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Scrambling for Africa

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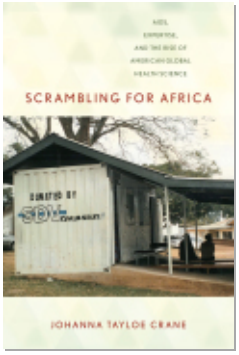

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Chapter 3

The Turn toward Africa

"Africa is in vogue now," Dr. Jason Beale told me in early 2005. "Three or four years ago, no one would mention it." His comment was not intended to be flip. Rather, it was a joking acknowledgement of the way in which science is subject to its own form of trendiness that governs both interest in and funding of research projects. Beale is a warm and enthusiastic man, prone to mild exaggeration when trying to make a point, but earnest and persuasive nonetheless. He is both extremely ambitious and morally driven—a combination that has served him well in advancing his HIV research, first in the United States, and then in Uganda. To prove his point about the research trend, he urged me to search the abstracts of the last several years of the Conference on Retroviruses and Opportunistic Infections—the United States' most prestigious scientific AIDS conference—for the word "Africa." "It probably won't even be mentioned until 2002 or 2003," he told me. Beale's prediction proved to be generally true, if somewhat overstated. A search of the abstracts for "Africa" showed a steady increase between 1997 and 2006, ranging from a low of six in 1998 to a high of ninety-

one in 2005.[1] This trend would continue in the years to follow. By 2011, the number of conference abstracts referencing "Africa" had risen to 174.

Dr. Beale was himself new to research in Africa. An HIV doctor turned researcher at the University of California, Beale focused his scientific career around the study of access and adherence to HIV medications among the poor and disadvantaged. His early work among urban homeless populations in the United States, described in chapter 1, made the case for universal HIV treatment access by demonstrating that even the most impoverished and socially marginalized patients were capable of taking complex drug regimens successfully. In the early 2000s, Beale began to shift his research focus to HIV treatment in Africa. As they had in their U.S. research, Beale and his colleagues sought to study patient drug-taking empirically, this time setting up shop in Kampala, the capital city of Uganda, a country known for its friendliness toward foreign researchers and its successful HIV prevention efforts (Thornton 2008). A few years later, when Kampala started to grow crowded with international researchers, he relocated his work to the town of Mbarara, four and a half hours away in rural western Uganda. At the time that Beale began working in Uganda, the free antiretroviral programs initiated by the Global Fund and PEPFAR were still several years away, but access to ARVs was slowly improving with the importation of cheaper generic ARVs from India. Beale's studies initially followed patients who were buying generic drugs out of pocket, and later included those who received free ARVs through the international programs.[2]

In this chapter, I use the stories of Dr. Beale and other American researchers to track what I call the "turn toward Africa" in U.S. HIV medicine. Dr. Beale, like many of his colleagues, expanded his research from one epicenter of the epidemic (the San Francisco Bay Area) to another one (East Africa) as HIV deaths stabilized in the United States and the push for treatment access in Africa gained political traction. I argue that this

1. Abstracts and keywords were searched using the "search abstracts" feature on the conference website. Because abstracts containing the phrase "African American" also appeared when searching under "Africa," I conducted searches under both terms and then subtracted the abstracts referring to African Americans from the total. While not an exact measure, this method gives a rough sense of how many papers were using data collected on the African continent. The earliest year for which abstracts were available on line was 1997.

2. In other words, patients enrolled in the studies obtained antiretrovirals on their own, not through Beale's research.

shift necessitated the translation of HIV disease from the qualitative, clinical language that predominates in Uganda into the quantitative, molecular terms deemed legitimate by U.S. doctors, medical journals, and funding bodies. This chapter shows how the ability to perform this kind of translation necessitates a certain kind of laboratory, and how access to such facilities can play a powerful role in governing who is able to participate in the making of global health science.

While the laboratory's importance in conferring scientific legitimacy has been well documented by science studies scholars, in low-income, postcolonial settings, laboratories wield an additional power to include or exclude scientists from the global South from participation in international science. This is another side of the molecular politics of global health described in the previous chapter. Aspiring African researchers have access to a surfeit of HIV patients from which to generate knowledge about the epidemic. (Indeed, it is this wealth of patients that draws American and other foreign HIV researchers to the continent.) However, they often lack the facilities necessary to conduct even the most basic molecular measurements, such as CD4 counts and viral load assessments, needed to make their studies publishable in major medical journals. Thus, in low-income African countries, the ability to participate as an equal in the international scientific arena often rests on access to elite, donor-funded laboratories. It is these "state-of-the-art" facilities that can provide the tools necessary to translate the often overwhelming level of clinical suffering in African clinics and public hospitals into terms considered scientifically legitimate in the global North. This suggests that the molecular terms of "global" health science are actually set *locally*, in the United States, Europe, and other technologically rich parts of the world, where the rise of randomized controlled trials and evidence-based medicine have rendered the clinic and the laboratory increasingly inseparable (Löwy 2000; Adams 2010b).

Golden Opportunities

Dr. Beale and other U.S. researchers were drawn to studying HIV in Africa by both humanitarian sentiment and scientific ambition. Having witnessed the seemingly miraculous impact of antiretrovirals on their own patients, American physician-researchers like Beale felt a moral imperative to use

their expertise to address the increasingly destructive epidemic in Africa. In addition, American HIV scientists saw a unique opportunity in Africa's untreated epidemic. By the early 2000s, efforts to garner international support for free ARV medications in Africa had turned a corner. The Global Fund to Fight AIDS, Tuberculosis, and Malaria was founded in 2001, and less than two years later PEPFAR was announced. Moreover, on World AIDS Day in 2003, the WHO and UNAIDS launched their 3x5 Initiative, which advocated a target of treating three million people in low-income countries with ARVs by the end of the year 2005.[3] It would take several years for these programs to actually materialize on the ground and succeed in getting "drugs into bodies." For U.S. HIV researchers, the prospect of large numbers of African patients on the cusp of receiving their first antiretroviral medications presented a scientific opportunity that could not be found domestically. Thus, researchers' humanitarian motivations to work in Africa were paired with scientific ambitions aimed at taking advantage of the valuable research opportunity that African countries were seen as offering at the time.

A vignette from my participant-observation among a team of American epidemiologists illustrates the importance of Africa as a research opportunity to Beale and his colleagues. In February of 2005, I sat in on a meeting attended by eight health researchers at the University of California, San Francisco (UCSF). Their agenda was to design a research protocol that could be used across the university's growing number of HIV studies being conducted in Africa. They needed to develop a standardized way of collecting social, behavioral, and biological information from African HIV patients participating in research so that the data could then be "pooled" across studies conducted in different countries, in order to create larger and more powerful data sets for researchers to work with. Data regarding the advent of antiretroviral treatment in Africa was of particular interest because it provided a second chance to study the impact of HIV drugs on a large population of previously untreated people—a research opportunity that had been, in the words of the meeting's organizer, "lost" in the United States. As the group discussed how large a blood sample would be necessary

3. The 3×5 Initiative promoted expanded antiretroviral access but did not actually provide funding for treatment. The target of three million was met, but not until 2007.

in order to obtain the desired biological data, the researcher leading the meeting suggested that the African study participants have their blood drawn twice, arguing, "I can't emphasize this enough—a biological specimen in the pre-treatment era is just golden to us. And 7mls of blood just isn't enough."

Afterwards I asked Dr. Beale what the meeting's organizer had meant when he said a research opportunity had been "lost" in the United States. What Africa now offered, Beale told me, was the possibility of studying the virus as it evolved in relation to exposure to drugs. The UCSF researchers believed that knowledge about this evolution could provide useful information about both the pathophysiology and treatment of HIV. The opportunity to conduct such a study had been lost in the United States because effective drugs became available here much earlier in the epidemic, before researchers realized what Beale called the "scientific value" of such a project. This recognition of scientific value would come later, after the development of viral load and drug-resistance tests that allowed researchers to study the impact of antiretroviral drugs at the molecular level, rather than simply at the level of the patient's body (the clinical level). As a result, researchers did not begin to study the impact of treatment in this way until after drugs had been available for several years, by which time most U.S. patients had already been exposed to HIV medications and were likely to harbor drug-resistance mutations. They were no longer the pharmacological blank slates preferred by researchers. Thus, the opportunity to study the impact of HIV drugs on a large number of previously untreated (or "treatment-naïve") patients in the United States was seen as "lost." This was precisely the opportunity that Africa now offered.

In Kampala, Ugandan researchers were well aware of these opportunities. As I described in the introduction to this book, Kampala's Makerere University Medical School and its affiliated teaching hospital were premiere institutions of medical research in East Africa until the 1970s, when the dictatorship of Idi Amin devastated both their physical infrastructure and faculty (Iliffe 2002). During the rebuilding of Ugandan society during the 1980s, Makerere researchers conducted some of the earliest published research on AIDS in Africa in collaboration with international colleagues. With little domestic government money available for research, these scientists welcomed foreign interest in their epidemic as a means by which to obtain funding for their own research endeavors and careers. They under-

stood that their large pool of patients was an asset that could not be found elsewhere. Dr. Joseph Muhwezi, a Makerere professor of pediatric infectious disease whom I interviewed in 2005, was particularly eloquent on this point. Muhwezi is an outspoken member of Makerere's scientific elite and the founder of a regional medical journal aimed at providing researchers an African-run venue for publishing their work. Reflecting on his own collaborations with European researchers, he made the following case for Uganda as a fertile environment for knowledge production:

> Yes, we want the state of the art, but what does the state of the art mean? For me, the state of the art means finding your niche where you are best and excelling in it. So if you want [to learn about] clinical care of HIV-infected children, the place to go is Uganda. If I go to the Netherlands, they don't even have patients. There's not even one child with HIV anymore in the Netherlands. There's not even one child! That's where we excel. We have clinical patients. We have loads and loads of patients. Other people don't have patients! They are training doctors under video—I saw it in the Netherlands. They have never touched patients! What type doctors are you going to produce? You work for us, our doctors, if there is an operation, the students go there. And they feel, they assist, they touch. And that's the excellence we want. Molecules and things, they are very important, but at the end of the day—it's the person that matters, in my view.

Importantly, Muhwezi's acknowledgement of opportunity has embedded within it an assertion of "excellence," or expertise—specifically, clinical expertise—as well as a value judgment that clinical expertise is ultimately more important than knowledge dependent upon technology.

During the course of my fieldwork, I encountered a number of physician-researchers from the United States and other countries in the global North who expressed admiration for the hands-on clinical acumen and flexibility wielded by their Ugandan colleagues. They were impressed by the ability of Ugandan clinicians to practice medicine without many of the basic medications and technologies Northern doctors had become dependent upon.[4] Yet they often paired this respect for the Ugandans' skills with uneasiness about

4. See Wendland 2010 (chapter 6) for the perspectives of Malawian doctors on their own clinical expertise and creative ingenuity in the context of scarcity.

the accuracy of diagnosis based on clinical symptoms. For example, while conducting research in Kampala in 2005 I met George Avery, a Canadian doctor teaching in an HIV-medicine training program based at Makerere Medical School's Infectious Disease Institute. During the daily "tea break" between morning lectures, I asked him to reflect on the low-tech environment in which most of the African trainees were working. As we snacked on hot tea, samosas, and boiled eggs that had been brought up for the class from the canteen, he told me that the African clinicians had very good clinical skills "because they don't have the diagnostics to fall back on the way Western doctors do." Then he told me the story of a Ugandan doctor he had observed evaluating a patient. The doctor's clinical examination suggested one diagnosis but the chest x-ray suggested another, and he had told his colleagues that he wasn't sure which he should trust. "In the West," Dr. Avery continued, "there would be no question—you would go with the x-ray." But in Uganda, he said, doctors are so confident in their clinical findings that it can actually lead them to doubt the diagnostics. He told this story with both a sense of awe for the clinical skills of the Ugandan physician, but also a sense of disbelief and discomfort with questioning the x-ray's results.

For international researchers, Uganda's clinics presented both an opportunity and a challenge. As Dr. Muhwezi notes, Uganda's patient-rich but "resource-poor" environment offered a chance for learning that could not be matched in wealthier, healthier countries. As I describe in chapter 5, this is an opportunity well known to visiting American medical students, who often find they are allowed much greater access to the bodies of African patients than they have to patients' bodies back home. However, clinical expertise is less valuable in the world of international research, which answers to the standards set by leading journals and funding bodies. Because these journals and funders are located almost exclusively in the United States and Europe, their standards reflect the highly technologically mediated and increasingly molecularized "evidence-based" medicine that is upheld as state of the art in these parts of the world (Adams 2010b). In this "global" scientific arena, researchers are expected to produce data that is both quantifiable and *portable*—in other words, data that can circulate internationally and be compared to data collected elsewhere (Petryna 2009). This is what the UCSF researchers were after in designing a common research protocol that could be used across the university's various studies on

the African continent. It is also what Dr. Beale needed in order to generate Ugandan data that was commensurable with existing data on HIV treatment collected in the United States. In other words, in the transnational research arena, Dr. Muhwezi's assertion that "at the end of the day—it's the person that matters" more than "molecules and things," does not really hold. In global health science, it is "molecules and things," not clinical signs and symptoms, that most often bear the mark of scientific legitimacy. However advanced the clinical skills of Ugandan physician-researchers might be, this expertise is of little value in the world of global science, where it is viewed as qualitative and localized rather than quantitative and generalizable (Adams 2010a; Feierman 2011).

Thus, for Beale and other U.S. researchers shifting their research toward Africa, a key step in generating authoritative scientific findings would be translating the clinical epidemic they confronted in "resource-poor" African clinics and hospitals into the molecular terms that would render it commensurable with data collected in "resource-rich" parts of the world. The encounter between their highly technical understanding of HIV and the clinical spectacle of human suffering they were to encounter in African hospitals was one they would find at once scientifically challenging, emotionally draining, and oddly nostalgic.

Clinical Nostalgia

Dr. Beale had never traveled to Africa until he began planning a research project in Uganda. This was not unusual among the American researchers I spoke with over the course of my fieldwork, and applied to myself as well. For him and for other American physician-scientists who had treated patients in the early days of the U.S. epidemic, the first trip to Uganda was often a confrontation with striking familiarity embedded in a context of profound difference. These differences ranged from the ordinary variation in language (though many Ugandans speak English), landscape, and culture encountered when traveling to any foreign country, to much starker contrasts of race and wealth. For example, "whiteness" was no longer the unmarked category it so often is in the United States; instead, white skin was highly conspicuous in an overwhelmingly black- and brown-skinned

nation, and *muzungu*—the Luganda term[5] for foreigner or white person—was often the first local vocabulary that the predominantly white American researchers learned. This difference was further accentuated by the contrast between Uganda's poverty and America's wealth, and the realization that elements of daily living often taken for granted in the United States—such as electricity, public transit, ATM machines,[6] residential street addresses, and refrigeration—were suddenly unreliable, confusing, or not available. The reliance on a cash-based economy and the rarity of receipts was particularly vexing for Beale's grant manager at the University of California, who was constantly struggling to produce a paper trail showing how the project's funds were being spent in Uganda.

American researchers turning their attention to Africa were confronted with the social and logistical realities of what it means to conduct research in a "resource-poor country" or a "resource-limited setting"—the terms most commonly used in international HIV research to describe low-income countries like Uganda. Dr. Beale, having spent years working in New York and San Francisco's poorest county hospitals, was no stranger to poverty and inequality. However, the signs of this poverty—young boys with bathroom scales selling passersby the opportunity to weigh themselves, women scavenging for wood to turn into charcoal they could sell, and the coffin shops lining the road between the airport and the capital city—were radically different from the urban poverty he was accustomed to in his "resource-rich" country. This confrontation with difference went both ways: when Beale's Ugandan staff began visiting San Francisco, they were deeply shocked by the large numbers of homeless people living and sleeping on the downtown streets, a rare sight in Uganda.

Yet, within this world of difference, visiting American researchers encountered an eerie familiarity upon entering the inpatient wards of

5. Luganda is one of the approximately forty African languages spoken in Uganda, and is the dominant local language in the capital city and surrounding areas. *Muzungu* is a word used for foreigner or "white person" in many East African Bantu languages, including Swahili (*mzungu*). English is Uganda's national language, a legacy of British colonialism, and is widely spoken among the educated classes.

6. The first time I traveled to Uganda, in 2003, ATM machines were not available and I had to arrive with enough money in cash and travelers' checks to cover two months of living expenses. By 2005, cash machines were common in downtown Kampala, and by 2009 they were also present in Mbarara.

Kampala's hospitals, where they saw patients with AIDS dying from infections they had not encountered since the first days of the U.S. epidemic. The experience was particularly striking, Dr. Beale told me, for those coming from the San Francisco area—a city that had been emblematic of the epidemic in the United States in the early 1980s much the same way that Uganda was to become emblematic of AIDS in Africa in the early 1990s. He described a senior colleague as getting "almost wistful" or "nostalgic" in Uganda's hospitals because he was reminded of his experience working in San Francisco General Hospital in the 1980s. He also told me of a young, gay epidemiologist on his staff who began crying when he first walked through the inpatient wards in Kampala because it reminded him of the partner he had lost to AIDS, of his friends who had died, and of what Beale described as the "slaughter" that was San Francisco before the discovery of effective HIV drugs.

The Bay Area–based AIDS researchers that I followed to Uganda often described the epidemic they saw there as resembling San Francisco in the pre-treatment era. They gave this description both with horror over the extreme and unnecessary suffering caused by the lack of drugs, and with the "nostalgia" that Dr. Beale identified. For Beale himself, this nostalgia was for a time when he felt he was really a part of a team, fighting a disease that no one understood, and caring for patients who had become social and medical pariahs in much of the rest of the country. The nostalgia was not about wishing the drugs did not exist—on the contrary, he has heavily advocated for expanded access to treatment throughout his career. Rather, it was about the kind of doctor he had been able to be in that era. "Right now," he told me in 2005, "HIV medicine is much more technical and much less human" than it used to be:

> In the 1980s, it was all human, because comfort and care were the only and the best thing you could provide. It was horrific, but it was also terrific because the staff was so close, and so dedicated. It was a very special relationship. Now, HIV medicine in the U.S. is much more frightening. It used to be about providing a painless and meaningful death. Now a death is a mistake. The cost of making an error is much higher, because the standard is that everyone lives. Now, making a technical error could have a major impact on patient survival. The weight of technical errors is much heavier now [when there are twenty drugs available] than in the '80s and early '90s, when there

> were only one to four drugs and none of them worked very well. Then there were fewer mistakes to be made, and mistakes didn't impact the outcome anyway. In the 1980s, the human was the best you had.[7]

Yet it would be a gross oversimplification to say that AIDS in Uganda is simply a time-delayed version of what AIDS was in San Francisco. Despite any nostalgia that they may have felt, when American AIDS doctors began traveling to Uganda and other African countries experiencing serious HIV epidemics, they encountered a disease that was fundamentally different in many ways than AIDS as they knew it, despite its eerie familiarity. While some of the visible manifestations of untreated HIV disease may have reminded them of their own patients in the past (the Kaposi's sarcoma, the wasting syndrome, the cryptococcal meningitis), other elements suggested an epidemic that is not commensurable with AIDS in the United States: the background of endemic malaria and malnutrition against which the infection plays out, additional "tropical" diseases not seen in the United States, and the large numbers of women and children with HIV. There were less visible differences, too, such as the distinct HIV subtypes described in the previous chapter.

The experiences of another Bay Area doctor highlight this tension between familiarity and difference that characterizes the turn toward Africa in American AIDS research. I met with Dr. Richard Swan in his office in downtown San Francisco in 2005. At the time, he was the director of a global HIV/AIDS foundation that supported HIV clinics and treatment in Africa, China, and the Caribbean. He had first encountered AIDS when working as a doctor at San Francisco General, the county's public hospital, when the epidemic hit in the early 1980s. In the 1990s he switched his focus to health policy and became a prominent member of the Clinton administration and an advocate for greater attention to the impact of AIDS on

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7. Claire Wendland describes similar feelings of shared humanity among present-day Malawian physicians and medical students, and links these feelings to the low-technology, high-risk conditions in which they must practice. "Not insulated from suffering by technology or equipment, or private patient rooms with walls and curtains, or high staffing levels that allowed nurses to do all the dirty work, or vaccines or postexposure prophylaxis that limited their risks of contracting killer diseases when they stuck themselves with bloody needles, these student doctors were made constantly aware that they were, as [medical student] Zaithwa Mthindi said, 'as human as everybody else'" (Wendland 2010, 180).

African American communities. (Years after our interview, he would eventually return to Washington to assume a leadership role in the PEPFAR program.) While working for the federal government in the late 1990s he served as a representative to UNAIDS, the United Nations body dealing with the global AIDS epidemic. The UNAIDS meetings were often held in areas of the world heavily affected by HIV, and in traveling to these places Dr. Swan found himself immersed in an epidemic that reminded him of his early days at San Francisco General Hospital, yet far exceeding anything he had witnessed in the United States. His reflections on this time are worth quoting at length:

> My travel in the developing world started around 1995 or 1996. I had to go to these quarterly meetings of UNAIDS, which would be held in Lusaka in Zambia, in Khayelitsha in South Africa, in Durban in South Africa, in Zimbabwe. They put them in areas that were heavily impacted by HIV. And so through the course of that, I began to see all of these extraordinary things.
>
> For a clinician to walk into hospital after hospital where people are standing in the hallways, they're sleeping in the hallways, they're two people in the bed, one underneath the bed—you have these large, open wards. I can remember being in Zambia about two hours outside of Lusaka, and we had been taken to this Salvation Army hospital that truly was out in nowhere, that was big—and in a ward of about sixty beds times three [three times as many patients as beds], there were probably twenty people with grand mal seizures, seizing in the beds, just from untreated cryptococcal meningitis. And the standard of care there—this was '98 or maybe '97—drugs that we all knew how to use were not available. Diflucan [fluconazole] was out; amphotericin, which is the drug of choice [for cryptococcal meningitis] was absolutely available but [they] couldn't pay for it. It was really startling, and that was when my mind started to say, "The need that I'm seeing is extraordinary, and it's completely unmet and unaddressed." And I began to think about the ethics of ignoring it, and not being able to ignore it.
>
> . . . So I started realizing that the epidemic really wasn't happening in North America at all, and was happening elsewhere. And not only that, having been a pre-ARV clinician [in the United States], I realized that all of what I knew was directly applicable to what I was seeing. These were people who've never seen ARVs. These are people who are dealing with opportunistic infections, and that's what we did up until 1994, in the United States. Fifty percent of the gay men in San Francisco were infected when I was in San Francisco. We were *full* on the in-patient service at San Francisco General

> Hospital; 70 to 80 percent of the patients in the hospital, all services, were AIDS-related. The emergency room was full of people coming in with complaints of infections related to HIV.

While Swan never uses the word "nostalgia" to describe his experiences in Africa, what he saw in Zambia in the 1990s clearly brought back memories of working in San Francisco in the 1980s. Swan's description of the crowded hospital and lack of medications in Zambia flows directly into his reminiscence of San Francisco General Hospital prior to the discovery of effective HIV medications in 1995. As a clinician, he realized that having worked in the pre-treatment era in the United States gave him experience treating the kinds of infections he was now witnessing in Africa. This eerie kinship between AIDS in San Francisco in the 1980s and AIDS in Africa in the 1990s and 2000s means that American doctors like Beale and Swan experienced their early trips to Africa as "travel across both place and time, not just to far away, but to long ago" (Wendland 2012, 116; see also Brada 2011b).

Yet, this clinical familiarity was paired with differences in scale and economics that were shocking to a doctor accustomed to the health care system of a wealthy nation. This is evident in Swan's description of the Zambian Salvation Army hospital—the open wards crowded to three times their capacity, two patients to each bed and a third on the floor, the simultaneous seizures among twenty patients from untreated meningitis—in which the epidemic takes on a spectacular level of suffering unmatched at even the most impacted hospitals in the United States in the 1980s. This is the dark side of the much more "human" and much less "technical" pre-ARV HIV medicine described by Dr. Beale; the "horrific" counterpoint to the "terrific" feeling of staff bonding and medical mission that the pre-treatment era fostered for San Francisco AIDS doctors.

AIDS by the Numbers

Uncertainty about the nature of AIDS and conjecture that it might be different in Africa than in the United States and Europe has existed since the early years of the epidemic. In 1985 *The Lancet* published an article by Ugandan researchers working in the Rakai district near Uganda's south-

western border with Tanzania. The article described a "new disease" that people in Rakai were calling "slim" because of the severe weight loss it brought on. The authors claimed, "although slim disease resembles AIDS in many ways, it seems to be a new entity." The basis of their argument was that slim and AIDS looked different clinically and epidemiologically: AIDS was found mainly in "Western homosexual patients" whose chief symptoms were often Kaposi's sarcoma and swollen lymph nodes (lymphadenopathy). Slim, in contrast, was found "primarily in the heterosexually promiscuous population," and had diarrhea and severe weight loss as its primary markers (Serwadda et al. 1985). Within months the *Lancet* article's claim that slim was "new" was contested, as it became apparent that many Ugandans with slim did indeed suffer from Kaposi's sarcoma, and many Westerners with AIDS developed severe wasting, making AIDS and slim more similar than different. However, for a time, a tacit acknowledgement of difference persisted in the medical literature—the equation of "slim" with "AIDS" was initially qualified by a reference to Africa: slim was "identical" not to AIDS but to "African AIDS" or to "AIDS as seen in Africa" (Kamradt, Niese, and Vogel 1985).

Although the idea that slim and AIDS were different diseases was short-lived, it is nonetheless an instructive example of the difficulty of establishing a universal definition of a syndrome made up of an assortment of diseases whose manifestation varies across geography and patient populations. It also challenges the universality of disease categories, and aptly demonstrates the "local biologies" that emerge when biological and social processes intertwine (Lock 1995; Lock and Nguyen 2010). Furthermore, the scientific sidelining of slim shows how Euro-American definitions of what constitutes "AIDS" have dominated the field from the very beginning. The vast majority of published papers describing AIDS at this time were based on research conducted among gay men in the United States and Europe. Thus, "AIDS" with no qualifier implied Euro-American AIDS, and this was the reference point against which other (qualified or marked) manifestations of the disease—such as "African AIDS"—were compared.

These qualifiers are now less common in the medical literature, but questions of difference persist in global HIV medicine. AIDS does look different in different places, both in its epidemiology (who gets sick) and its pathophysiology (how they get sick). But in the current moment, perhaps the biggest difference between AIDS in the United States and AIDS in

Uganda is technological. Since the advent of effective antiretroviral drugs in 1995, HIV care in wealthy countries has grown increasingly molecularized. As Nikolas Rose has noted, this shift mirrors a more general trend toward the "molecular gaze" in biomedicine:

> The clinical gaze has been supplemented, if not supplanted, by this molecular gaze. . . . Life is now understood, and acted upon, at the molecular level, in terms of the functional properties of coding sequences of nucleotide bases and their variations, the molecular mechanisms that regulate expression and transcription, the link between the functional properties of proteins and their molecular topography, the formation of particular intracellular elements—ion channels, enzyme activities, transporter genes, membrane potentials—with their particular mechanical and biological properties. (Rose 2007, 12)

What Rose describes is a shift in scale: where clinical medicine works with the unit of the human body at the level of organs and vital systems (circulatory, respiratory, digestive, etc.), molecular medicine operates at the microscopic scale of the intracellular, the genomic, and the proteomic (protein manufacture).[8] Within HIV medicine, molecular technologies have had a huge impact and have yielded some of the most important therapeutic and diagnostic tools available to patients and their doctors. Protease inhibitors, the class of antiretroviral drugs that made the first successful triple-combination therapies possible, are the product of structure-based drug design, in which pharmaceuticals are engineered to interfere with viral replication at the molecular level. In addition, molecular diagnostic technologies that measure the strength of a patient's immune system (CD4 testing) and the level of virus in the blood (viral load) have taken on great importance in HIV care, and are now integral to treatment guidelines specifying when patients should be started on antiretrovirals. The same is true for HIV research, where these technologies provide a standardized means by which to track disease progression and treatment efficacy.

Molecular biology has shaped scientific responses to the AIDS epidemic since it first came into widespread public and scientific awareness in 1981.

8. As many scholars have noted, Rose's observations about the molecularization of medicine do not account for the sharp disparities in biomedical resources and practice across the globe, or what Matthew Sparke calls "the uneven global landscape of body counting" (Sparke 2013).

The isolation of the HIV virus in 1984 and the development of an effective HIV blood test shortly thereafter were both enabled by then-recent developments in molecular biology. As one historian noted in 1989, "From many points of view, the AIDS pandemic is necessarily a new disease; the pathology could not even exist as a concept before the recent discoveries made by molecular biology and immunology" (Fantini 1991, 53; see also Harden 1991). However, outside the laboratory, the molecularization of HIV medicine was a much more gradual process. For the first decade of the epidemic, an AIDS diagnosis in the United States (and elsewhere) was made according to clinical signs and symptoms, not the molecular diagnostics of CD4 cell count and viral load by which it is currently characterized. In 1982, shortly after the disease was named acquired immune deficiency syndrome, the CDC defined a case of AIDS as "a disease . . . occurring in a person with no known cause for diminished resistance to that disease. Such diseases include KS [Kaposi's sarcoma], PCP [Pneumocystis carinii pneumonia], and serious OOI [other opportunistic infections]" (CDC 1982). In the media and the public imagination, this definition of AIDS was embodied in images of gaunt young men covered with the iconic purple blotches of Kaposi's sarcoma.[9] In 1985, following the isolation of the HIV virus and development of a commercial blood test, the CDC added the criterion of a positive HIV blood test to the AIDS case definition, but otherwise this definition remained strictly symptom-based until 1993. Beginning in that year, the CDC expanded its definition of AIDS to include any individuals whose CD4 lymphocytes, or "helper T cells," had fallen below a count of 200 (CDC 1992).[10] Now there was a standardized, quantitative measure to define AIDS. Unlike Kaposi's, this measurement was also invisible, in that it was possible for a patient to have a CD4 count of less than 200 without having visible indicators of "full-blown AIDS."

CD4 cells or T cells are a key component of the body's immune system and a preferred target of the HIV virus, which kills them slowly over time,

9. Perhaps the best-known example of this is Alon Reininger's photograph of a dying San Francisco man titled "Ken Meeks, Patient With AIDS, Being Cared For By A Friend." It was named World Press Photo of the Year in 1986 and was published in *Life* magazine in 1988 (Museum of Contemporary Photography 2008).

10. A normal CD4 cell count ranges between about 500 to 1,500 cells per cubic millimeter of blood.

leaving the body increasingly vulnerable to disease. Low CD4 cell levels were documented in AIDS patients from the very beginning of the epidemic in 1981, and CD4 testing was used in the earliest U.S. effort to screen blood donations prior to the development of the HIV blood test (*The Lancet* 1981; Galel, Lifson, and Engleman 1995). The ability to measure CD4 levels was enabled by prior advances in molecular biology, principally the development of monoclonal antibody technology in 1975. Yet clinicians and researchers viewed CD4 testing as limited in its clinical and epidemiological utility, both because CD4 counts tend to be naturally changeable over time and because test results may vary across laboratories. This is perhaps why a measurement that is so integral to HIV medicine today was relatively marginal to AIDS care for the first twelve years of the epidemic.

This began to change with the 1993 inclusion of CD4 count within the CDC's official AIDS case definition. At the time, the decision to do so may have been largely political in nature. For years, the CDC had faced criticism that its list of AIDS-defining conditions was biased because it reflected the illnesses most commonly seen in gay men in the United States. (For example, gynecological conditions and "tropical" infections characteristic of AIDS in women or in the global South were not on the list). The addition of low CD4 count to the AIDS case definition was seen as a way to create objective disease criteria in response to these criticisms (Sheppard et al. 1993). In addition, CD4 testing was useful to researchers working to develop pharmaceuticals effective against HIV, as it provided a standardized numerical means by which to measure the impact of a drug on a patient's immune system (Schoenfeld, Finkelstein, and Richman 1993). The molecularization of HIV was furthered by the development of viral load testing in the mid-1990s, which used newly developed polymerase chain reaction technology to measure the concentration of virus circulating in a patient's blood, thus providing a quantitative method for measuring a drug's success in killing HIV (Löwy 2000). With the development and rapid dissemination of effective antiretroviral therapy in the United States in the mid- and late 1990s, CD4 and viral load testing became integrated into clinical care as quantitative methods for monitoring patient response to these powerful new medications. These tests, known in medicine as "surrogate markers," made it possible to respond to warning signs of declining health (such as a falling CD4 count or a spike in viral load) before a patient fell ill with potentially life-threatening opportunistic infections. Indeed, in the United

States, the technologies of CD4 count and viral load measurements are now inextricably bound to the way that HIV and AIDS are conceptualized, studied, and treated. As a result, in a U.S. context, it is nearly impossible to have a medical discussion about HIV without referring to CD4 count and viral load.

The situation in Uganda and other low-income countries is quite different. When Dr. Beale began conducting HIV research in Uganda in the early 2000s, patients could receive a blood test to detect HIV infection, but after testing positive patients' disease progression was measured largely according to clinical symptoms, since CD4 testing was possible only on a limited basis and only in Kampala. In the absence of molecular monitoring technologies, doctors used "clinical monitoring"—physical examination and bodily signs such as weight loss, hair texture, and skin condition—to assess their patients' proximity to an AIDS diagnosis. Ugandan physicians and researchers recorded patients' status using the World Health Organization's "staging" system for HIV. This system is a categorization of progression toward death based on weight loss and infections, in which Stage I represents asymptomatic HIV infection and Stage IV (the final stage) constitutes advanced, bedridden illness. Although the availability of CD4 testing in Ugandan clinics has grown significantly since PEPFAR and the Global Fund began providing free treatment in late 2004, access to more expensive viral load tests remains very limited and drug-resistance testing is extremely rare. Thus, clinical monitoring remains a principal means of determining the extent of a patient's HIV disease, and—for those able to access antiretroviral medications—of discerning whether or not the drugs are working.

"Clinical monitoring" is perhaps best explained as hands-on doctoring: assessing the patient's condition primarily through physical examination, supplemented by very basic laboratory tests when available. Doctors may feel the texture of a patient's hair, the condition of his or her skin, and the firmness of the abdomen and lymph nodes. They look for rashes, thrush, lesions, clubbing of the fingertips—all indicators of possible AIDS-related illnesses. They note whether their patient is losing weight or seems dehydrated, or if one side of the chest is rising more than the other when the patient breathes. And they listen very closely to the lungs for sounds that might warn of pneumonia or tuberculosis. One of the tricky aspects of managing HIV treatment in the absence of molecular monitoring technologies

is that many of the side effects of antiretroviral medications closely resemble symptoms of AIDS-related illnesses. Diarrhea, changes in body fat (lipodystrophy), pain in the extremities (peripheral neuropathy), and rash are all potential antiretroviral side effects that can also be signs of AIDS. Thus, in the absence of lab work, Ugandan clinicians find following patients on antiretroviral therapy to be an exercise in uncertainty, in which the bodily manifestations of successful treatment can be difficult to distinguish from symptoms of the disease itself (see also Okeke 2011).

Giving Them a Laboratory

For American researchers like Beale, bridging the technological divide between HIV medicine in the United States and Uganda is a matter of professional scientific survival. While clinical monitoring is seen as an acceptable, if flawed, answer to the lack of laboratory monitoring technologies available to Ugandan doctors in the clinic, it is not an acceptable means of assessing HIV disease progression for the purposes of global health science. Without the molecular quantitative measures afforded by CD4, viral load, and drug-resistance testing, Beale's research would be essentially unfundable and unpublishable. Thus, his establishment of a successful research project in Uganda has been contingent upon his ability to translate the "molar" body of "limbs, organs, [and] tissues" found in the clinic to the "molecular" body that NIH grant applications and leading journals insist upon (Rose 2007, 11).

As Bruno Latour has famously described, laboratories are what make this kind of translation possible, because they transform the disorder of nature into orderly data, suitable for making persuasive scientific arguments (Latour and Woolgar 1979; Latour 1983, 1987, 1999). This is certainly the case for Dr. Beale and other American HIV researchers working in Uganda, who rely heavily upon the services of a few select laboratories in order to render the disease in the molecular terms required by their funders and publishers. However, what Latour's otherwise helpful insight leaves unconsidered are the power dynamics particular to labs in the postcolonial world, where in addition to being "centers of calculation," laboratories may also be donor-funded development projects, products of medical humanitarianism,

or facilities built to enable the work of visiting and expatriate scientists. Often they are all three, as was the case with Beale's primary laboratory at Kampala's Infectious Diseases Institute (IDI), which was built in 2004.

The Institute was the brain child of Max Edwards, an American infectious disease doctor who, like many senior AIDS researchers in the United States, made a name for himself treating and researching AIDS in San Francisco during the first years of the epidemic. He began working in Uganda in 1989, as part of a U.S.-funded study of heterosexual transmission of HIV. In addition to his career in academia, Dr. Edwards spent seventeen years as a member of the scientific advisory board of Pfizer, one of the most profitable pharmaceutical manufacturers in the world. Edwards, who died in 2007, was notorious among his university colleagues for his sociability and powers of persuasion. Thus it was not as surprising as it might have been when, over dinner in 2001, he managed to parlay his friendship with the CEO of Pfizer into a $5 million grant from the company's philanthropic foundation to support the building of the IDI. In addition to providing spaces for clinical care and physician-training programs, the IDI would also include a state-of-the-art research laboratory. The Institute would be affiliated with Makerere University's medical school and be located on the campus of Mulago Hospital, the university's teaching facility, where its new construction and bright exterior made it stand out against the sooty, weathered façade of the adjacent main hospital building—an architectural testament to the special access to donor money that HIV holds over other afflictions.

Upon its completion in 2004, the building was christened with a gala grand opening celebration presided over by Ugandan President Yoweri Museveni. The guests at the celebration represented the numerous stakeholders in the Institute and illustrated the complex web of alliances and jockeying for power that has characterized the Institute's administration. In addition to President Museveni and the Pfizer CEO, the dedication was attended by members of the Academic Alliance, a collaboration of U.S. and Ugandan HIV physician-researchers organized by Max Edwards to govern the institute and raise funds for its continued support. Two other groups of American stakeholders also participated in the grand opening: U.S. HIV researchers who had ongoing studies based at Makerere Medical School, and representatives of Richard Swan's San Francisco–based foundation, which was the fiscal agent for Pfizer's donation and had overseen the construction of the Institute.

The rationale for building the IDI varies according to the accounts of different stakeholders, as do feelings about its appropriateness. In interviews with me, its boosters described the Institute as a way to leave something tangible to benefit Makerere Medical School and Mulago Hospital, repeatedly pointing out that it was the first building to be built on the teaching hospital's campus in thirty-seven years. It is also true, of course, that the building provides a very visible example of Pfizer's corporate philanthropy, one that helps the company promote itself as being in the business of saving lives in Africa even as it defends the drug-patenting laws that put medicines financially out of reach for many in Uganda (Milford 2011). Publicly, the Institute's training program for African doctors has been promoted as the Institute's primary raison d'etre, and Max Edwards echoed this sentiment in his interview with me. Privately, some stakeholders—including Richard Swan and a few North American researchers—suggested to me that the IDI's state-of-the-art, U.S.-certified laboratory was actually the jewel in the crown, built to attract more internationally funded research projects and to benefit the research of North American members of the Academic Alliance. Indeed, the IDI became a lynchpin of international HIV research in Uganda almost instantly upon opening its doors. During my fieldwork there in 2005, moped couriers from the global shipping service DHL regularly visited the building, testifying to the constant transnational flow of materials and information circulating through the institute.

The facility's power to attract high-profile American AIDS researchers was made clear to me by Karl da Silva, a colleague of Beale's and the director of a prominent, nonprofit California virology research center. In his San Francisco laboratory, Da Silva was spearheading what was viewed as some of the most exciting and promising research on the molecular biology of HIV—research that could lead to entirely new ways of treating the disease. At the time of our interview in late 2004, his virology center had just moved into a gleaming new building in a formerly industrial part of the city that was then being redeveloped into a biotechnology research campus. His office offered an expansive view of the surrounding area and the assortment of corporate and university research facilities being built through the city's public-private redevelopment initiative.

Da Silva was avuncular in manner and enthusiastic yet humble about his own research. He had just returned from Kampala, where he had attended the dedication ceremony for the IDI building at the invitation of American

colleagues involved with the Institute. It had been his first trip to Africa, and he spoke like a converted man, decrying the lack of adequate medical treatment, the underequipped hospital, and an average life span nearly cut in half by AIDS. "The scope of the problem," he told me, "is *immense*." As a result of his trip, he said, he was determined to start a research project of his own in Uganda. The new laboratory housed within the Institute made this determination possible. Though it was not the only high-quality research lab in Kampala, the researchers I spoke with regarded it as the best. I was told several times that it was the only laboratory in East Africa to be certified by the College of American Pathologists.[11] This certification meant that the tests conducted there were quality controlled, audited on a regular basis, and acceptable for clinical trials and the registration of new drugs. As such, it was preferred by major funding agencies such as the NIH and its British equivalent, the Medical Research Council, as well as by drug companies.

For Da Silva, the lab made it possible to carry out biological analyses in Kampala, rather than dealing with the complicated shipment of perishable biological materials across several continents to a U.S. lab:

> It becomes a bit problematic to be trying to send cells from Uganda to here [California]. A lot of times they get stuck in customs in some country or they get lost. Or they thaw, and valuable samples are lost. The IDI offers the opportunity to actually be able to do a lot of the analysis right there, from fresh samples, which is far better.

Like Da Silva, Dr. Beale was initially attracted to the IDI lab because of its sophisticated technology and reputation for excellence. (In addition, both researchers were former colleagues of Max Edwards, who earlier in his career had treated patients at San Francisco General Hospital and founded the virology institute that Da Silva would later head). Furthermore, during his first years working in Uganda—when his research was still based in

11. This was the case until an additional U.S.-supported laboratory was certified at Makerere in July 2005. This was followed by certification of a lab in Tanzania in 2007, one in Kenya in 2009, and a third lab in Uganda in 2009. All three currently certified Ugandan labs are in or near the capital city of Kampala, and all receive support from U.S. universities or government agencies (College of American Pathologists 2012).

Kampala—Beale found the lab's central location convenient, much as Da Silva did. However, even after moving his research several hours away to Mbarara, Beale continued to use the IDI as his primary laboratory facility. His allegiance to the Kampala lab, and the considerable logistical challenges he was willing to overcome in order to continue to have his samples processed there, speaks to the power of a U.S.-sanctioned laboratory in postcolonial science. It also speaks to an evolving geography of scientific inclusion and exclusion within Uganda.

Geographies of Power

Dr. Beale's decision to relocate his research to Mbarara was in part intended to counter critiques that his Kampala findings were not representative of Uganda's primarily agrarian population. Although Mbarara town is relatively urban by Ugandan standards, the Wellness Clinic from which Beale would enroll his study participants drew patients from a wide swath of surrounding rural areas. Many patients supported themselves through small-scale farming or gardening, and some traveled long distances on public transit to make their monthly clinic visits. In addition, Beale found that Kampala had grown crowded with international researchers attracted to the safe and friendly English-speaking city and its internationally known medical school. Prominent Ugandan researchers at Makerere found themselves increasingly bombarded with requests to collaborate as competition for research sites and subjects in Kampala grew. This meant that Beale and other researchers now had to put more and more energy into competing with each other for relationships with Ugandan researchers and their patients. Even though it was home to a university, Mbarara was off the beaten track for foreign medical researchers. The Mbarara University of Science and Technology and the Wellness Clinic welcomed Beale's University of California team as their first major international research collaborators.

The scientific value of Beale's relocation to Mbarara derived from the town's comparatively remote geographic location, which researchers from the United States and Europe perceived as a more authentic representation of Uganda—and even Africa as a whole—than Kampala's urban environment. This was brought home to me in 2005, when I trailed a pair of visiting Swiss researchers as they toured the wards of Mbarara's teaching hospital.

The Swiss were in Mbarara at Beale's invitation, and he was courting them as potential research collaborators. Their research involved the comparison of patients' biological responses to ARV treatment in Africa to those in wealthy parts of the world, in hopes of providing scientific evidence that Africans were benefiting from the treatment as much as Americans and Europeans had. Though they deplored the unequal health care conditions suffered by African HIV doctors and patients, they nonetheless observed the crumbling buildings, rusting bed frames, and crowded conditions of Mbarara's hospital with a form of approval, assuring each other that Mbarara had "real wards," unlike the well-appointed, corporate-funded outpatient clinic at the IDI in Kampala.

For Beale, the scientific legitimacy gained by working in the more "authentic" environment of Mbarara had to be balanced against the scientific risk posed by the area's lack of trustworthy laboratory infrastructure. For this reason, Beale decided to continue to use the IDI lab in Kampala rather than process his blood samples locally. At the time he began his research, little could be done with the samples in Mbarara. The Wellness Clinic's sole CD4 machine was notoriously slow and unreliable, and viral load testing was completely unavailable. In addition, Beale needed a facility that could reliably store and ship some of his samples back to the United States, as certain tests necessary for his research (such as drug-resistance genotyping) were not available in Uganda. Again, these storage and shipping services were not available in Mbarara. Lastly, the IDI's certification by the College of American Pathologists ensured quality results that would be accepted as commensurable with results derived from a U.S. laboratory.

In order to continue using the IDI lab, Beale's research team went through considerable trouble to transport the blood samples taken from patients in Mbarara to the laboratory in Kampala in a timely manner. The route was about four hours (and sometimes five, with road work) on a two-lane paved road through rolling countryside punctuated by small roadside trading stops, family farm plots and grazing lands, and an occasional large town. Samples needed to be delivered to the laboratory on the same day they were drawn in order to prevent them from deteriorating. This meant scheduling all patient blood draws in Mbarara between 7:00 and 10:00 am so that the samples could arrive in Kampala by mid-afternoon, when the IDI lab closed. It also necessitated finding a reliable and affordable way to transport the samples to the capital city on a daily basis. This task was left

up to Eve Ozobia, Beale's on-site research director in Mbarara. The child of an American mother and a West African father, Ozobia had grown up on both continents and obtained her Masters in Public Health degree at one of the United States' most prestigious programs. Her self-described "bicultural" identity proved invaluable in her role as the liaison between the American and Ugandan researchers. It also gave her a knack for devising creative responses to logistical problems that the American researchers were unaccustomed to solving.

After considering several options for transporting the blood samples, including using a courier service (too expensive, and possibly unreliable) and a private taxi driver (reliable, but still too expensive), Ozobia decided that the best solution was to hire someone who would deliver the samples by bus—an eight- to ten-hour round trip that would need to be made four to five days a week. Although Beale and other U.S. research staff were skeptical that anyone would agree to such a position, Ozobia correctly assured them that it would not be a problem. (When I returned to Mbarara in 2009, I learned that a local man had been doing the job for the past three years. His Ugandan supervisor told me that he had never requested a vacation, never gotten sick, and never missed a day of work during that time). Ozobia also solved the problem of how to keep the samples cold during the trip. This required they be stored with dry ice, which Ozobia learned was only available from Kenya, and could only be purchased in very large, industrial-sized quantities. She solved this problem by brokering a deal with Mbarara's local Coca-Cola bottling plant, which also used dry ice and agreed to sell the study the small amount it needed to keep the samples cool in transit.

The challenges of shipping the blood to Kampala, and Beale and Ozobia's willingness to go out of their way to overcome them, speak to the way in which scientific legitimacy in "global" research is contingent upon the availability of specific technologies—technologies that might more accurately be described as "local" to the United States, Europe, and other wealthy parts of the world (Feierman 2011). Furthermore, the concentration of laboratory technology in Kampala has created new types of inclusions and exclusions within Uganda. Specifically, the co-location of the IDI and a handful of other top-quality labs in or near Kampala has created a distinct geography of power in Ugandan medical science. Because U.S. researchers such as Karl Da Silva locate their research in Kampala in order to take advantage of the city's superior laboratory infrastructure, Ugandan doctors and aspiring

researchers working in more rural, "up-country" areas have considerably fewer opportunities to participate in international projects.

For those up-country physicians who do find ways to become involved in research, the dependence on Kampala labs can relegate them to the role of "blood-senders," making it difficult for them to establish an equitable relationship with their collaborators (Fullwiley 2002). For example, Dr. Gregory Odong, the physician from embattled northern Uganda, complained to me that his collaborators (also Ugandan, but based in Kampala) required that all his blood samples be sent to their lab in the capital, even though he had a CD4 machine at his hospital in the northern city of Gulu. I asked him if he felt like a "blood sender." He responded, "That's what I am describing. We're just a blood sender. And we shall not be quoted into their results if they come out." In other words, he and his local colleagues would not be included as authors—thus denied the professional recognition and social capital that comes with publication, despite the fact that they supplied the raw materials (samples) for research.

Laboratories, in other words, are significant not simply in their ability to translate patient bodies into scientific data but also in their physical locations. The geography of laboratories is the geography of scientific networks. For American scientists working in many parts of Africa, state-of-the-art laboratories are essential tools that allow them to maintain their legitimacy in the increasingly molecularized field of global HIV science even as they shift the focus of their work to "resource-poor" locations. For African researchers struggling to find both scientific funding and recognition, these laboratories offer the possibility of entrée into "resource-rich" international science or—in the case of the geographically disadvantaged—further marginalization.

The Means of Scientific Production

The laboratory and its relation to different forms of power have served as rich topics of scholarship in science and technology studies since the 1970s. Early proponents of "laboratory studies" made the case for anthropologists in the laboratory, arguing that social studies of science should not simply examine the institutional politics of science (as had been the case historically) but also the production of scientific knowledge itself (Latour and

Woolgar 1979; Lynch 1985; Knorr-Cetina 1981). Karin Knorr-Cetina describes laboratories as "fact factories" that enable scientists to isolate and manipulate objects in ways not possible in nature. In observing these fact factories, anthropologists and sociologists could witness the generation of scientific knowledge as a product of contingent "local" practices and constraints rather than the discovery of universal natural truths. Thus, for her, "the power of the laboratory is the power of locales" or, in other words, the power of context to shape knowledge (Knorr Cetina 1995, 157). In Latour and Woolgar's seminal lab ethnography *Laboratory Life*, the power of the lab lies in its ability to transform the disorder of the natural world into legible data suitable for the making of scientific arguments (Latour and Woolgar 1979). In addition, some works have examined relationships of power within the laboratory, such as the division of scientific labor (and social capital) between those recognized as "scientists" versus mere "technicians" (Shapin 1989). Most of this earlier work in laboratory studies, as well as science and technology studies more broadly, has focused on scientific politics and practice in wealthy, industrialized parts of the world.

In the postcolonial science studies literature, laboratories take on new meaning as sites of extraction and exchange. In his historical account of Carlton Gadjusek's studies of kuru disease among the Fore people of New Guinea, Warwick Anderson emphasizes the important role played by the laboratory in transforming embodied organs (in this case, brains) belonging to the Fore into autopsied specimens belonging to Gadjusek. For Gadjusek, Anderson argues, the key to exerting his ownership over brains and other biological samples collected from the Fore was to render these objects "scientific" rather than personal, a feat that was accomplished via the laboratory:

> To make a Fore person's brain into one of Gadjusek's kuru brains, it would be necessary to cut the network, to differentiate native and scientific exchange regimes. The principal site at which this transformation took place was the bush laboratory. . . . In the laboratory the scientist applied his tools to the transformation and de-animation of Fore body fluids and tissues—they came in as persons and left as things. (Anderson 2008, 108)

Many of the other recent works examining postcolonial science have also noted its extractive tendencies, in which plants, animals, and human blood

and tissues from the global South supply Northern-funded science with valuable specimens and data (Petryna 2009; Sunder Rajan 2006; Lowe 2006; Reardon 2005; Hayden 2003). In this scenario, Southern scientists must guard against being relegated to the position of mere "senders" of blood, samples, or other raw materials, as Dr. Odong described above. Unfortunately, this is not an uncommon scenario within postcolonial science, where too often "those at the margins are allowed to contribute data, while those in centers provide the theories through which scientific reason will be known" (Lowe 2006, 51).

At the same time, the postcolonial laboratory may offer Southern-hemisphere researchers chances for inclusion and scientific opportunity even as it threatens to marginalize them. For example, in her ethnography of a transnational effort to discover pharmaceutically active plants, Cori Hayden describes the contrasting attitudes of different Mexican chemists toward the project's use of a laboratory technique called the brine shrimp assay. This simple test, used to assess the pharmaceutical potential of raw plant material, was viewed disparagingly by a Mexican government scientist, who saw it as allowing Mexican chemists to perform only "basic tasks" while more complex chemical analyses were reserved for scientists in the United States. At the same time, the Mexican biochemists involved in the project viewed their use of the test with pride as it involved chemical work not being done by their Chilean or Argentinean colleagues, who simply collected and sent dried plant samples to their Northern funders (Hayden 2003, 210). The simultaneous threat and opportunity represented by elite postcolonial laboratories was certainly apparent to me in Uganda, where the careers of aspiring Ugandan scientists could be made or foreclosed based on access to facilities like the IDI and the international funding and mentorship networks circulating through them. These "fact factories" are the means of global health scientific production, and access to them signifies access to the professional benefits of inclusion in international science.

Perhaps not surprisingly, valuable laboratory facilities may become crucibles of postcolonial power struggles, with both donor and host nations resisting their collaborators' assertions of control. This was in fact what happened at the IDI, where Ugandan and North American stakeholders would find themselves in a face-off over the laboratory's long-term ownership. According to Max Edwards, the construction of the new Institute building had been partially motivated by a desire to have a "lasting impact"

on Makerere Medical School and hospital. However, once it was built, some of the American members of the Institute's governing body resisted ceding its control to Makerere University, as had been previously agreed. Following a somewhat acrimonious series of negotiations, the U.S. foundation that was the fiscal agent and official owner of the building eventually forced the turnover of the IDI to Makerere. As a result, American researchers who once had very easy access to research opportunities through the Institute found themselves having to lobby for attention, "because," as foundation director Richard Swan put it to me, "now [the Ugandans] can decide not to use them." Not long after, the employment contract of the British woman who had been running the IDI laboratory was not renewed, even though she wished to stay. When Eve Ozobia asked a Ugandan colleague about the incident, she was told the Ugandans at the IDI were simply "sick of the *bazungu* [white people/Westerners] and their collaborations."

Questions about ownership, control, and the nature and meaning of collaboration would also arise in Mbarara. Not unlike Max Edwards, Dr. Beale envisioned his work as enriching Mbarara's medical school and HIV clinic. This was an accurate vision, given the medical technologies, jobs, and career development opportunities that the project brought with it, and was shared by many of the medical school's faculty and some of the clinic doctors. Nonetheless, as the project expanded, both the potential benefits and the burdens of having international research in Mbarara also grew, fueling resistance to some of the demands of the research project and igniting tensions over the ownership and obligations of global HIV science. Many of these tensions were fed by the project's unintentional but seemingly unavoidable entanglement in the donor-client politics of development and humanitarian aid that have dominated U.S. involvement in Africa in the postcolonial era. It is the negotiation of these dynamics via Dr. Beale's research at the Wellness Clinic that is the focus of my next chapter.