium treatment.[472] This practice had the effect of reducing the mortality figures directly associated with sanatoriums, making it difficult to assess the efficacy of these institutions. Effective or not, the sanatorium in the literary imagination figured not as the location of death, but as the site of a kind of lingering on, a time outside of linear historicity.

From the vantage of the present, Thomas Mann's *The Magic Mountain* stands as an elegy for this lost time, not only for a pre-chemotherapeutic age that has come and gone, but for a quality of time that has not survived into the present. Mann began writing this work in 1912, before the outbreak of the First World War, but it would not be completed and published for another twelve years. In Mann's novel, the dream-like time of the sanatorium perched in the hills is spatially segregated from the aggressively forward-moving time of the plains, in which unprecedented events can radically alter a situation and people are always catching up or falling behind. In the plains, time blazes forward without any consideration. In the plains, there are wars to be fought, commendations to be sought, ships to be built and degrees to be pursued, at least for Mann's characters. But in the sanatorium, this eventful time of achievement and failure, of loss and change, is subtly displaced by a different kind of temporality.

When Mann's protagonist Hans Castorp first arrives in the mountains of Davos to visit Joachim Ziemssen, his cousin, he has yet to learn about how time moves in the sanatorium. Hans asks the kinds of questions you ask when you have different expectations of time, expectations that make sense in the plains. He asks Joachim to return with him to Hamburg, in just a few weeks. But Joachim knows something about time, something that he could not quite put into words. Just wait and see, he counsels.[473] Time in the sanatorium is not measured in weeks. In fact, time in the sanatorium does not seem to progress in any recognizably linear fashion, making the measurement of duration an almost impossible task.

As Hans waits for Joachim to come to his senses, he begins to catch glimpses and glimmers that startle him. He is slowly "caught up" in this time and a bodily conversion takes place.[474] Hans becomes without knowing what he becomes or willing it to be so. Much to his embarrassment, his face acquires a permanent flush, providing a physical sign of this conversion. Through such signs, he is marked by the time of the sanatorium. As he is increasingly caught up in this temporal order, he simultaneously becomes stuck out of joint with the time of the plains.

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[471] Gandhi's Collected Works Vol. 77, p. 88, first printed in *Harijan* on November 25, 1939

[472] Condrau 2010:77

[473] Similar to Joachim, Veena Das (2007) describes waiting as a means of being marked by the other. In this case, Hans is marked by the time of the sanatorium, a marking that leads to his ontological transformation from a person of the plains to a sanatorium patient in the hills.

[474] See Favret-Saada (1980) on being caught as a process that precedes and does not depend upon rationally-motivated acceptance and cognition.

In the sanatorium, he finds a new community, a group of interlocutors who inhabit this time with him. The sociality of the patients at Davos has less to do with sharing a biological condition, and more to do with inhabiting the same chronic condition.[475] Hans and Joachim were initially separated in that they inhabited distinct temporal orders. In the sanatorium, they are made untimely together.

If time can be measured in Mann's novel, this measuring occurs through the interpretation of bodily signs. In the basement of the sanatorium, Hans goes to see the supervising physician and director, Hofrat Behrens. Behrens had previously run into Hans in the hallway, and intuited that he might have a real talent for being a patient. This is a talent that might be understood as the capacity to be marked by the time of the sanatorium, to become other to the plains. At Behren's request, Hans peels off his shirt and submits to meticulous percussion – a sounding out of the body, a precise drumming that elicits a morse-code symphony of resonance – and auscultation – a more direct listening that reveals the morphology of the bodily interior to the physician's cultivated hearing. Behrens extends his body's capacities by means of a stethoscope, but also with the assistance of an x-ray machine. Taking image after image, Behrens enumerates, localizes and describes lesions in order to compare them against previous findings. Patients are also exhorted to keep fever charts, measuring their temperature at regular intervals. These signs allow Behrens to diagnose illness, but also to measure how the body has changed with the passage of time.

When pressed for a prognosis by Hans, Behrens replies: we'll see in six more months, in a year, in the fall. This sort of talk is perhaps typical of the discourse of the sanatorium, a figure of speech that repeats without end. Time in the sanatorium has a chronic quality. Save for the eventuality of death or discharge, there is always more time in the sanatorium, time for more of the same. The talented patient learns to stop asking for a prognosis, for a precise discharge date. The chronic nature of time in the sanatorium is an open secret, articulated in a myriad of little diagnoses. It can be experienced, but it cannot be told outright. It can be known, but it cannot be expressed to others. Just another few days, weeks, months, years . . . The chronicity of the sanatorium is a secret deferred into the ellipses.

The time of the sanatorium is lost, if it ever existed in the first place. Historians of tuberculosis have been unrelenting in their criticism of Mann's romanticized vision of the sanatorium.[476] These historians have pointed out that there was no singular sanatorium, but rather many different architectural forms and therapeutic modes that were classified under the term. They point to divisions of class and gender that complicated sanatorium life, and the relations with the outside world ("the plains") that were never as neatly severed as they seem to be in Mann's novel. Sanatorium patients would often show improvement or run out of money and obtain discharge, only to return again after a short time. This circulation between the plains and the sanatorium, between outside and inside, disturbed the idea of two distinct temporalities. On the other hand, there is no doubt that the figure of the sanatorium signals a different era both in the imagination and in the world of therapeutic practice. Those ruins of sanatoriums that persist into the present, like Dr. Muthu's facility at Tambaram, have been transformed into hospitals and other kind of institutions that are understood to better suit the contemporary therapeutic moment.

[475] See Rabinow 1996 on the sharing of a biological condition, what he terms "biosociality." By contrast, see Stewart 2007 and in particular Pandian 2012 on the sharing of a temporality.
[476] See in particular Bryder 1988, but also Condrau 2001, 2010

Despite the end of the sanatorium in all of its forms, there is perhaps something of that time that is hinted at in the diagnosis and treatment of present-day chronic conditions. Prior to the development of antibiotics, tuberculosis was sometimes characterized as a chronic condition, and at other times as terminal, ending either in death or cure. In the present moment, public health experts and physicians are quick to say that tuberculosis is curable. The Government of India's national tuberculosis program has even launched a media campaign espousing this fact. Despite the number of patients who die from tuberculosis, and the many patients who are cured only to relapse or become re-infected, tuberculosis retains a veneer of curability, at least within the medical establishment.[477] When a disease is deemed curable, the enduring possibility of chronicity cannot be openly avowed – it becomes, once again, a secret.

In India today, the chronicity of tuberculosis is kept secret not only through the hope for total cure, but also through the subsequent diagnoses of relapse and re-infection that draw attention away from the precariousness of the cure by pointing to non-adherent patients or insistent bacteria. This unacknowledged chronicity of tuberculosis has become entangled with the open celebration of chronicity in regard to HIV/AIDS, as the two conditions become increasingly intertwined in co-infection. In a time of mass pharmaceutical production, the chronicity of HIV/AIDS is not bound by totalizing institutions, though it is no less caught up in other disciplinary regimes that work through regular supervision, self-help and medication.[478]

During the 1980s and early 1990s, infection with HIV was understood to inevitably lead to death. With the development of antiretroviral drug combinations, this sense of fatality gave way to the promise of chronicity. The story of HIV treatment is often told as a tale of triumphal science, but it is equally a story about the triumph of therapeutic activism. Human rights groups, affected populations (such as gay men in the United States) and other concerned parties lobbied, staged dramatic protests and otherwise sped up the drug development and testing process for antiretroviral drugs.[479] The chronicity promised by antiretroviral drugs underpins the logic of access-to-medication movements ranging from the early radical ploys of ACT UP to the more recent corporate and contemporary stratagems of the Clinton Foundation in brokering cheap drugs manufactured in India for export to parts of Asia and Africa.

Chronicity is officially and explicitly acknowledged as the condition produced by HIV infection managed with antiretroviral drugs. Governments and international aid organizations are increasingly accounting for lifelong treatment for HIV-positive patients, engaging in complex and ethically fraught cost-benefit analyses regarding the relative values of treatment and prevention. Those infected with HIV are understood to be patients for life. At the level of the clinic, doctors and counselors regularly relay this message of chronicity to patients.

Before examining how chronicity is shaped in the clinic, with and without the use of antiretroviral drugs, I want to turn for a moment to the police. In 2011, during the monsoon season, I found myself spending the night at a small police station in Besant Nagar, a mixed-class neighborhood in Chennai that faces onto the Bay of Bengal. It was the night of a friend's birthday, and he had taken a break from the festivities to get some fresh air, only to discover that his motorcycle was missing. The watchman at the house next door gestured toward us. In a matter-of-fact tone, he informed us that the police had confiscated it.

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[477] See the chapter entitled "Cures."

[478] See Goffman (1961) on the total institution. See Foucault (1975) on modern forms of discipline. See Biehl (2007) and Nguyen (2010) on the ways in which discipline can become mobile or intermittent, particularly in regards to HIV/AIDS. See Deleuze (1996) for a more prospective take on mobile forms of surveillance.

[479] See Martin 1994 and Epstein 1996

My friend and I walked to the police station to try to get the bike back. The bleary-eyed officer behind the desk explained that they had taken my friend's motorcycle "in order to keep it safe." It had been locked improperly, he told us, and anyone could have come by and stolen it without our knowledge. He asked us to wait until the officer-in-charge returned, as only he had the authority to release the bike into our custody.

As the rain poured down outside the station, the officer began to ask us questions about our life, our work, our families – less as an interrogation and more as chit-chat, a way to pass the time. When the officer discovered that I was conducting research in an HIV hospital, he was surprised. "They're all going to die anyway, isn't it?" asked the officer. I found myself defending my research by explaining about antiretroviral drugs, about how they had changed everything. HIV was no longer a death sentence, I told the officer, but a chronic condition. Now you could live a normal, healthy life with HIV, I explained. Word for word, this was almost the same monologue that I had heard innumerable times, the same talk that counselors gave to newly-diagnosed patients in the HIV hospital. Seemingly satisfied with my response, the officer grunted and offered us some tea.

The motorcycle was eventually returned, but I found myself wondering long after about my choice of words. In the HIV hospital founded by Dr. Solomon, I had spent many afternoons with a counselor named Prabhakar, whose words I had parroted in my conversation with the police officer. In most instances, antiretroviral drugs have greatly extended the lifespan of people living with HIV. Prabhakar provided pre- and post-test counseling to the patients who came to the hospital, assuring them of this fact.

When a patient's test results came back positive, Prabhakar would deliver the news of infection with the utmost calm and pragmatism, explaining the necessity of taking antiretroviral drugs everyday, morning and night, at exactly the same times. This was the key to ensuring that HIV remained a chronic condition. Because of the pharmacokinetics of the drugs, timing is everything, Prabhakar would explain. He would compare HIV to diabetes, a condition that has become highly normalized throughout India. "If you have *sarkkarai*," sugar, the word that has come to stand in for the diabetic condition, "you have to take your medicines everyday," Prabhakar would tell patients.[480] "HIV is just like diabetes – you can live an absolutely normal life," he would say. Of course, he would add, it was important to eat nutritious food, drink boiled water and exercise regularly – but this was true for anyone, regardless of HIV status. Prabhakar preached a gospel of temporal normalcy, a well-practiced form of disclosing the truth of infection while limiting its radical implications for the temporal structure of life. If you take your medicines everyday, and at the right times, Prabhakar would explain, then both the activities of your life and your lifespan can remain normal – this was the promise of antiretroviral drugs, a promise that Prabhakar voiced everyday and that I echoed in my conversation with the police officer on that rainy night.

According to Prabhakar's gospel of normalcy, a once-fatal condition could be rendered chronic. HIV could be made into a condition resembling diabetes. Prabhakar's words were intended to provide hope, to make a difficult truth manageable, and – as in my conversation with

480 Through a substitution of perceived cause and effect, "sugar" comes to stand for "diabetes" in much of India. Prabhakar moves from this substitution to a simile, such that "HIV" becomes like "sugar." Another kind of substitution takes places for tuberculosis, in which clinicians will often use the more obscure term "Pott's disease" in front of a patient in order not to cause them undue worry. This logic of substitution faces its limits in the many situations in which doctors, often at the urging of family members, do not disclose to the patient their own diagnosis – because they are too young or too old to handle it, because they lack the education required to understand, because it will cause them "tension" (stress) and make the condition worse.

the police officer – justify continued research and treatment. But in the wake of infection and daily antiretroviral therapy, what exactly was an "absolutely normal life?" How was time refigured in such claims to normalcy?

The answer to this question came from Dr. Murthy, who had taken over the daily operation of Solomon's hospital. Dr. Murthy was always immaculately dressed in creased slacks, shining black shoes to match his belt, and a white coat draped over his dress shirt, usually without a tie. He was an immensely confident man, providing answers to questions that had not been asked. During in-patient rounds, he would take time to deliver short expositions to the junior doctors on various topics related to the latest research on HIV.

One morning during rounds, he began speaking about natural history. "The natural history of HIV is changing," he said. Turning to face me, he continued: "If you return in ten years, it will have changed again." The history of natural history is replete with attempts at classifying, describing and generally understanding what at various points has been classified as nature. What counted as part of nature, as well as which methods were understood to be proper to the study of this nature, have varied greatly.[481] Generally speaking, studies of natural history have tended to emphasize observation over experimentation. Observation was by no means always understood to be a passive act by an external subject. Rather, observation often entailed an active movement of organizing, classifying and describing.

The history of medicine in Europe has long been connected to the development of natural history as a field of study. In writing about the contributions of early modern European medicine to the field of natural history, the historian Harold Cook notes that physicians from this period "increasingly came to believe that pursuing 'matters of fact' rather than correct reasoning would provide the most certain basis for both their art and science."[482] Cook argues that these early modern physicians investigated things in nature not only for the purposes of developing treatments – *materia medica* – but also to acquire a non-philosophical, experiential knowledge of health and disease.

The present use of natural history in medicine combines this early modern interest in an empirical knowledge of disease with a more recent focus on observing organisms in what is understood to be their natural environment. When Dr. Murthy and others at the hospital spoke of natural history, they were referring to the progression of an illness, from beginning to end. In the case of infectious disease, the beginning is understood to be the moment of infection, and the end is either the death of the patient or the resolution of the illness.

Since at the latest the early decades of the nineteenth century, physicians have made use of natural histories of disease as indispensible aids for both treatment and diagnosis. If the more common mode of interpreting medical signs depends on synchronic comparisons – this sign *not* that one – knowledge of the natural history of a disease allowed for diagnosis based on a sequential order of symptoms – this sign *before* that one. As was the case with pulmonary tuberculosis and many other diseases related to the lungs, distinct conditions could share many of

[481] For more on the histories of natural history, see for example Spary (2000) on eighteenth-century French natural history, and in particular Ogilvie (2006), who argues that natural history as a discipline of description, distinct from medicine and natural philosophy, was an invention of Renaissance Europe, despite having roots in antiquity. See also Jardine, Secord and Spary (1996) for a broad overview of the many forms that natural history has taken in different places and times. See Grant (2007) for a more straightforward history of natural history from antiquity into the nineteenth century. See Anderson (2004) for an exploration of how the study of the natural history of infectious disease in the twentieth century made use of the idea of "disease ecology" to escape the reductionism of microbe hunting.

[482] Cook 1996:91

the same signs, but in a different order. Knowledge of natural history also made possible the staging of illness, equipping physicians with a means of determining how far a particular condition had progressed. Knowledge of the order in which signs appeared enabled physicians to distinguish between conditions as well as between different stages of a single condition. The idea of a natural history of disease was intertwined from the start with the history of the patient's body as a bearer and producer of signs.

In Dr. Solmon's hospital, the concept of natural history was used in a variety of specific senses. In the many studies produced at the hospital, there was no natural history of HIV *per se*. Rather, there was a natural history of HIV specific to South India. Although this history might bear resemblance to the natural history of HIV in other places and peoples, the natures in question – the patient's body and the socioeconomic circumstances that produced that body – were distinct. These circumstances, which precede the beginning of a natural history – the moment of infection – are folded into this history through the ways in which they affect the course of the illness.

Dr. Murthy further clarified that the present natural history of HIV in South India was quite different than the natural history prior to the widespread availability of antiretroviral drugs. After these drugs became available, he told me, the incidence of opportunistic infections like tuberculosis within the natural history of HIV had decreased dramatically. Patients were also living much longer through the use of these drugs, extending the duration of this natural history. As Dr. Murthy explained to me, increased availability of discounted or government-provisioned drugs also meant that more patients sought diagnosis sooner, and began treatment earlier. Drugs in the patient's body became a part of the nature against which the course of the disease was charted. In Dr. Murthy's view, the engine for this transformation of the natural history of HIV at the level of the population was the domestic manufacture of combination antiretroviral drugs by India's booming generic pharmaceutical industry. Without these drugs, HIV would once again be a fatal condition.

But the normalcy that Prabhakar associated with the use of these drugs was not always equivalent to chronicity, to the continuation of life with disease for an indefinite duration. What was more common was an extension of lifespan, the phenomenon referred to in the medical literature as "survival." The extension of life provided by antiretroviral drugs is located somewhere between a death sentence and a chronic state. In this sense, the concept of survival implies that a limit has been transgressed, a threshold at which death should have intervened decisively to put an end to the time of the body. To know whether life has been extended, it becomes necessary to grasp this limit, to somehow know or establish the boundary of life. In determining the natural history of HIV, before and after the advent of antiretroviral drugs, the doctors at the hospital were able to know this limit. In a study published by the hospital in 2003, the mean duration of survival for patients taking antiretroviral drugs was found to be nineteen months longer than that of patients who were not taking the drugs. In this study, patients only received antiretroviral drugs after their CD4 cell count dropped bellow a certain threshold (<200 cells/mm3), which was at that time considered a definitive sign that an HIV infection had progressed to AIDS. Antiretroviral drugs had not necessarily transformed HIV into a condition of indefinite extension. Rather, these drugs had helped to refigure expectations for life and lifespan, making it possible to speak of HIV as a chronic condition, a condition that instead of dying from, a patient could live with.

Too Small

Along with the natural history of HIV, other histories have been affected by the broader availability of antiretroviral drugs in India. The combination of retroviruses and antiretrovirals has also altered what I call the natural history of the body. Such a natural history traces how the human body moves through time – how the body ages – as charted against the "nature" constituted by both HIV and the use of antiretroviral drugs. In the natural history of HIV, the drugged body serves as environment. In the natural history of the body, the relationship between the terms is altered.

In the hospital, there were certain cases that required me to think differently about chronicity and survival, and about the natural history of the body. If the in-patient ward was where those patients came who stood at the limit between life and death, the out-patient clinic seemed to be where chronicity was monitored and given shape. On Sundays, most students in the state of Tamil Nadu have the day off, a perfect time to see children in the clinic. One Sunday each month, Dr. Ravichandran would travel down from his pediatric hospital in the Mysore hills to see children who had been diagnosed with HIV. Dr. Ravichandran had that reassuring presence well suited to pediatric work. He made jokes and laughed with the children, shaking their hands vigorously and handing out chocolate candies.

Over the course of a morning in late 2011, I sat with Dr. Ravichandran as he saw about sixty children, ranging from twenty months to sixteen years of age. He explained to me that the standard recommendation was that young children should not be told their HIV-status until they were mature enough to understand and cope with the diagnosis. In practice, Dr. Ravichandran explained to me, "disclosure" depended largely upon when parents were ready for their children to know of their HIV-status. It seemed to me that many of the children must have already known something of their diagnosis – the regular visits to the doctor, the medicines morning and night, the explicit directions about how to take care of a cut or scratch. In many cases, Dr. Ravichandran suggested, it was the parents who needed "disclosure" about the fact that their children already knew of their diagnosis. The sick, even the very young, often knew without being told.

The secret of the infection, even if it seemed to be an open secret, was continuously kept at bay through the hopes that parents held for their children. Parents' desires for their children seemed to be a way to defer mourning, to aspire towards middle-class futures, to lay claim to the possibility of a future. Logically, part of the power of the child is the capacity to transcend childhood, to eventually become an adult. When human growth, understood through the correlation of chronology and biology, loses ground against viral replication, the child's future as an adult is put into question.

On that particular morning, a fifteen-year-old boy named Shankar came to the clinic with his father. Shankar knew about his condition. He had been diagnosed with HIV a few years earlier when his mother died from an AIDS-related condition. After giving birth to Shankar, his mother had required a blood transfusion. At that point in time, blood was rarely screened for HIV, so it was quite possible that she was infected through this transfusion. Shankar was likely infected during the course of breast-feeding, the milk from his mother carrying with it the virus. Unlike many of the other pediatric patients, he was not born with the virus, but acquired it early in life. Breast-feeding, often touted as the best thing a mother can do for her child, takes on an ambivalent aspect when HIV is involved.[483]

483 This brings to mind a Puranic tale of Krishna. His homicidal uncle, fearing that the infant Krishna will grow up to take his life and usurp his throne, sends a demoness to breast feed all of the newborns in the kingdom. Her milk is

Surprisingly, Shankar had not begun taking antiretroviral medications, and seemed quite healthy, despite having harbored the virus for over a decade. His family would never have suspected that he was infected if not for the diagnosis and death of his mother. By all appearances, Shankar seemed to be a happy, healthy adolescent, an intractable smile plastered across his face.

Dr. Ravichandran later explained to me that Shankar was part of a class of HIV-positive patients known as "long-term non-progressors." Roughly one in five hundred HIV-positive people fit this description, a classification based more on the absence of pathological signs than on any ontological basis or causal mechanism – although weak viruses, genetic mutations and epigenetic factors are all held out as possibilities. It is unclear whether all long-term non-progressors fail to progress for the same reason. Although infected with the virus, the rate of viral replication and white blood cell destruction in such cases is incredibly slow. These patients can live for years, and even decades, without demonstrating symptoms and without succumbing to opportunistic infections.

By the then-current Indian and WHO guidelines, patients did not begin receiving treatment until the ratio of CD4 white blood cell count in their bloodstream has plummeted below a certain threshold. In Shankar's case, this had not yet happened – and it might *never* happen. After confirming that Shankar's white blood cell count remained normal, Dr. Ravichandran sent him off with a pat on the back, an anti-oxidant (which Dr. Ravichandran explained away as a harmless medical trend) and encouragement to study hard in school.

Long term non-progressors like Shankar reveal a chronicity that existed prior to and continues to exist alongside drug-based therapy. Chronicity was not an invention of drugs. Instead, drugs served to democratize the dream of chronicity, making it possible to make promises about living an "absolutely normal life." Antiretroviral drugs are not a cure, but the hope is that they might be able to turn all people living with HIV into something akin to long-term non-progressors.

In the pediatric clinic, most of the children were not like Shankar. Parent after parent expressed their concerns to Dr. Ravichandran: "He's not studying well," "She's not eating enough," they said. But what I heard asked about most often was size: "My child isn't growing." "He's too small." "She's much smaller than her sister." I silently agreed with these parental assessments. A boy who I took to be ten years old revealed himself to be sixteen. A girl who I thought was eight was in fact thirteen. I watched as child after child sat in the chair in front of Dr. Ravichandran, their feet dangling a few inches above the floor. Dr. Ravichandran explained to me that his primary task was to reassure parents that their child was healthy, that they shouldn't worry too much about size. "He might not grow very much," Dr. Ravichandran explained to one anxious mother. "But Sachin isn't very tall either, and look what he's done!" he said laughingly, affectionately patting the grinning child on the shoulder. Dr. Ravichandran was of course referring to the "Little Master," Sachin Tendulkar, who at five feet five inches looms large as the most famous cricket player in India.

Soothing words and role models helped reassure children and their parents, but X-rays seemed to help more. Dr. Ravichandran ordered wrist X-rays for most of the children. When a

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poison, and she leaves a trail of dead children in her wake. When it is Krishna's turn, he sucks the very life out of her, metabolizing her poisonous milk. With her death, he frees her from her sin, as she acted as a mother to him (even if it was as a murderous mother). The ambivalence toward the breast described by Melanie Klein becomes substantialized in the case of Krishna, and in the case of HIV. For a more directly relevant discussion of the complex ethical and medical issues related to breast-feeding in South India, see Van Hollen 2003.

nurse came back in with the radiographic image, he would count the number of metacarpal bones in the image of the child's wrist. Dr. Ravichandran explained to me that the number of metacarpals, plus one, indicated the developmental age of a child. After comparing this developmental age against the chronological age of a child, Dr. Ravichandran was able to determine to what a degree a child's growth had been stunted – he's three years behind, she's only a year delayed, he'd remark.

Only one child, who showed a dramatic disjuncture between chronological and developmental age, was given specific treatment, a very expensive and specialist hormone therapy. Dr. Ravichandran explained that such therapy was too expensive for most families, and for most of these children, it would not be worth the meagerly appreciable outcomes.

In Dr. Ravichandran's determination of developmental age, the natural history of the body was pulled apart at the seams. The time of the body and the time of the calendar, sutured together in a manner that made these two temporal streams virtually indistinguishable, were held to be one and the same thing. With HIV and antiretroviral drugs, time had fallen apart from itself. The dissonance between developmental age and chronological age should not be read as an instantiation of the nature-culture divide. If by natural we mean given before experience, then neither form of aging is natural. Developmental aging depends upon interpreting marks in and on the body, whereas chronological aging depends upon marking days. Age reckoning in the clinic always required mediation, through the interpretation of radiographic images and parental concerns.

In almost all of these cases of stunted growth, Dr. Ravichandran calmed the parents' anxieties, reassured them that they were taking good care of their children, and urged them not to worry, that their child was "healthy." In speaking of a healthy HIV-positive child, Dr. Ravichandran was referring to the standard measure of white blood cell count and a lack of symptoms. A child might be healthy but still exhibit stunted growth. Dr. Ravichandran told many of the parents that their children would eventually grow. He later confided to me that these children might not grow, that they would probably always be small for their age. In the language of clinical research, this "lack of thriving" is the most common condition associated with HIV-positive children. In such studies, thriving is determined through a combination of height and weight measurements.

Although he admitted that nutrition played a part in child development, Dr. Ravichandran related these variances between chronological and developmental age to the metabolic effects of the virus. In children, Dr. Ravichandran noted that the virus hijacked normal metabolic processes for the sake of its own growth – in a perverse sense, he explained, feeding children meant feeding the virus. In this narrative of metabolic hijacking, the act of eating became a questionable good. Dr. Ravichandran's metabolic explanation for this "lack of thriving" draws upon what Hannah Landecker has described as the nineteenth-century formulation of metabolism – "bodily conversions of food into energy" – but with the added twist of a metabolism shared between a human child and a multiplicity of viruses.[484]

Dr. Ravichandran's ambitions for these children were more concerned with the everyday present – eat vegetables, listen to your parents, take your medicines daily, be good. His hopes indicated an acceptance that life could be extended to a certain point, but even chronicity had its limits. The parents of these children, however, seemed to hold a different view. In her ethnographic work with Tamil children, Margaret Trawick writes of the ideal Tamil child who is "flawlessly beautiful and irresistibly attractive, suffers no unfulfilled desires, and possesses

[484] Landecker 2013:495

perfect grace."[485] As Trawick puts it, "there may be threats, either animate or existential or both, but in the state of ideal childhood one can outmaneuver them and ultimately defeat them."[486]

Some threats could be withstood, through the everyday discipline of taking medication coupled with episodic care for acute situations. Other threats – sudden infections that overwhelmed the body's defenses – seemed to come without warning or recourse. For the parents of these children, height and weight mattered, but thriving was something more expansive. Parents spoke to Dr. Ravichandran of their desires for their children – to come first in their class, to gain acceptance into a good university, to get a job in the technology sector, to get married. These were the normal hopes that have come to characterize an upwardly-aspirational Indian population, against a backdrop of a natural history of the body that threatened such hopes. Death was an almost daily occurrence in the in-patient wards. But I noticed that when a child died in the hospital, not only the family, but the entire hospital staff went into mourning.

Too Soon

With the exception of these special pediatric days, the patients who came to the hospital were mostly adults. As with the HIV-positive children, my age reckonings for adults turned out to be wildly inaccurate, but in the opposite direction. I found myself regularly reducing my estimates to get closer to the age marked on patients' charts.[487] When I told Dr. Murthy of my poor guesswork, he explained to me that HIV resulted in an increased rate of aging in adults. The narrative he offered was not just about metabolic hijacking by the virus, but about metabolic disorder. In adults, he said, this kind of disorder was a product of both HIV and anti-HIV medications. In contrast to the slackened development observed in children, adult bodies experienced rapid aging. Many possible explanations for this rapid aging have been proposed, including increased inflammation and drug-related side effects.

Some of these signs of aging were visible to the unassisted eye or manifest to the touch, whereas others required serological exams in the laboratory. Among these signs were impaired neurological function, kidney failure, osteoarthritis and lipodystrophy, or fat displacement. Lipodystrophy in particular is a well-recognized side-effect of Stavudine, a drug regularly provided to patients by the Government of India. Alterations in the bodily topography of fat, literally fat rendered out of place, is among the most "normal" and visible signs of aging. But for these patients, fat was not only out of place, but out of place at the wrong time in the natural history of the body. Not only were these patients seemingly too young to experience fat out of place, but the fat was often relocated in striking ways: humps on the upper part of the back or neck, or increased abdominal fat on an otherwise gaunt patient.

Even among adults, there were surprising exceptions. On many mornings, I would accompany Dr. Vijay on his rounds of the in-patient ward. The in-patient ward was where chronicity often met its limits. Patients in the in-patient ward tended to be extremely sick, arriving at the hospital as a last resort after developing serious complications. Some of these patients had stopped taking antiretrovirals and would come in with opportunistic infections. A few of the patients that I saw in the in-patient ward were in comas, a sign of late-stage

[485] Trawick 2007:9
[486] Trawick 2007:8-9
[487] Though it cannot be assumed that the age listed on patients' records were accurate. Many patients were uncertain of their own chronological age and did not know their birthdays. See Gupta (2012) on how age reckoning and knowledge of chronological age come to matter a great deal in the practices and politics of accessing government services.

tuberculous meningitis. Others were suffering from complications related to the antiretroviral drugs – painful rashes, necrotizing skin and the poorly understood immune reconstitution inflammatory syndrome (IRIS), in which it is thought that the recovering immune system reacts to the presence of the virus through a devastating inflammatory response.

Despite the variety of conditions that populated the in-patient wards, rounds were usually an efficient and quiet affair. Dr. Vijay would move quickly from bed to bed, scanning patient records, performing clinical exams and asking questions of the patient or their caretaker. He would bark revised treatment protocols at the nurse, taking time between patients to crack a joke or to answer my questions. As the senior man-in-charge, Dr. Murthy would often join Dr. Vijay and the other junior doctors during rounds. As they moved around the ward, Dr. Murthy would quiz the junior doctors about diagnostic and treatment measures, as well as outline grey areas in need of research. At times, Dr. Vijay seemed to be humoring him, publicly acknowledging Dr. Murthy's authority so that he could get on with the practical work of treating patients.

One morning in particular, a very thin old man named Shekhar was lying in one of the beds. Shekhar seemed to be doing much better than many of the patients in the beds around him. Dr. Murthy was handed Shekhar's records by one of the nurses, and after reading the test results, he smiled.

He turned to Shekhar and asked, "Tell me, did you spend time in Bombay?" Shekhar nodded, explaining that he was involved in some small business trade that required him to travel quite a bit within the country. Dr. Jayasurya nodded knowingly and turned towards me. I could see that he expected a look of amazement in response to his act of clairvoyance, and I did my best to accommodate him.

"How did I know?" Dr. Murthy asked me somewhat smugly. I promptly confessed my ignorance. Dr. Murthy explained to me that the old man, Shekhar, had tested positive for HIV-2. In comparison to the most common subtype, known as HIV-1, the subtype harbored by Shekhar's body was exceedingly rare. Much more difficult to transmit, HIV-2 was confined largely to West Africa. When a case emerged in India, Dr. Murthy confided, you could be almost certain that transmission had occurred in Bombay.

HIV-2 was first detected in India in Bombay in 1991. Unlike much of South India, Bombay has a brothel-based sex work system, a red light district. Dr. Murthy explained that many cases of HIV-2 in India had been traced back to this area, which was frequented by West African businessmen, he told me. Based on the HIV subtype that Shekhar had been infected with, Dr. Murthy had been able to make a guess about Shekhar's historical movements, as well as retrospectively project the route of transmission, from West Africa to western India, and then finally to Chennai. Dr. Murthy had mapped the history of the strain onto the migratory biography of a patient. The historical movement of the virus across space was correlated with the movement of a single body through time and space.

Dr. Murthy told me that Shekhar might have been infected for quite some time. The fact that he was presenting with symptoms only now demonstrated the relatively lower virulence of HIV-2 in comparison to the more widespread strains of HIV-1. Dr. Murthy explained that the natural history of HIV-2 predicted a much slower route from the time of infection to the manifestation of develop visible symptoms. Infection and illness were held apart by time, producing a phenomenon similar to long-term non-progression. In HIV-2, the slow progression from infection to illness is attributed to the relatively lower virulence of the virus itself, its limited capacity to grow and cause illness. In the case of Shankar, the reason for the delay in

progression was unclear – it could have been due to a virus with low virulence, Shankar's biology, or the interaction between biology and virus. Chronicity can be derived from a variety of sources: virus subtype, idiosyncratic biology or pharmaceutical intervention.

Not only does chronicity come into being through a variety of means, but it also takes many different forms. Chronicity does not signify a steady flow of time, a smiling advertisement of the healthy life, until death suddenly strikes at a ripe old age. In the case of HIV, aging is visceral, marking the body inside and out in a variety of ways. For pediatric HIV patients, old age might not come at all.

At the same time, age in the clinic was not simply assessed as a quantitative value. How aging was construed depended upon when aging was construed, the chronological moment at which developmental age was assessed. When a child was found to have a lower developmental age than chronological age, their growth was understood to be stunted –Dr. Ravichandran would say that a child was failing to mature at the proper rate. For these pediatric cases, aging is desirable. The absence of aging is a problem, made concrete in the form of images of bones against a blacklight. For adult patients, aging is the problem – they are *growing old* too fast, they are *aging* too rapidly. These patients were not *maturing* or *developing*, but becoming old too soon. For these adults, aging was construed as a negative value. Aging can be seen as the temporal equivalent of Mary Douglas' idea of pollution as matter out of place. The problem for both children and adult patients was not aging in itself, but rather aging at the wrong time, and not aging at the right time. In the clinic, the natural histories of HIV-positive bodies were neither even nor homogenous. Time, in the form of age, is submitted to radiological exams, to a visual inspection of the body, and to the testing of bones and brains, stamping a unique character onto each case of chronicity.

The newest paradigm in HIV medicine is to treat early. A recent multi-country study, with Dr. Solomon's hospital as one of the research sites, demonstrated that early treatment decreases the rate of infecting sexual partners. Starting treatment early was shown to maintain nearly undetectable viral loads, which in turn led to a decrease in the probability of exchanging viral material during sex. This new paradigm has been termed "treatment as prevention," collapsing two modes of addressing HIV that were for many years thought to be at odds by government officials and public health experts. But many medical professionals have registered concerns over this new paradigm.[488] The effects of antiretroviral therapy on the history of the body – in the prying apart of chronological and developmental age – offer one such site of concern.

When confronted by untimely bodies that all too often meet untimely ends, idealizations of the human lifespan, including the prototypical four-fold *ashramadharma*, not only fall short but prove to be impossible. Such ideal trajectories of life were in all likelihood rarely realized in the course of actual lives. But in the wake of an epidemic, and in light of the long history of epidemics in India, it would be worthwhile to consider how the limits of the body's history forces us to rethink aging, life span and life itself.

The idea that HIV is a chronic condition seems odd when juxtaposed with annual mortality statistics in India, and with the sight of patients at the brink of death being rushed to the in-patient wards. On the other hand, long-term non-progressors like Shankar, and patients with HIV-2 like Shekhar, exhibit forms of chronicity that existed prior to and continues to exist alongside drug-based therapy. Antiretroviral drugs might promise to make all HIV-positive people like Shankar or Shekhar, but the specific drugs that are available in India – many of

[488] See Nguyen et al. 2011

which are no longer prescribed in the United States – often produce deformity, disability and death. If chronological and biological age had at one point seemed to be naturally one, pure age, then virus and anti-virus have worked together to alter this natural history of the body, producing a range of chronic conditions in which the ages of the body could be made separate.

FATALITIES

Heteronomy

Since the findings of the Madras Study and the development of specific drugs that act against microbes, the life and death of patients have become deeply tied to the problem of drug adherence. During one of my first visits to Dr. Solomon's HIV hospital, I was invited into Dr. Murthy's office to discuss my research. As I began explaining my work in an admittedly unclear fashion, Dr. Murthy intervened with what seemed to him to be a more useful proposal. "Why don't you study adherence?" he asked me. In particular, he wanted me to find out why many of the patients who came from the neighboring state of Andhra Pradesh did not adhere to the prescribed regimen of antiretroviral drugs.

This final chapter is in part an attempt to address Dr. Murthy's question. In the clinics in which I worked, adherence was tied to life, to the maintenance of a condition as chronic. On the other hand, non-adherence pointed to death. Quite often, the reverse was also true. A patient who died was retroactively pronounced as non-adherent, often times without evidence that the patient had missed doses or stopped taking medication.

In the more abstract conversations I had with tuberculosis and HIV physicians in India, non-adherence was often explained in terms of a variety of economic and social factors. But in the midst of clinical engagements with patients, physicians often characterized non-adherence as a problem of the will. How does the will enter into conversations about life and death, and about adherence and non-adherence, in the clinic?

Drawing upon ethnography in Dr. Solomon's HIV hospital, I will begin by describing a substitution of wills – a patient who is asked to live not for himself, but for his mother. Although I suspect that the problem of the will is tied to issues of adherence and non-adherence at various sites across the globe, I want to suggest that the clinical interpretation of the non-adherent patient in India can be productively understood to be a part of a longer colonial and even pre-colonial legacy of Indian fatalism. As a counterpoint to the first chapter on vitalism, I want to think here about how ideas about a particularly Indian form of fatalism continues to shape the ways in which people talk about death and the will, especially in the clinic.

My contention however is not that all or even some Indians are fatalists. Rather, I want to suggest that certain forms of death and dying, such as dying from non-adherence, are haunted by the long shadow of missionary and colonial encounters that engendered an image of Indians as essentially fatalistic. Fatalism as produced from within these counters was not simply a desire for death, but a submission to the machinations of fate, that things are working themselves out as they will – but not as we might will. I argue that the idea of fatalism in India is alive and well, present in every Malthusian proclamation that Indians do not value any individual life (except perhaps close kin) because there are so many of them. But fatalism also lurks behind the notion that Indians are unable to innovate, an accusation leveled against much of the Indian science and technology sector. In the HIV clinic, fatalism rears its ugly head in the assertion that seemingly non-adherent patients do not want to live

To think about these clinical encounters differently, I turn from fatalism to the Sanskritist Alf Hiltebeitel's idea of fatalities. For Hiltebeitel, fatalities are the conditions that make certain kinds of death possible while foreclosing others. In the classical examples that Hiltebeitel draws upon from the Sanskrit tradition, fatalities have everything to do with language. Fatalities are

words with performative power, words that make certain ways of dying not only possible but compulsory. At the same time, fatalities do not dictate how one should approach death. I focus on another patient in the HIV clinic, a man who wished to die in order to fulfill what he perceived to be his filial obligation. I consider how he approached his own physical death as a substitute for the social death of his daughter. If fatalities are the conditions that make a certain death possible, I contend that fatalism is only one way in which such a death is approached.

She'll never recover

Sendhil hesitantly entered the Dr. Vijay's office, accompanied by his elderly mother and brother. At that point, I had been conducting research at Dr. Solomon's HIV hospital for about six months, spending each morning with Dr. Vijay. Stern with his patients, Dr. Vijay would occasionally break into a toothy grin when talking about his family or the latest medical discovery. In addition to his work at the HIV hospital, he worked night shifts at another hospital to cover the bills. Remarkably, he never seemed to tire, or at least never showed it, in spite of the two jobs and a new baby at home. He finished scribbling case notes from his previous consultation before looking up from his desk.

The three new arrivals to Dr. Vijay's examination room sat down, Sendhil sandwiched uneasily in the center. I sat perched awkwardly at the edge of the examining table, greeting Sendhil and his family while trying not to knock over the stack of medical records piled up next to me. A dark cloud followed Sendhil into the room, disrupting the pragmatic sensibility with which Dr. Vijay went about seeing patients. Sendhil's mother and brother wore sad expressions on their faces. They took turns explaining that Sendhil had not been sleeping, and that he had not taken his medications in fourteen days. Their concern for Sendhil was palpable. After listening to their worries, Dr. Vijay quietly asked Sendhil's mother to wait outside, without explanation. He seemed to be concerned about what could be asked and answered in front of her. Without protest, Sendhil's mother quietly stood up and left the room, gently closing the door behind her.

As soon as she had exited, Dr. Vijay turned to Sendhil and began firing questions at him. Sendhil, however, remained silent and avoided eye contact. Instead, it was his brother Selvan who answered. Selvan explained that Sendhil would leave the house in the morning as if going to work, only to return a few hours later in an intoxicated state. Sendhil would then spend the rest of the day sleeping, Selvan told Dr. Vijay sadly. When Sendhil was not sleeping or "hitting the water," he lingered around the house, not working, not doing much of anything.[489] Sendhil also continued to experience occasional "fits," Selvan diligently reported, an unmistakable look of concern creasing his face.

In spite of these intermittent seizures, Dr. Vijay assured Selvan that Sendhil was "almost normal" now. It was a miracle that he had survived at all, he added. Dr. Vijay later explained to me that Sendhil had been admitted to the hospital about six months earlier. At that time, he had been diagnosed with tuberculous meningitis. Bacteria had infected the meninges, the protective membrane surrounding the brain and spinal cord, leading to severe inflammation. Sendhil's weakened immune system had been unable to keep the infection in check. Tuberculous meningitis is quite difficult to diagnose and treat, particularly when specialists and certain kinds of medical equipment are in short supply. A few weeks earlier, I had observed a middle-aged man in a coma admitted into the in-patient ward. Dr. Vijay had performed a lumbar puncture in order to collect cerebrospinal fluid. Even without the results of the laboratory tests, he suspected that the patient was suffering from tuberculous meningitis. Dr. Vijay had considered inviting a

[489] "Hitting the water" is the most common Tamil euphemism for drinking alcohol.

neurologist from another hospital for a consultation, but he knew that the comatose man was already in a late stage of disease. He explained to me that the neurologists that he had previously called upon were extremely hesitant to work with HIV-positive patients, so he only asked for consultations when he thought that something might be done for the patient. In that particular case, Dr. Vijay had decided that it was too late. The patient died the next morning.

Sendhil's case had been different. After a few weeks of intensive monitoring in the hospital's in-patient ward, Sendhil had been pronounced clear of the infection and allowed to return home. Since this near fatal episode, Sendhil's health had improved remarkably. In the weeks and months following Sendhil's hospitalization, there had been no discernible trace of tuberculosis and the virus levels in his body had been reduced to a fraction of their former level. Bacteria and virus had been, if not defeated, at least momentarily held at bay.

Dr. Vijay gestured towards the hefty patient file sitting on the desk in front of him, seemingly to indicate how much work had been involved in keeping Sendhil alive. Admission and discharge records, counseling reports, drug regimens, clinical observations, laboratory results and specialist referrals populated this record of Sendhil's medical history. But for Dr. Vijay, this was also a history of labor, of expensive drugs and scarce time devoted to the work of preserving a life. Dr. Vijay turned towards Sendhil and repeatedly asked him why he was not taking his medications, but it was his brother Selvan who responded over and over again: "he won't tell me why, he just drinks."

Taking a deep breath, Dr. Vijay launched into a homily of sorts: "Your life is in your hands. We've put in all of this work for you," he said. "Now, you must do something, keep yourself busy – play table tennis, badminton, get a job, anything at all. Keep yourself busy instead of lying around at home," he urged plaintively. Sendhil remained silent, avoiding Dr. Vijay's eyes while searching for a safe spot to train his vision between the doctor's chin and the clinic floor.

In an attempt to connect with Sendhil, Dr. Vijay switched tracks. "Listen: if something happens to you, your brother will be sad for some time, but he'll be okay again after a while. Your father will be sad too, but he will also be okay. Your mother," he began, "and mothers are different than fathers," he added, "your mother will be heartbroken. *She'll never recover*. I've seen that your mother accompanies you on every visit to the hospital. Just think of how lucky you are. Listen: we all have problems. Some seem worse than others, but all are relative. We must learn to live with it."

Dr. Vijay concluded by hastily scratching a list of drugs on his prescription pad. He tore out the page and handed it to Selvan. The two brothers left, Sendhil never having said a word. Throughout the brief meeting, Sendhil had sat quietly as his doctor, his brother and, for a brief moment, his mother discussed his situation. Sendhil's physical presence had been crucial to the conversation, to serve as the focus of the doctor's address and to silently authorize his brother's speech. At the same time, Sendhil seemed to lack a certain kind of presence or standing, to be unable or unwilling to speak. Dr. Vijay's speech was in almost in the form of an apostrophe, addressed to someone who was not actually present. It required Selvan's intervention to make good on the communicative exchange.

But to what extent can we speak of Sendhil's mother as taking part in this clinical encounter? She was gone from the exam room before I could take much account of her appearance, her comportment, even her speech. But in her absence, she became an integral part of Dr. Vijay's address. She was the one who accompanied Sendhil to the hospital each time. She was the one who waited for him just outside the examination room. Her physical presence was

limited in the clinical encounter, but her presumed desire for her son to live was very much present, articulated through the doctor's speech.

It was in the name of his mother that Dr. Vijay called upon Sendhil to live – *she'll never recover*. Such a claim, it seemed, could not have been articulated from the position of just any kin relation. As Dr. Vijay remarked, brothers and fathers could recover, but mothers would remain heartbroken. Within this discourse, duty, love and the possibility of recovery depend upon specifically gendered relations between kin. If Sendhil died, Sendhil's mother would still have another son. But in Dr. Vijay's admonition, we find that sons are decidedly not replaceable.[490] Kinship was made to work both generally and specifically. While the generic relation of mother and son was important, the actualization of this relation appeared in this case as singular and non-substitutable. Sendhil's mother would never be able to replace Sendhil, in spite of having another son.

While drawing upon the generic and gendered trope of the dutiful and doting Indian mother, Dr. Vijay was also implicitly refusing the standard condescension of insisting that Sendhil had "so much to live for." Dr. Vijay never suggested that Sendhil might have so much to experience or enjoy by continuing to live. For Dr. Vijay, Sendhil did not need to live in order to "play table tennis, badminton, [or] get a job." Conversely, he needed to do these things, do "anything at all," as Dr. Vijay put it, in order to live. If Sendhil was asked to make a sacrifice, it was not to give up his life, but rather to give up (or at least defer) his death by continuing to live, for the sake of his mother.

Despite Sendhil's non-adherence to the discipline required by therapeutic protocol – his continued drinking and smoking, as well as his silent refusal to take the daily antiretroviral medications prescribed by Dr. Vijay – there was no indication that Sendhil actively *sought* death. Rather, what I had heard many doctors say of patients like Sendhil, so-called "non-adherent patients," was that they "did not want to live." Not wanting to live and wanting to die were different things. If Sendhil continued to refuse antiretroviral therapy, there was a high likelihood that his white blood cell count would drop, and that he would be prey to opportunistic infections, many of which could be fatal. But regardless of which infection killed him, many of the medical and public health professionals with whom I worked in India were likely to perceive another chain of causality haunting Sendhil's death, linking stigma and depression to lack of will and non-adherence. Sendhil might not be seeking death, but what Dr. Vijay seemed to be suggesting in asking Sendhil to live for his mother, was that Sendhil did not have the will to live.

In much the same way as this causal chain is meant to explain non-adherence and AIDS-related deaths, a parallel structure underlies much of the discourse of survivorship. If the will to live allows for the possibility of enduring amid hardship, the absence of this will seemed to open up the possibility of death. But as Lochlann Jain has cautioned in her work on breast cancer, triumphalist narratives of survivorship that depend upon the concept of the will can mark death as a personal and moral failure.[491] Those who die come to be seen as committing a betrayal, not only of friends and family, but also of the community of survivors. Dying becomes synonymous with giving up, with lacking will, and with betrayal.

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[490] Sophocles' Antigone, regularly invoked in scholarly discussions on kinship and death, risks her life in burying her brother. She famously proclaims that husbands and sons are replaceable, but brothers are not (1947). Although Sendhil's brother Selvan speaks for him in the clinical encounter, Dr. Vijay chose to highlight the mother-son relation. We can speculate what might have occurred if there was a different familial arrangement, if there was perhaps a sister involved instead of a brother, but what matters here is the way in which Dr. Vijay made use of the relationships available to him.

[491] Jain 2007a

In the conversation that took place in Dr. Vijay's office, what was at stake was not only survival, but also the very will to live. For Dr. Vijay, Sendhil's silent refusal to take life-extending antiretroviral drugs seemed to indicate an autonomous will to survival. In its place, Dr. Vijay offered as substitution a heteronomous duty to Sendhil's mother. If Sendhil could not live for himself, perhaps he could live for someone else.[492]

The dialect between the autonomous will and the duty to an other is explicitly thematized in Kant's moral philosophy. For Kant, deference to an external law constituted non-morality, as only autonomously willed action can be truly moral. As much ethnographic research has shown, such a conception of the autonomous will does not necessarily ground moral personhood across South Asia. In connection with his work with Kashmiri Pandits, T.N. Madan notes that "there is one debt . . . which never gets repaid because it cannot be repaid: this is the debt one owes one's mother (matr-rna). There is no one—not to speak of one's father, not even God—obedience to whom is enjoined more on human beings than to one's mother."[493] Madan's intervention is critical because it demonstrates the close connection between being a moral (human) being and the duty to one's mother. Crucially, he argues that this obedience to the mother is more important than obedience to God or to one's father, echoing Dr. Vijay's words that "mothers are different than fathers."

Within India, there are ethnographic examples closer at hand. In the case of Tamil-speaking South India, Margaret Trawick writes that "*amma*" [mother] is the "one word in the Tamil language more imbued than any other with sentiments of love."[494] Over and above any moral law, obedience, but also love, is owed to the mother. Sendhil's implicit refusal to adhere to the antiretroviral regimen was refigured by Dr. Vijay as a dereliction of his duty to his mother. If Sendhil lacks the will to live, then what Dr. Vijay is suggesting that he should live for his mother. Instead of submitting to his own death, Dr. Vijay asks Sendhil to submit to his mother's will, one that she demonstrates in bringing Sendhil to the hospital and taking care of him. If "Indian fatalism" has been understood as the pathological absence of a will to live, Dr. Vijay's exhortation reveals that submitting to an other's will can sustain both biological and moral life. To understand further how Sendhil's story complicates both narratives of medical survivorship and fatalism, of the will to live and its lack, we have only to turn the pages of the newspaper.

Tales of suicide, punctuated narratives of punctuated lives, are endemic to the pages of both the English and Tamil newspapers and popular weekly magazines that circulate widely in the state of Tamil Nadu. Farmers despair due to their inability to repay debts when the monsoon fails, students buckle under the pressure of highly competitive school exams and exacting parents, wives and daughters-in-laws are worn down by abusive husbands and in-laws, corrupt politicians fear the selectively long arm of the law, distraught lovers are unable to resist arranged marriages orchestrated by their families. These explanations have become highly standardized, serving as templates that easily assimilate seemingly self-inflected death into self-evident news

[492] In her work with Inuit youth, Lisa Stevenson asks "whether it is possible to articulate my own desire for the life of an other without making that desire an imperative, allowing that other to risk his or her own life" (2009:73). She contrasts her own difficult desire with that of the medical and legal establishments, which make anonymous demands that all citizens live: "When life becomes an indifferent value, it no longer matters who you are – simply that you cooperate in the project of staying alive" (2012:601). Dr. Vijay seems to somehow navigate between these two poles. The desire-as-imperative that he offers is neither his own, nor that of an anonymous establishment, but rather that of Sendhil's mother – what Stevenson describes as the recognition of "how our existence is bound up in others" (2012: 606).

[493] Madan 1988:231

[494] Trawick 1992:113

stories. Whereas a particular suicide might come as a surprise, the reasons for suicide never seem to be. Letters to the editor in Indian newspapers regularly lament the low esteem in which Indians hold life; these letters usually blame this low estimation on a combination of population size, corrupt government and a decline in public morals. We are, as many of these letters remind us, living in *kali yuga*.[495]

Bordering Tamil Nadu to the west, the state of Kerala has been infamously dubbed the "suicide capital of India." In her work on Kerala, Jocelyn Chua has attempted to grapple with "how violence and suffering has been distilled down to such a neat equation between discrete motivation and death."[496] Chua describes the ways in which both popular and expert discourses of suicide "fracture the realm of everyday social life and suffering into measurable and decipherable attributes."[497] The histories of the dead are telescoped into simple suicidal tales of underachieving students or beleaguered wives – biographical vicissitudes and the circumstances surrounding the event of death are swept away to allow for ready-made representations of broader social ills.

The "suicide archetypes" that Chua identifies are quite similar to those found in Tamil Nadu.[498] The deaths of HIV-positive people constitute yet another suicide archetype, reported with a similar level of self-evidence. *He killed himself because of the stigma surrounding AIDS. He committed suicide because he was depressed from having AIDS. He internalized the stigma associated with AIDS.* Such explanations were not only regularly presented in the newspapers, but were rampant amongst the doctors and public health practitioners with whom I worked. At a queer film festival that I attended in Chennai, the audience was asked to bow their heads in a moment of silence dedicated to those who have taken their own lives, because of stigma, we were told.

These tales of death seem to fall into the cracks of everyday consciousness, unremarkable filler stories that occupy the inner pages of thick newspapers. It is telling that suicide has become unremarkable in a variety of postcolonial settings. Writing about an epidemic of suicides among the Inuit in the Canadian Arctic, Lisa Stevenson argues that the "absence of surprise is significant. Suicide is at once prohibited and awaited."[499] In spite of the expected and unsurprising nature of suicide, stories of suicide continue to work to great effect in the domains of public health and law. Such tales reveal what might be termed the scandalousness of the social.[500] In light of the scandal of suicide, large sums of money have been contributed by philanthropic organizations and international agencies to "eliminate stigma" and "create supportive environments" in India. The term "stigma" offers a convenient means of encompassing all of the negative aspects of the social, rendering the social an object that can be known, acted upon and transformed. The idea of stigma has an incredible explanatory power,

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[495] In Hindu cosmology, *kali yuga* is the fourth and final era in the history of existence before total destruction and the subsequent renewal of the cycle. It is a time of moral failure and uncertainty, as in the blurring of boundaries. *Kali yuga* is invoked in popular conversation as a general explanation for immoral behavior, social disorder and lapses from religious duty.

[496] Chua 2012:205

[497] Chua 2012:221

[498] Chua 2012:206. A notable exception is the archetype of the spoiled child who kills himself because his consumer wishes go unfulfilled (Chua 2011, 2012). I have not encountered this kind of narrative in Tamil Nadu, but it would be worthwhile to track whether such tales begin to emerge as the range of available consumer goods increases in the state.

[499] Stevenson 2012:603

[500] cf. Cohen 1999; Dirks 2006

requiring no accomplices to make sense of death. But in the process, those deaths attributed to stigma are often rendered quite banal. Death is brought to heel and loses all claim to singularity in the unfolding of public health campaigns and legal cases to combat this ubiquitous killer.

When I first sat down to write about Sendhil, a brief story appeared in the *Times of India* on page three, only fifteen lines long, under the heading "HIV+ man immolates self at Tambaram."[501] The article began as follows: "A 42-year-old man, who was HIV positive, committed suicide in Tambaram by immolating himself early on Wednesday morning. Police said that he set himself on fire due to depression arising out of social ostracism."[502] The causal chain could not be any clearer: stigma leads to depression, which in turn leads to suicide. Fifteen lines were all that were required to narrate what was already self-evident. Stigma might be a fatality in Hiltebeitel's sense, producing the possibility of certain forms of death for HIV-positive people. At the same time, stigma also served as a fatality in a retrospective sense, narrowing the ways in which the death of HIV-positive people could be understood. Even if Sendhil had spoken, could his words have escaped the censorship of such generic prose?

The spirit of the juggernaut

The self-evidence of HIV-related deaths in India can be related to a longer history of reportage and reflection concerning what was perceived to be a distinctively Indian fatalism.[503] In 1827, the German philosopher Hegel issued a stinging review of Wilhelm von Humboldt's 1825-1826 lectures on the *Bhagavad Gita*.[504] As the historian of religion Dorothy Figueira has noted, "The moral dilemma of fatalism that we have attributed to the Western reception of Indian thought in general found its first systematic articulation in Hegel's essay responding to Humboldt."[505] As much a disparagement of the possibility of Indian genius as a chastisement of Humboldt's sympathetic orientalism, Hegel's reading of the *Bhagavad Gita* underscored the place of India in his general philosophy of the history of Spirit. "'In the state of dreaming [which characterizes Spirit in India] . . . Spirit has ceased to exist for itself in contrast with alien existence, and thus the separation of the external and individual dissolves before its universality."[506] In India, Spirit takes the form of pure imagination, resulting not only in an immoral disregard of physical reality, but in a neglect of the boundary between self and other. For Hegel, a corollary of this "monstrous, irrational imagination" is a thoroughgoing Indian fatalism.[507]

Although Hegel described this fatalism in the domain of politics, in the often-discussed oriental tendency to submit to the lethal whimsy of despots, he also fixed his sights on religious practice at the festival of Jagannath. Though this festival took place (and continues to take place) on the eastern coast of the subcontinent, in the modern state of Odisha (formerly Orissa), it quickly became a metonym for India and Indians as a whole. During this festival, Hegel informs

[501] Tambaram is an area in the outskirts of Chennai, the capital of the state of Tamil Nadu. It is also the location of what is purportedly the biggest HIV hospital in all of Asia, which was once Dr. Muthu's tuberculosis sanatorium.
[502] *Times of India* 2012:3
[503] For a helpful discussion on the legacy of fatalism in relation to biomedical interventions in Egypt, see Hamdy (2009). Hamdy (2004) also points out that accusations of fatalism come not only from European and American commentators, but from within Islamic reform movements.
[504] As Masuzawa puts it, "a much disturbed Hegel interrupted the revision of his *Encylopedia* (1817) and wrote a two-part response longer than Humboldt's text" (2005:161).
[505] Figueira 1994:74
[506] Hegel 1861:147
[507] Hegel 1861:174

us that "the image of the god Vishnu is drawn in procession on a car . . . and many fling themselves down before its wheels to be crushed to pieces."[508] Hegel writes that in India, "the Spirit wanders into the Dream-World, and the highest state is Annihilation."[509] "How little," he remarks, do Indians "hesitate to sacrifice themselves to the Highest—to Annihilation."[510] Borrowing from the reports of English explorers, he provides varied illustrations of this peculiar Indian disregard for life: widow burning, self-immolation, infanticide, self-induced drowning. For Hegel, this fatalism characterizes the state of development of Spirit during its sojourn in India, in the time of its immaturity, before its realization of its truth through the course of the "truly historical."[511]

This thesis of Indian fatalism hinges in large part upon deterministic understandings of popular theological concepts like *dharma*, *karma*, *maya* and reincarnation. In the *Bhagavad Gita* in particular, the heroic Arjuna's *dharma* to battle against his preceptors is reread as his destiny. This specifically Hegelian version of Indian fatalism oscillates between an actual desire for death (to escape rebirth) and an indifference to this-worldly life (as it is both fated and inconsequential in relation to the imagination). But the seeds of Indian fatalism, particularly in relation to the metonym of the festival of Jagannath, have a much longer history, stretching back before Hegel by at least five hundred years.

After the publication of the travel writings of Marco Polo, tales of wonder became extremely popular and influential in medieval Europe.[512] One such tale, penned in the early fourteenth century, is attributed to the Franciscan traveler Odoric of Pordenone. After having described the process of constructing the chariot for the god Jagannath, he reported that:

> Many pilgrims also put themselves under the chariot wheels, to the end that their false god may go over them: and all they over whom the chariot runneth are crushed in pieces, and divided in sunder in the midst, and slain right out. Yea, and in doing this, they think themselves to die most holily and securely, in the service of their god.[513]

For Odoric, death at the festival of Jagannath is figured as a sacrifice, a holy service proffered to a "false god." Although Odoric's tone clearly suggests that he finds such sacrifice idolatrous and misguided, he does not characterize these pilgrims as exhibiting an indifference to life. In so far as these pilgrims do in fact desire death, Odoric seems to be saying that they desire a particular kind of (good) death, in service to Jagannath. In Odoric's description, the elaborate practices through which these pilgrims constitute their deaths as sacrifice indicate an investment both in the forms of this-worldly life and in the means by which death is realized. The pilgrim alone might sacrifice his life to Jagannath, but it is only in the company of friends and family:

> when any man offers to die in the service of his false god, his parents, and all his friends assemble themselves together with a consort of musicians, making him a great and solemn feast: which feast being ended, they hang five sharp knives

[508] Hegel 1861:157
[509] Hegel 1861:155
[510] Hegel 1861:156
[511] Hegel 1861:121
[512] Daston and Park 1998
[513] Odoric 1900:333

about his neck carrying him before the idol, and so soon as he is come thither, he taketh one of his knives crying with a loud voice, For the worship of my god do I cut this my flesh, and then he casteth the morsel which is cut, at the face of his idol: but at the very last wound wherewith he murdereth himself, he uttereth these words: Now do I yield myself to death in the behalf of my god, and being dead, his body is burned, and is esteemed by all men to be holy.[514]

The pilgrim openly sacrifices himself with full sanction of friends and family. In Odoric's narration of events, this act of self-sacrifice is simultaneously intentional and conventional, following a ritualized format by which the family participates in the sacrificial activity. The pilgrim announces his intention to sacrifice himself to Jagannath. He is feted with food and music. The burnt remains of his body are held to be holy.

Odoric's description of Jagannath seems to have become something of a sensation, encouraging a long line of works that drew upon his descriptions. Most famous was the mid-fourteenth century *Mandeville's Travels*, which contained the following depiction of the same festival, which I quote at length:

> [S]ome of them fall down under the wheels of the car, and let the car go over them, so that they be dead anon. And some have their arms or their limbs all to-broken, and some the sides. And all this do they for love of their god, in great devotion. And them thinketh that the more pain, and the more tribulation that they suffer for love of their god, the more joy they shall have in another world. And, shortly to say you, they suffer so great pains, and so hard martyrdoms for love of their idol, that a Christian man, I trow, durst not take upon him the tenth part the pain for love of our Lord Jesu Christ. [. . .]
>
> And then for the love and in worship of that idol, and for the reverence of the feast, they slay themselves, a two hundred or three hundred persons, with sharp knives, of the which they bring the bodies before the idol. And then they say that those be saints, because that they slew themselves of their own good will for love of their idol. And as men here that had an holy saint of his kin would think that it were to them an high worship, right so them thinketh there. And as men here devoutly would write holy saints' lives and their miracles, and sue for their canonizations, right so do they there for them that slay themselves wilfully for love of their idol, and say, that they be glorious martyrs and saints, and put them in their writings and in their litanies, and avaunt them greatly, one to another, of their holy kinsmen that so become saints, and say, I have more holy saints in my kindred, than thou in thine!
>
> And the custom also there is this, that when they that have such devotion and intent for to slay himself for love of his god, they send for all their friends, and have great plenty of minstrels; and they go before the idol leading him that will slay himself for such devotion between them, with great reverence. And he, all naked, hath a full sharp knife in his hand, and he cutteth a great piece of his flesh, and casteth it in the face of his idol, saying his orisons, recommending him to his god. And then he smiteth himself and maketh great wounds and deep, here and there, till he fall down dead. And then his friends present his body to the idol.

[514] Odoric 1900:333

> And then they say, singing, Holy god! behold what thy true servant hath done for thee. He hath forsaken his wife and his children and his riches, and all the goods of the world and his own life for the love of thee, and to make thee sacrifice of his flesh and of his blood. Wherefore, holy god, put him among thy best beloved saints in thy bliss of paradise, for he hath well deserved it. And then they make a great fire, and burn the body. And then everych of his friends take a quantity of the ashes, and keep them instead of relics, and say that it is holy thing. And they have no dread of no peril whiles they have those holy ashes upon them and put his name in their litanies as a saint.[515]

Following Odoric's text, Mandeville includes a description of the involvement of friends and family in the festival. But the event he describes seems to be something akin to a passion play with an all-Indian cast, the re-enactment of the Crucifixion on the subcontinent. The "sacrifice" of the man who endures pain, suffering and tribulation, in order to "martyr" himself for "love of God," is granted eternal joy as a "saint" in "the bliss of paradise," his body becoming a burnt "relic." Mandeville's idiom is emphatically Christian. He even goes so far as to make the allusion explicit, stating that a Christian would not suffer even a tenth of what those he describes undergo.

Despite probably never having witnessed the festival of Jagannath firsthand, Mandeville provides an alternative figuration of these deaths, one that is couched in Christian idiom and imagery. For both Odoric and Mandeville, these deaths are primarily understood to be sacrifices. While these highly Christianized readings of sacrifice might have little purchase for a scholarly understanding of fourteenth-century India, they do suggest that the story of Indian fatalism had yet to take root in Europe. In these texts, the Indian Other still had its own rationality, albeit one that bore a marked resemblance to European and particularly Christian forms of reason. Death was not a simple submission to the machinations of fate, but rather a deliberate act through which the Indian pilgrim demonstrates his love of God before an assembly of family and friends.

Non-fatalist readings of such practices of sacrifice began to lose ground just prior to Hegel's exegesis, in the writings of the missionary Abbé Dubois. In the first decade of the nineteenth century, the Abbé Dubois penned his highly influential account of Hindu customs. In large part a treatise on caste, Dubois asked in his text whether Brahmins had "ever attempted to restrain the frenzy of those fanatics who, in their mistaken devotion, foolishly allow themselves to be crushed under the wheels of the car of their idols, or throw themselves headlong into the stream at the junction of the Ganges and the Jumna?"[516]

In Dubois' accusation, there is no longer time for a feast. These acts of deaths take on a spontaneous character, with none of the deliberation found in Odoric's text. Pilgrims "allow themselves" to die, rather than choosing death as a mode of sacrifice. Death occurs as an act of frenzy. The support of friends and family is supplanted by the unrestrained movements of the "senseless mob."[517] Christian allusions and idioms are largely absent, as the medieval age of bodily discipline and passion plays has not only passed, but has become an embarrassment to the orthodoxy, to be re-scripted if possible as an era of unfortunate heterodoxy.[518] The Abbé Dubois does offer a culturalist logic of sorts, stating that "the tendency of Hindus to submit their bodies

[515] Mandeville 1900:117-8
[516] Dubois 2007:606
[517] Dubois 2007:319
[518] See Niklaus Largier (2007) on practices of bodily discipline and self-mortification in medieval Christianity.

to severe and often cruel tortures, or to spend their means in costly offerings, is manifested whenever they find themselves in critical circumstances, and particularly in times of sickness."[519] The mortification of the flesh in extreme times is rendered as a particularly Hindu tendency. With the Abbé Dubois' re-reading of the scene at Jaganath, the discovery of Indian fatalism is imminent. With Hegel, the redaction of the festival reaches its zenith. The movement of the cart over the bodies of pilgrims can only be understood as a microcosm of a necessary stepping-stone along the path of Spirit. Rushing to one's death at the feet (wheels) of Jagannath is a sign of a fatalism specific to India, in which the material is absorbed and perverted by the imagination. For Hegel, neither sickness nor devotion can have anywhere near the explanatory power of as the world historical movement of Spirit in its quixotic quest for realization.

In the long movement from Odoric to Hegel, sacrifice becomes an instance of spontaneous fanatical irrationality. The death of the pilgrim is extracted from the familial scene and gradually inserted into the mob. If in Odoric, the devotional rationality of self-sacrifice is recognized by the family, in Dubois and Hegel, the irrational mob has no standing to impart such recognition.

In Durkheim's writing on suicide, the scene at Jaganath figures as a matter of fact in his exposition on the kind of person who "kills himself purely for the joy of sacrifice, because, even *with no particular reason*, renunciation in itself is considered praiseworthy."[520] For Durkheim as well, Indians die without reason. "The Hindu" in particular, he notes, "was always inclined to self-destruction."[521] In regard to the "story of the fanatics who let themselves be crushed to death in throngs under the wheels of the idol Juggernaut," he reports that it has become a "classic."[522] Death at the festival is refigured as an anonymous act amid an anonymous multitude, no longer merely mistaken but actually meaningless.

Dead elephants and women on the battlefield

If missionaries, explorers, philosophers and sociologists have brought us a vision of Indian fatalism under the wheels of a chariot, perhaps we can find an alternative history amid other chariots, on the battlefield of Kurukshetra. In one of the greatest family dramas of the Hindu corpus, death figures prominently without the reductive force found in contemporary Indian dailies. During the great battle of Kurukshetra in the *Mahabharata*, the eventually victorious Pandavas face an army of seemingly unvanquishable opponents. Instead of turning to the dialogue between Arjuna and Krishna, the material of the *Bhagavad Gita* that so inspired Humboldt and revolted Hegel, we can look to the ranks of the Pandavas' foes. In his book on battle in the *Mahabharata*, Alf Hiltebeitel notes that "Almost always, and especially in the battle scenes, certain fatalities set up the conditions whereby a particular death becomes possible: not only curses and blessings, but oaths and vows and personal prohibitions, whether dishonored or honored."[523] By fatality, Hiltebeitel seems to be referring to these spoken words – curses, blessings, oaths and vows – that make these deaths not only possible but inevitable.

Among the deaths that Hiltebeitel discusses is that of Drona, the former *guru* of the

[519] Dubois 2007:600. As anyone who has experienced the brutality of cancer therapy and the associated high costs can affirm, Hindus are not the only ones to behave this way when "they find themselves in critical circumstances." See Siddhartha Mukherjee (2010), as well as Lochlann Jain's growing body of work on breast cancer (2007a, 2007b, 2010, 2013).
[520] Durkheim 1979:223, emphasis added
[521] Durkheim 1979:223
[522] Durkheim 1979:224
[523] Hiltebeitel 1990:39

Pandavas, who is bound by an oath of allegiance to fight against the Pandavas. Having taught the Pandavas all that they know, Drona is clearly their superior in the martial forms. The only way to kill him would be for him to accede to his own death. But how could the Pandavas convince him to do that? Only through a clever ruse, engineered by the impish Krishna. He has an elephant killed, a particular elephant that bears the name Aswatthama. Coincidentally, this is also the name of Drona's son. Yudhisthira, the eldest Pandava brother whose honesty is beyond question, is charged with proclaiming that Aswatthama the elephant is dead. In a particularly Indian *sotto voce*, a conch shell is sounded over the crucial information, that Aswatthama *the elephant* is dead. Falling prey to the play of the conch, Drona despairingly lays down his arms, and in effect lays down his life. He is slain immediately thereafter by the Pandavas' brother-in-law, Dhristadyumna. Hiltebeitel reminds us of how Drona himself provides the means of his own defeat, telling Yudhisthira before the battle: "I shall abandon my weapon in battle having heard something very disagreeable."[524] Drona's words establish this fatality, creating the conditions that make possible his death.

Others are similarly caught in the crossfire between kin. Bhishma, the celibate grand-sire of both parties in the battle, is nevertheless obligated to fight on the side of the Pandavas' enemies. Like Drona, he is also undefeatable in battle. Again, the Pandavas resort to cunning. They enroll Dhristadyumna's brother, Shikhandi, into their forces. In his previous life, Shikhandi had been a woman named Amba. Bhishma had spurned Amba's advances, on account of the life-long vow of celibacy made to his father. Vengeful, Amba undertakes severe *tapas* [austerities] so as to gain the power to become the cause of Bhishma's death. Amba's rebirth as Shikhandi provides the perfect opportunity for revenge.

Shikhandi acts as Arjuna's charioteer, placing himself in harm's way in order to defend Arjuna. Luckily for Shikhandi, Bhishma recognizes him as Amba reborn and lays down his weapons, refusing to fight a woman (an odd thing to do, considering that many of the soldiers on the field may well have been women in previous lives; Arjuna himself had been a woman for a year just prior to the events at Kurukshetra, during his exile, in the form of Brihanala). Arjuna releases a volley of arrows into the disarmed Bhishma's body. But, Bhishma does not die. His vow of celibacy had earned him a boon from his grateful father Shantanu, the power of *iccha mrityu*. Literally a death wish, this boon gave Bhisma the power to choose the time of his own death. Hiltebeitel glosses Shantanu's boon as "death at his own will" or the "indefinite postponement of death."[525]

While awaiting the auspicious time of *uttarayanam*, when the sun moves from south to north, Bhishma lectures to Yudhisthira on good governance. Although his enemy in battle, Bhisma recognizes Yudhisthira will win the war and attempts to prepare him for his future role as king – in fact, Bhisma had already given Yudhisthira knowledge of how to defeat him before the battle commenced, just as Drona had done. He had earlier provided Yudhisthira with a list of people that he would not fight, including women. Bhisma even went out of his way to say that no "male being" could defeat him, an example of what Hiltebeitel calls the "riddlelike character of 'subtle dharma.'"[526]

Drona and Bhisma are both undone by language – through deceitful proclamations and vows of celibacy. At the same time, they are also undone by relations of descent. Both sides are related to Drona as *guru* and Bhisma as ancestor. Having sworn their allegiance to the kingdom

[524] Hiltebeitel 1990:252
[525] Hiltebeitel 1990:246
[526] Hiltebeitel 1990:247-8

of Hastinapura, Bhisma and Drona were duty-bound to fight for the Kauravas. But Bhisma's deathbed oration to Yudhisthira suggests that his duty conflicted with his sense of both the good and the inevitable. This creates an impossible situation: Bhisma and Drona must fight for the Kauravas, but they know the Pandavas to be in the right. Bhisma and Drona are also invincible in battle – neither could be killed without in some way willing it so, without opening themselves to death.

In Bhisma's case, the boon from his father quite literally makes his death a question of will. Krishna's subterfuge makes possible the conditions of possibility of their deaths, but Bhisma and Drona seem to welcome this deception, going so far as to provide advice to Yudhisthira on the means to subdue them. Through the agency of a well-timed blast of the conch shell and an instance of metempsychotic transgendering, Bhishma and Drona were able to fulfill their duty to one descent group (the Kauravas) while allowing their other descendants (the Pandavas) to emerge victorious. Death became the singular means by which kinship duties could be realized at the same time that the right (of the Pandavas) could be upheld. Caught between warring members of their clan, who are also the rulers and would-be rulers of the land, Bhishma and Drona do not submit to death in order to escape from the world into the imagination. Rather, through their words, Bhisma and Drona make their own deaths as part of an effort to remake the world.

Not the usual injection

Returning from the din of the battlefield to the relative quiet of the HIV hospital, I found that not all patients were as silent as Sendhil. Vasudevan was amongst the first to arrive at the hospital that morning, and so would be amongst the first to be seen by the doctors. A middle-aged man with a respectable head of gray, Vasudevan was not only prompt but also regular – he never missed a check-up. He was for many of the doctors an ideal patient. That morning, Vasudevan was called to meet with Praveen before seeing the doctors. Trained as a social worker, Praveen offered regular adherence counseling to patients, to encourage them to continue to take their medications and remain healthy. Praveen's small office had a window facing out onto the troubling juxtaposition of a sprawling park and an ever-growing garbage heap. There was no fan, so the lone window provided the only solace from the heat. Hung on the wall was a calendar offered as a gift by a diagnostic laboratory, each month featuring smiling professionals decked in lab coats examining slides and operating x-ray machines. Vasudevan sat down in front of Praveen's desk and began to dab his forehead furiously with a crumpled handkerchief extracted from his shirt pocket.

I spent many of my days in the hospital witnessing doctors screaming at patients about skipping doses and appointments. Vasudevan was never subject to such displays. His commitment to both the duration and discipline of therapeutic time had been beyond reproach – over the course of many years, he never missed appointments and took his medications twice daily. Adherence to therapeutic norms of time has been a central tenet of public health programming since at least the early 1950s, with the introduction of long-term chemotherapy for tuberculosis. Failure to adhere, to "comply" in an earlier idiom, often resulted in easy labeling: non-compliant, non-adherent, defaulter. "There's no point," I was told by numerous doctors. "They don't want to get well."

By such measures, Vasudevan wanted to get well – or at least stay well, the best that can be hoped for when a condition was chronic. The contrast between Vasudevan and Sendhil was clear. Vasudevan's medical file recorded his regularity through its relative narrowness: instead of

the heterogeneous sheets of paper that indicated problems – hospital admissions, treatment for opportunistic infections and various other complications, the very sorts of papers that populated Sendhil's file – Vasudevan had only the regular laboratory reports and clinical notes indicating that all was well. Vasudevan bore none of the visible stigmata of HIV infection, not even a mild fatigue that might indicate that something was amiss. To my eye, he appeared quite healthy.

Praveen began to run through his regular battery of questions. "Are you taking your tablets daily?" he asked. "Yes, morning and night," Vasudevan responded. "Any physical problems, old or new?" "No," Vasudevan said. This interview seemed destined to produce yet another innocuous sheet of paper to be fitted neatly into his patient record. Praveen's pen raced across the page as he made all of the cursory marks in the patient file that indicated that there were no concerns. Putting down his pen and closing the file, Praveen looked up and asked Vasudevan if he had any other questions, doubts or concerns.

Vasudevan dabbed his brow, clearly losing the battle against the indomitable heat. "Yes," he replied. "One question." He met Praveen's eyes with his own. "Can you," he asked, pausing for a moment, "give an injection to kill me?" I leaned forward slightly from my chair which was placed a few feet behind Vasudevan's right shoulder. I thought perhaps that I had heard incorrectly. But Praveen appeared to be visibly startled. He quickly regained his composure and asked Vasudevan to repeat himself. The question remained unchanged.

The oddity of Vasudevan's request had immediately brought to mind a recently concluded Supreme Court case that had been somewhat of a c*ause célèbre*. The newspapers had carried daily coverage of the case and television pundits regularly expounded their views on the theological, medical and legal issues at stake. The case itself involved a nurse from the South Indian state of Karnataka, Aruna Shanbaug, who had been working in the King Edward Memorial Hospital in Bombay. In 1973, Shanbaug had been raped and beaten by a ward boy, putting her into a vegetative state. She became a patient in the same hospital where she had worked, cared for by her fellow nurses. In 2010, the journalist Pinki Virani filed a plea for euthanasia in the Indian Supreme Court on behalf of Shanbaug. The Court's landmark judgment stated that passive euthanasia was acceptable under certain strictly defined conditions. I cannot know whether Vasudevan had the Shanbaug case in mind when he made his plea to Praveen, but the timing of his request and the ubiquity of the case in the media made it highly likely that he knew something of the euthanasia ruling.

While Vasudevan's appeal was unexpected, the specific modality of death that he requested, the injection, was unexpectedly common. As a treatment, the injection works faster, I was often told. The injection (*ūsi*) is more effective than tablets (*māthirai*), others insisted. As one patient explained to me in what seemed to be a rather forced effort to appear balanced, the injection is more effective than tablets, but only for some people. As many medical anthropologists and public health scholars have noted, the injection enjoys extreme popularity as a therapeutic modality throughout India.[527]

When the injection was requested, the particular substance to be injected was usually left unspecified by patients. "Doctor, my body is not okay, please put an injection" (*udambu sariya illai, ūsi podungo*). Even without specifying a particular symptom or a particular therapeutic substance, patients could usually identify their preferred modality of treatment, the injection. In a

[527] Nichter 1980, 1996; van der Geest 1982; Whyte et al. 2002. The success of smallpox vaccination campaigns in India (see Bhattacharya et al. 2005; Bhattacharya 2006) might well have provided the injection with some of its contemporary halo, although such injections were not curative, but preventative. Others have suggested that doctors themselves encourage injections in order to extract more money from patients.

government chest hospital where I would later conduct research, many of the patients experienced a very specific symptom, difficulty breathing. Doctors regularly offered bronchodilators in the form of an oral formulation or an injection. When given this choice, patients almost always requested the injection. Some scholars have argued that the potency of non-biomedical therapies resides not in the therapeutic substance in and of itself, but rather in the healer's charisma (which may be transferred to the substance).[528] In the case of the injection, both charisma and substance are superseded by modality.

In Vasudevan's plea, the heightened healing potential of the injection had been reversed, transforming a therapeutic modality into a means of death. Similar to the Greek *pharmakon*, the Tamil word *marunthu* is generally used to refer to medicine, but in slightly modified forms it can refer to pesticide, insecticide, poison or magic used to cause illness in humans. Vasudevan's entreaty extended this ambiguity to the injection, as a particular modality or form of *marunthu*.

Praveen was initially dumbfounded by Vasudevan's request. What could possibly be wrong, he wondered aloud. After all, Vasudevan seemed to be incredibly healthy, with none of the signs or symptoms of illness. He was not suffering from any of the debilitating opportunistic infections or drug-related side effects that plagued many of the other patients who sat waiting outside of the counselor's office. Vasudevan's laboratory results were consistently positive. His white blood cell counts were high. The drugs were doing their job. What could be the reason for his death wish?

The problem, explained Vasudevan, was precisely related to his continued good health. He knew that he was doing well. But to maintain the efficacy of his treatment, he had recently switched to a second-line regimen of anti-HIV drugs, which was substantially more expensive than his earlier first-line regimen. Like the drugs that constitute basic first-line therapy, second-line drugs were also available from Indian generic drug manufacturers. But even in generic form, these drugs remain prohibitively expensive for the majority of HIV-positive Indians. Second-line drugs were dispensed without cost through the Indian National AIDS Control Program, but only by means of a very selective, time-consuming rationing process that involves repeated meetings by state-level boards composed of medical bureaucrats. This left many without treatment. Many of those who have eventually been granted access to government-provisioned second-line therapy only received medications after becoming quite ill – horror stories abound of those who died while waiting. Vasudevan purchased the drugs with his own money to circumvent these time-consuming and potentially lethal bureaucratic channels, but the high cost of these drugs drained a good portion of his government pension. That money, he lamented, should have gone to "settling his daughter" [arranging her marriage], but was instead diverted for his medication.

Vasudevan further explained that he lived with his family in a small village near Kanyakumari, at the southernmost tip of the Indian subcontinent. He belonged to the large Brahmin community in his village, into which he wished to marry his daughter. He despaired that if his condition were to be discovered by the other villagers, his daughter's prospects for marriage would dwindle to nothing. Word would spread quickly to the other Brahmins of the village, and no one would marry a daughter into such a family. Marriages were alliances between families, and a daughter's honor was in large part a reflection of her parents. It was not his illness that posed a danger to his daughter, but rather the *knowledge* of that illness if made public.

Praveen listened to Vasudevan's concerns. During the time I spent in Praveen's office, I had heard many patients and their families raise concerns about marriage. If patients were unmarried and young, they would often ask Praveen whether marriage was still a possibility.

[528] Kakar 1982, Barrett 2008

With the assistance of Positive People's Networks, marriage alliances could occasionally be arranged between HIV-positive people. Even when such arrangements were sought, issues of caste, language and region remained priorities in the selection of a suitable spouse. Vasudevan's problem was different. He was not in search of a spouse for himself, but for his daughter. While his daughter had not inherited the virus that pervaded his body, she was in danger of inheriting the consequences of his illness.

After acknowledging Vasudevan's anxieties, Praveen offered a counterpoint. If Vasudevan were to die, if he were able to somehow safeguard the secret of his illness and redirect his financial resources to settling his daughter, who would remain alive to ensure that his daughter was properly settled?

Death might solve other problems, but it would create a lack. His daughter would be without a father. It was Vasudevan's duty as a father, Praveen maintained, to orchestrate his daughter's marriage and ensure that a suitable match was made for her. Although Vasudevan's wife was alive and had not been infected by the virus, both Praveen and Vasudevan seemed to implicitly agree that she could not fulfill this (fatherly) duty. Vasudevan had spoken about his death as being in service to his daughter and her future happiness, as part of his duty as a father to settle his daughter. Praveen had reversed the terms of this argument by insisting that Vasudevan must not die for his daughter, but on the contrary, must live for her.

Vasudevan's *iccha mrityu*, his death wish, poses a different sort of interpretative challenge than Sendhil's silence. He explicitly provided his motivations to the counselor, undercutting the possibility of any simple causal narrative of suicide from stigma or depression. Vasudevan was also concerned about kinship, and about money. As a householder, and especially as a father with a daughter of marriageable age, one of Vasudevan's primary duties was to ensure that she was married off properly.[529]

What was meant to be a routine check-up quickly became a debate on the duties of living and dying. Vasudevan presented his own death as the means by which he could fulfill his duty as a father. Praveen contested Vasudevan's claim, arguing instead that death was a dereliction of duty. This was not a discussion about the illegality of suicide and active euthanasia.[530] Even if the Aruna Shanbaug ruling played a role in inciting this conversation, Praveen and Vasudevan were concerned with a very different set of ethical demands. Praveen and Vasudevan agreed that it was a father's duty to settle his daughter. Their disagreement concerned the practical and ethical means by which such a duty could be fulfilled.

Drawing upon Kierkegaard's reading of the story of Abraham and Isaac in his own meditation on death, responsibility and sacrifice, Derrida asks about the possibility of sacrificing oneself for an other, about the possibility of life as a gift that one gives to an other through giving oneself death ("*se donner la mort*").[531] Following Heidegger, he notes that life cannot be given to another as a repudiation of that other's death. For Derrida, substituting one's death in place of other's death is impossible. What Vasudevan seemed to be saying to Praveen involved an altogether different mode of substitution. Vasudevan hoped that his physical death could provide the possibility of life for his daughter, as a wife and a mother. His physical death could prevent

[529] The framework of *ashramadharma* provides a blueprint for an ideal life consisting of four stages: *brahmacharya* (celibate student), *grihasthya* (householder), *vanaprastha* (forest dweller) and *sanayasa* (renunciant). Each stage has its own set of norms and responsibilities. In practice, few Hindus realize or even desire to realize the final two stages. The acclaimed paragon of wisdom and duty from the *Mahabharata*, Bhishma, never progresses beyond the first stage, in observance of the vow of celibacy he takes for his father.
[530] Suicide is illegal in India, under the Macaulayian Indian Penal Code that for the most part remains in force.
[531] Derrida 1995

her social death, her descent from a certain idealized vision of Tamil Brahmin womanhood. One form of death could take the place of another, as well as *for* the other.

Critically, neither Vasudevan nor Praveen speak of Vasudevan's request for death as suicidal, in spite of the lingering possibility of the semantic glide from therapeutic injection to lethal injection. Vasudevan explained to Praveen that he had a reason to die. Praveen inverted Vasudevan's explanation, presenting it as a reason for him to live. The nuanced rationality of Vasudevan's request for death has less to do with desiring death in itself, and more to do with death as a means to another end.

The many deaths that crowd the daily newspapers, especially those figured as suicides, are also described in terms of archetypal reasons.[532] The death of the HIV-positive patient from stigma is one way in which such archetypal forms produce a narrative closure of Indian lives and deaths. In Vasudevan's case, HIV produced the conditions that made possible his request for death. The way in which Vasudevan approached that death, as a form of sacrifice that could substitute for the social death of his daughter, was not an attempt to reject the world. Rather, he hoped to remake the world, at least the world of his daughter, through ending his life. In Sendhil's case, the sacrifice was in turning away from the possibility of death, in continuing to live for his mother. In these cases, adherence and non-adherence are not simply choices about one's own life and death. Rather, adherence to treatment can be a form of living death, and non-adherence can be way of continuing life for an other.

[532] See Spivak (1988) on the forms of subaltern publicity made possible and foreclosed through suicide.

CONCLUSIONS

In the face of a series of scientific revolutions, from germ theory to molecular diagnostics and everything in between, tuberculosis and HIV persist. Neither breakthroughs in medicine nor historiographic pronouncements about the end of disease have succeeded in quelling these conditions. I began by discussing the work of Dr. David Chowry Muthu, a Tamil doctor from Madras who spent his life producing evidence and arguments in favor of a vitalist vision of the body, disease and environment. Muthu's career spanned Europe and India, and his thought similarly drew upon the philosophy of the open-air sanatorium movement and partook in the neo-Ayurvedic revivalism of early twentieth-century India. In offering a critique of germ theory, Muthu also provided an argument against a certain form of civilization and the ways in which it reshaped the colonial environment.

In the gap between Koch's proclamation of a specific cause for tuberculosis and the development of antibiotics, those who suffered from tuberculosis turned to sanatoriums and other therapeutic forms in hopes of a cure. The cure that emerged in the mid-twentieth century turned out to be partial at best, an ending that lacked finality. Over half a century later, the "functional cure" developed for HIV suffered from the same partiality. Both of these therapeutic forms demand a rethinking of what it means to heal, to cure and to write about the end of disease. The history of the development of these cures also asks us to consider what forms of evidence and authority can be marshaled to make a claim about therapeutic efficacy.

The question of treatment, however, can only proceed the prior question of diagnosis. How do we know that a condition is a particular condition? In tracing the history of diagnostic techniques and technologies, I asked about how certain ways of knowing disease persisted across time as survivals. What can X-rays tell us in the twenty-first century, and what do X-rays enable in terms of treatment, but also in regard to deferral and referral? How are space and time reshaped by such diagnostic technologies? As my discussion of infected sloth bears and cows demonstrated, diagnosing tuberculosis is not an exclusively human concern. I showed how specific forms of the disease travelled between species, bringing into question the desirability and dangerousness of certain kinds of interspecies relationships.

In addition to questions of life and death, of vitalisms and fatalities, I have explored how time was and continues to be actively reshaped by and around certain conditions. Drawing upon ethnographic material from an HIV clinic in Chennai, I showed how the aging of both children and adults was diverted from a "natural" course to produce new natural histories of disease and the body, histories in which chronological and biological age were pulled apart at the seams. Although these histories might necessarily end with death, how death came to be understood depended in large part upon colonial and pre-colonial histories of what was perceived to be a particularly Indian brand of fatalism. Turning to the work of Alf Hiltebeitel, I argued that the notion of fatality allows us to see how adherence to strict drug regimens is not equivalent to adherence to life.

In a time when co-morbid conditions are common, scholarly treatments of single diseases are important but perhaps inadequate. HIV and tuberculosis have become intertwined in clinics and hospitals in India, as well as in many other parts of the world. The idea that tuberculosis has returned is in part premised on the idea that the disease has taken advantage of the immune suppression produced by HIV – both literally and figuratively, tuberculosis is an opportunistic

infection. But to write simply of co-infection is to neglect the ways in which institutional structures and histories are also co-infected. The discipline of microbiology developed in many ways around tuberculosis. Although HIV is a retrovirus, not a bacterium, advances in microbiology were central to understanding and treating the disease. With the development of chemotherapy, tuberculosis sanatoriums were thought to be no longer necessary. The emergence of HIV in the 1980s provided a new use for these structures, bringing new life and new forms of death to these almost-forgotten facilities. I have tried to show that there is more to co-infection than the simple co-presence of virus and bacterium in a single body.

In the last two years, many new sources of hope have emerged that allow us to imagine that tuberculosis and HIV might soon be conditions of the past. The case of the Berlin Patient and the subsequent trial of similar therapies on other patients have brought new funding and attention to the possibility of curing and not simply preventing HIV. For the first time in half a century, a new pharmaceutical agent – bedaquiline – has been developed for the treatment of tuberculosis. This drug has already been released in South Africa and is in use in the private sector in India, but lacks any serious regulation or oversight from either domestic or international authorities. The fear is that this new drug and any that are to follow will soon fall prey to the problems of the first generation of antibiotics. Drug resistance, some public health experts fear, is always just around the corner. I have suggested that resistance is central to the working of these drugs, not a side effect. Instead of attempting to avoid resistance or locate persons or institutions to blame, the question that might be asked is how resistance can be anticipated and managed as an unavoidable part of any large-scale treatment program. The recent discovery of what is being called "totally drug-resistant" tuberculosis in Mumbai suggests that the chemotherapeutic cure has fully met its match, but this finding also offers a challenge to linear histories of disease. How can we write the history of a disease that was potentially curable (with antibiotics), and then no longer curable (as is perhaps the case with "totally-drug resistant" tuberculosis), and that might be curable again (for example, with the introduction of bedaquiline)?

Along with new drugs coming out of the pipeline are new diagnostic technologies like Gene Xpert. The pipeline itself is a metaphor-image that makes use of space to describe time – the time of research and development, as well as of clinical trials. Even when a technology or drug is approved, there remain substantial issues to its generalized use. Cost and climate are serious obstacles in the deployment of Gene Xpert, for example. A test to determine drug resistance to bedaquiline has not yet been developed, which means that resistance will likely develop before we have a way of diagnosing it other than through clinical failure.

We might also ask about how these new forms of diagnosis require us to consider what it is we are trying to diagnosis. In other words, what is the ontological structure of disease, in particular, tuberculosis? This is an old question, one that historians have discussed at length. This question however takes on a new urgency and a new set of possible answers in light of molecular diagnostics and DNA fingerprinting technologies that identify disease in terms of genetic structure. The question is no longer about whether disease is microbial, miasmic, constitutional or hereditary, but instead about degrees of illness (subclinical, symptomatic) and modes of identification (DNA, sputum).

In the management of disease and health, it often appears that prognostications are inescapable. Quite often, such imaginings of the future turn out to miss their target, as I discussed in relationship to the Gates Foundation's idea that HIV in India would become a generalized epidemic, "just like Africa." Time threatens to prove our best guesses wrong. Time

also has the power to redirect and reform. In a beautiful essay published in 1984, Margaret Trawick recounts her research on the cult of the goddess Mariamman, the smallpox goddess, in a northern suburb of Madras. She asks a simple question: what does the smallpox goddess do after smallpox is eradicated? By 1970, Madras was ostensibly free of the disease. But the cult of the goddess retained its popularity. Through her ethnographic work with a devotee of Mariamman, Trawick reveals that the goddess and her cult were not eradicated along with smallpox, as might be imagined. Instead, the smallpox goddess became the tuberculosis goddess! What comes next is not always what we expect. Perhaps we cannot help but make guesses about the future, but neither will we fail to be surprised by the twists that time takes.

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