

Epidemic Intelligence.

Langmuir and the Birth of Disease Surveillance

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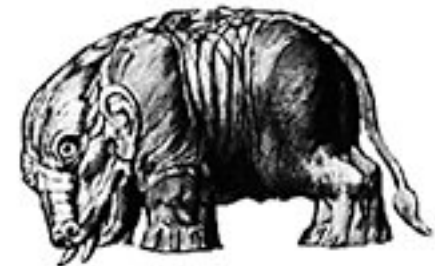
Abstract:

In the wake of the SARS and influenza epidemics of the past decade, one public health solution has become a refrain: surveillance systems for detection of disease outbreaks. This paper is an effort to understand how disease surveillance for outbreak detection gained such paramount rationality in contemporary public health. The epidemiologist Alexander Langmuir is well known as the creator of modern disease surveillance. But less well known is how he imagined disease surveillance as one part of what he called “epidemic intelligence.” Langmuir developed the practice of disease surveillance during an unprecedented moment in which the threat of biological warfare brought civil defense experts and epidemiologists together around a common problem. In this paper, I describe how Langmuir navigated this world, experimenting with new techniques and rationales of epidemic control. Ultimately, I argue, Langmuir’s experiments resulted in a set of techniques and infrastructures – a system of epidemic intelligence – that transformed the epidemic as an object of human art.

Keywords: diseasesurveillance; social determinants of disease; epidemiology; biological warfare; preparedness

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“[...] so great a plague and mortality of men was never remembered to have happened in any place before. For at first neither were the physicians able to cure it through ignorance of what it was but died fastest themselves, as being the men that most approached the sick, nor any other art of man availed whatsoever. All supplications to the gods and enquiries of oracles and whatsoever other means they used of that kind proved all unprofitable; insomuch as subdued with the greatness of the evil, they gave them all over.”

Thucydides, *The Peloponnesian War*, Book II, (115)

The Greek historian Thucydides described the plague at Athens as a revelation of the vulnerability of human institutions. The failure of rites, knowledge and faith under the duress of death and disease overturned the order of the city itself. To this day, epidemics continue to provide the occasion for a reckoning of human knowledge and political order. Among international health experts and policymakers, the outbreak of Severe Acute Respiratory Syndrome (SARS) prompted such a critical occasion. These critiques moved swiftly from a recognition of the fatal danger of the virus to a condemnation of human failures – both scientific and political. Above all, these critiques focused on delays in recognizing the new virus and poor communication between health organizations.

SARS critiques singled out China as an opaque space, hidden from the view of international health institutions. This opacity had two dimensions. First, local health authorities did not immediately identify or report the existence of a new disease to the central government in Beijing. In addition, the Beijing authorities belatedly confirmed the existence of the epidemic to the World Health Organization (WHO), enabling the virus to spread to Hong Kong and around the world (see Fidler 2004; Kleinman and Watson 2006; Greenfeld 2006). As David Fidler (2004) concludes, SARS revealed the weakness of the disease detection and response capabilities of the international health regime. WHO quickly passed a resolution demanding the prompt and transparent reporting of all cases, as well as the sharing of information that might help prevent international transmission. In the 2003 World Health Report, WHO called for the extension of surveillance systems around the world in order to detect the appearance of new disease outbreaks. The Report declared that “across the board strengthening of systems for outbreak alert and response was the only rational way to defend public health security against not only SARS but also all future infectious disease threats, including those that might be deliberately caused” (WHO 2003).

This paper is an effort to understand how disease surveillance for outbreak detection gained such paramount rationality in contemporary public health. Paul Farmer (1999), Mike Davis (2005) and Nicholas King (2001, 2002, 2003), among others, have criticized this reliance on the detection of disease emergence. Epidemic detection, they argue, is a post-hoc technical solution, which ignores the correlation of disease outcomes with social inequality and the role of social conditions in the production of disease.[1] This paper returns to the birth of modern disease surveillance in order to identify precisely how the practice of epidemic control moved beyond the analysis of social conditions of disease. Alexander Langmuir, lead epidemiologist at the U.S. Centers for Disease Control and Prevention (CDC) [2] from 1949 to 1970, is credited by global health institutions with conceiving and refining the modern practice of disease surveillance (Declich/ Carter 1994, 287). But less well known is how he imagined disease surveillance as one part of what he called “epidemic intelligence”.

Langmuir developed the practice of disease surveillance in the post-Second World War United States, an unprecedented moment in which the threat of biological warfare brought civil defense experts and epidemiologists together around a common problem. In this paper, I describe how Langmuir navigated this world, experimenting with new techniques and rationales of epidemic control. Ultimately, I argue, Langmuir’s experiments resulted in a set of techniques and infrastructures – a system of epidemic intelligence – that transformed the epidemic as an object of human art.

A legacy of grandeur or malice?

In 1996, the American Journal of Epidemiology devoted an entire issue to remembering the life and work of Alexander Langmuir. The articles enumerated Langmuir’s manifold contributions to the sciences of air-borne pathogens, population control, veterinary health, and of course, the invention of disease surveillance. The narrative structure of this hagiography, however, relied on writing the history of public health as what Thomas Kuhn once criticized as a “development-by-accumulation” (Kuhn 1996). The authors situated Langmuir within a linear progressive development; standing between the nineteenth century hygienists and ourselves, he is described as “passing the epidemiologic torch from [William] Farr to the world” (Foster/Gangarossa 1996, 65). As one author declaimed, “we do indeed stand on the shoulders of those who came before us, and in public health, we are grateful for the shoulders of Alexander Langmuir” (Foege 1996, 15).

A few years after the honorary volume, however, Langmuir’s legacy and influence in American public health became the object of historical criticism. In an article published in the American Journal

[1] See especially Nicholas King (2001, 2002, 2003) for the history of the “emerging infections worldview” and its paramount demand for surveillance and information.

[2] When founded after World War II (see below), today’s Centers for Disease Control and Prevention was known as the Communicable Disease Center. But the acronym has always been CDC.

of Public Health, Theodore Brown and Elizabeth Fee (2001a) revealed Langmuir's historical relationship to the biological weapons defense establishment and warnings about biological sabotage. Langmuir, they wrote, exploited popular fears of biological warfare in order to build the CDC and disease surveillance infrastructure. Brown and Fee identified two specific harmful effects of this exploitation. First, by giving credibility to these fears, he "added legitimacy to one dimension of the fear-driven mentality of the Cold War era" (2001a, 725). Second, and more importantly, Langmuir's emphasis on the "exotic threat" of biological warfare "channeled the energy and narrowed the scope of epidemiological research to an infectious disease focus" (2001a, 725).

Brown and Fee questioned the idea that all investment in public health, no matter what the motive or objective, is a good. "Choices must be made," they wrote. "Funding towards one set of problems can be – and in our experience often is – diverted from others" (2001a, 725). In this case, while funding for biological warfare research and defense increased, funding for local public health departments decreased. They concluded by drawing a comparison to our own time, in which fears of biological attack are once again used to promote certain forms of public health preparedness.

D.A. Henderson, a former student of Langmuir's most known for his leadership of the global smallpox eradication program, disputed Brown and Fee's causal arguments in a subsequent letter to the editor (Henderson 2001). A member of the Epidemic Intelligence Service in the 1950s, he pointed out that only one out of fifty or so EIS officers worked on biological weapons threats at the time. In addition, while the decline of local health departments is indisputable, Henderson questioned whether Langmuir's biopreparedness efforts could be held responsible for this decline.

As Brown and Fee subsequently acknowledged, these two historical perspectives "do not see eye to eye" (Brown/ Fee 2001). Amidst these crossed gazes that do not recognize each other, I believe the truth of Langmuir's work remains unseen. Langmuir's life and work reveal a transformation that is neither a "strengthening" nor a "narrowing" of public health. Instead, the articulation of civil defense planning with epidemiology – what he called "epidemic intelligence" – changed the nature of the epidemic as a scientific problem.

In order to make this transformation visible, I depict Langmuir's world as what Paul Rabinow calls a "problem-space" (see Rabinow 2003). Rabinow draws on Michel Foucault's concept of problematization as a moment of "uncertainty, a loss of familiarity [...] the result of difficulties in our previous way of understanding, acting, relating." The analysis of a problem-space does not see historical situations as givens of an existing narrative, but as *milieux* with both constraints and

possibilities. The world in which the defense against biological warfare became the task of epidemiologists forced Langmuir to develop and experiment with new techniques and goals. In order to understand how he transformed epidemic diseases as a scientific problem, I locate Langmuir within the uncertain convergences of disease, warfare and government that characterized his world.

Malaria, 1950

During the height of World War II, United States military authorities worried about the incidence of malaria among soldiers, particularly those at bases in the southern part of the country. In an experimental program called Malaria Control in War Areas (MCWA), epidemiologists joined with environmental engineers to eliminate malaria and malaria-harboring mosquitos around military bases. The project was strictly military and limited in scope to improving the health of soldiers during the war. However, MCWA director Joseph Mountain quickly began to imagine expanding the scope of the institution in both time and space. In a January 1942 memo, Mountain argued that “the defense emergency could result in an improvement in civilian health; that after the war, services having to do with the general population could be developed” (Etheridge 1992). In 1945, MCWA extended the malaria control program to include civilian populations. One year later, in the culmination of Mountain’s vision, MCWA merged with a couple of national public health laboratories and was renamed the Communicable Disease Center. The CDC soon became the most powerful arm of the federal Public Health Service.

Although the CDC was responsible for the control of a large number of communicable diseases, in the early years malaria remained central. In 1947, the malaria control program’s epidemiologists and engineers developed a five year plan for the total eradication of endemic malaria from the United States population (Andrews et al. 1950). Alexander Langmuir was the lead epidemiologist. While his engineering colleagues were digging trenches and spraying DDT, Langmuir began to develop new practices for tracking incidence and prevalence. Three years into the program Langmuir and two colleagues undertook a review of progress. The results were both surprising and provocative. Cases of malaria in the U.S. had declined from over sixty thousand in 1945 to around four thousand in 1949, apparently indicating that control and eradication methods were wildly successful. Yet Langmuir and colleagues were not convinced. Instead, they argued that “a change in the method of morbidity reporting [...] requiring the identification of patients [...] plus the elimination by states of obviously doubtful reports based on appraisal are responsible for the abrupt decline in reported malaria morbidity since 1947 (Andrews et al. 1950). In other words, the apparent abrupt decline was only a more accurate account

of actual malaria incidence. The solution was better collection of information regarding incidence and prevalence.

As Langmuir later recalled, it was in the midst of the malaria eradication program that surveillance of diseases was first implemented (Langmuir 1965). Before this program, doctors did report cases of certain diseases to state health departments. The state health departments collected these reports and periodically sent them to the federal Public Health Service. But disease reporting was by no means standardized across the country, nor were reports typically verified by states. The collected numbers were mostly used to keep long-term records of annual changes in prevalence of certain diseases (Thacker and Berkeleman 1988). During the malaria eradication program, Langmuir actively intervened in the reporting system, demanding that states eliminate obviously doubtful reports and that diagnosed cases be identified. Not trusting the original diagnostic report, Langmuir ensured that every reported case was reviewed by CDC trained nurses to ensure diagnostic accuracy. For final confirmation, the nurses collected blood samples to be sent to laboratories for analysis (Andrews et al. 1950).

By naming these new practices 'the surveillance of disease', Langmuir made a conceptual point. He wrote that "surveillance, when applied to a disease, means the continued watchfulness over the distribution and trends of incidence through the systematic collection of morbidity and mortality data and other relevant data" (Langmuir 1963).

Langmuir always claimed his ideas were simply elaborations of the 19th century London statistician William Farr's work (Langmuir 1976). However, 'surveillance of disease' in fact differs significantly from the way Farr collected and analyzed reports of disease. The difference between Farr and Langmuir illuminates the difference between two epistemological fields of practice. Farr was a moral epidemiologist. He assembled reports of disease and death into statistical archives, analyzing the city of London into numerical populations and sub-populations with different average rates of disease. He aimed to identify the causal factors, which made certain sub-populations fall ill and die at far higher rates than others. Farr correlated sub-populations suffering higher average morbidity with patterns of social life or urban environment (including occupation, altitude above the Thames, or housing conditions) (Eyler 1979). 19th century statistical epidemiology revealed the conditions of existence that place human beings at greater or lesser risk of disease. Out of these investigations, epidemiologists developed norms of hygiene and health and disseminated them to fields as diverse as urban planning and education (Coleman 1982; Delaporte 1982; Rabinow 1995; Porter 1999a).

Langmuir's use of disease reports is quite different. Disease surveillance, in Langmuir's terms, collects reports of disease in order to provide a continuous picture of the actual extent of an epidemic. Rather than providing the material for causal determinations, the disease report enables a "continued watchfulness" over an epidemic. During the malaria eradication program, Langmuir did not attempt to determine causal factors or conditions, since he found these already established. He knew that a parasite transmitted through the bite of an *Anopheles* mosquito vector caused malaria. With this knowledge presumed, he worked to transform reporting requirements in order to more accurately detect the presence of these parasites in human hosts, including through the use of laboratory testing. By doing so, he discovered the epidemic was much smaller than anyone imagined. Through the vigilance of continued watchfulness, Langmuir suggested, the CDC could detect the appearance and disappearance of epidemics. The epidemic was transformed from a problem of population pathology into a discrete event framed by outbreak and subsidence.

Epidemic Intelligence

In the malaria control program, Langmuir designed disease surveillance in order to track the gradual subsidence and ultimate eradication of *Plasmodium* parasites from the U.S. population. The use of disease surveillance to track an epidemic's subsidence to case '0' is what makes disease eradication possible, as D.A. Henderson makes clear in his reports on global smallpox eradication (Fenner et al. 1988; Henderson 1999). However, Langmuir also made disease surveillance the basis of a second function: epidemic detection.

Langmuir elaborated disease surveillance for the detection of disease outbreaks, a function he referred to as 'epidemic intelligence'. In 1951, he persuaded reluctant state health agencies to standardize and expand reporting of certain diseases to the federal government. For the first time, all states agreed on a standard list of fifty-one diseases (classified as "of national importance") as the basis for national reporting, a system known as the National Notifiable Disease Surveillance System (NNDSS). At the same time, Langmuir personally organized a special group of federal epidemiologists called the Epidemic Intelligence Service (EIS). The construction of a mechanism for standard national disease reporting, as well as the creation of a team of epidemic "first-responders," transformed the function of disease reports. Langmuir's design of an epidemic intelligence infrastructure transformed disease reporting from an "archival function prior to 1950 to [a function] in which there is a timely analysis of data and appropriate response" (Thacker/Berkelman 1988).

The urgency with which Langmuir promoted this model of epidemic intelligence at first seems unlikely for the postwar period. Malaria and other infectious diseases were rapidly disappearing in the United States. Many public health researchers were calling for a shift in resources to follow the so-called epidemiological transition, the transition from infectious to chronic diseases as the prime cause of population morbidity and mortality (Susser 1985, 149). And in fact, the impetus for epidemic intelligence did not come from the academies or departments of public health. The construction of the NNDSS was planned by civil defense administrators concerned about the potential enemy use of biological weapons. Langmuir was one of them. In order to understand how Langmuir turned disease surveillance from an epidemiological practice into a governmental institution, his concepts and practices must be situated within the broader history of civil defense of which they formed a part.

Civil defense was a central organizing principle of United States postwar social policy. After signing the Civil Defense Act in 1950, President Truman announced that “people, property, and production” had become concerns of national as well as social security (Federal Civil Defense Administration 1951). The legislation was deeply rooted in postwar military strategy. Military planners declared that contemporary technologies of warfare (air war, atomic, chemical, or biological weapons) erased the distinction between battlefield and homefront (Sherry 1977; Yergin 1997). With people, property and production as front lines of potential war, the protection of these resources became a national security responsibility.

In 1950, the National Security Resources Board published two volumes, which set out the role of civil government – including public health – in Cold War national security plans. In United States Civil Defense, the NSRB argued that the technical qualities of modern “air-atomic” warfare demanded a reconsideration of national defense strategy. Defense of military installations alone was insufficient. Rather, “productive power” (based on industrial plant, critical infrastructure, and human labor) and civilian morale were essential components of the military machine and required equivalent defensive measures:

“Since there can be no absolute military defense, an effective civil defense is vital to the future security of the United States because it might provide the means whereby this country, if suddenly attacked heavily and without warning, could get up off the floor and fight back.” (NSRB 1950a, 1)

Any city or factory was a potential target, and there was no way to know if or when an attack would come:

“The civil defense program for this country must be in constant readiness because for the first time in 136 years an enemy has the power to attack our cities in strong force, and for the first time in our history that attack may come suddenly, with little or no warning.” (NSRB 1950a, 7)

In a recent series of articles, anthropologists Stephen J. Collier and Andrew Lakoff describe the development of a “rationality of preparedness” in postwar U.S. civil defense planning (Collier/Lakoff 2007, 2008a, 2008b). Facing the threats of air war and nuclear munitions described above, administrators found the basic tools of risk assessment—probability calculations, population averages and insurance of normal conditions – ineffective. Drawing on knowledge of air warfare in Europe and the atomic bombs in Japan, planners determined that the destructive potential of warfare required new forms of preparedness planning. While the likelihood of an attack was low, the degree of potential damages was extremely high. Planners developed methods of preparing for low-probability, high-consequence events: early warning systems, vulnerability mapping, simulation exercises, and protection of critical infrastructure such as roads, electricity grids, and communication channels. Rather than absolute safety, or risk-based security, the strategy aimed to ensure the continuity of ‘critical systems’ of political authority and production if an attack did occur.

Yet air-atomic war was not the only catastrophic threat that preoccupied civil defense planners. The NSRB turned to biological weapons in a second volume published in 1950, *Health Services and Special Weapons Defense*. According to the NSRB, the characteristics of biological weapons differed significantly from air-atomic war. Whereas nuclear weapons brought entirely unprecedented dangers, the NSRB considered biological weapons a mere extension of natural forces.

“Biological warfare against people should not be looked upon as some mysterious, uncontrollable means of wholesale destruction of life. Actually, nature has directed biological warfare against man for thousands of years, but health workers have devised and applied constantly improving preventive methods.” (NSRB 1950b, 25)

According to the NSRB, an “efficient defense system” against pathogenic microbes could be found in the basic techniques of public health (Ibid., 201). Such a defense system would be equally powerful whether the enemy was “nature” or “man”. Yet much still needed to be done, and the practices of public health needed to be refocused.

"Today, with few exceptions, infectious diseases are well controlled in this country. The mechanisms, as well as the knowledge and experience to control biological warfare, whether waged by nature or by man, are present in our current health system. The entire system, however, will need strengthening to be able to cope with enemy use of biological weapons." (Ibid., 25, emphasis added)

In order to strengthen the system, particularly against the threat of sabotage, the NSRB focused on improving what they called vigilance.

"Prevention of an overt attack with biological weapons is a military problem, but prevention of sabotage requires constant vigilance by civil agencies and civilians." (NSRB 1950b, 25)

Ensuring constant vigilance required transforming the collection of morbidity reports into a method of epidemic detection. While the reporting system during peacetime "probably is sufficiently effective for the most dangerous diseases [...] for civil defense health services, the problem is somewhat different and the system is probably not adequate" (Ibid., 170). Because of the unexpected and unusual epidemiology of biological sabotage, "routine detection methods would not be adequate to cope with such incidents" (Ibid., 205). The NSRB argued that the most pressing need was the "nationwide refinement and reinforcement of the present [morbidity reporting] system" (Ibid., 170).

"The reporting of cases of disease caused by biological warfare attack would be a necessary procedure to provide effective treatment and to limit the extent of damage to the population." (Ibid., 203)

In conclusion, NSRB assigned the task of strengthening national morbidity reporting to the Public Health Service (Ibid., 205). Their suggestions did not go unheeded. In 1950, the PHS called a special meeting to address the problem of biological warfare for public health. Langmuir, who was at the meeting, later recalled that the outcome of the meeting was "common agreement that the basic need was for the development of strong epidemiological investigation of all types of epidemics occurring anywhere in the nation" (quoted in Etheridge 1992, 142). But what epistemological basis stood behind the common agreement that epidemic intelligence was the solution to the biological weapon threat?

The potentialities of biological warfare

Langmuir began work in public health during the 1930s. At the time he strongly believed in social medicine. He later remembered his support of the Committee on the Costs of Medical Care's 1932 report that called on the federal government to enact social medicine policies. As recorded in an oral history interview, he then believed "the real future is to have the health society control the distribution of medical services" (The Reminiscences of Alexander Duncan Langmuir 1964, 28). During the war, however, he served on a high-profile epidemiological task force in the military, which was ordered to track and control outbreaks of acute respiratory illness among soldiers. The experience deeply transformed his view of public health. As he stated in the oral history interview, "the war completely turned [him] on to epidemiology, four solid years of epidemiology" (The Reminiscences of Alexander Duncan Langmuir 1964, 30).

Historian Dorothy Porter points out that the moral program of social medicine was, after the war, reduced to a technical program of epidemiological research (Porter 1999b; see also Porter/Porter 1988). While following a similar movement towards technical rather than moral problems, Langmuir differs in significant respects from the broad trend of postwar epidemiology. As he described, his epidemiological work within the military was "quite contrary to the study section research grant" epidemiology (The Reminiscences of Alexander Duncan Langmuir 1964, 30). Langmuir's team did not have the time to plan long-term statistical investigations into broad correlations of disease with socio-natural environments or lifestyle behaviors. Instead, military epidemiologists tracked ongoing disease outbreaks, identifying and isolating cases, and experimenting with control measures (different bunk arrangements, chemicals for cleaning surfaces) during the course of the epidemic.

Langmuir also saw his work taking place amidst a growing threat of biological warfare. After the war, Langmuir briefly taught at Johns Hopkins School of Public Health. There he met and befriended professor of epidemiology Kenneth Maxcy. Along with his academic duties, Maxcy served on the U.S. Committee on Biological Warfare. The highly classified committee, created in 1941, developed the program and strategy for biological warfare and defense. Langmuir often filled in for Maxcy on the committee and when Maxcy fell ill with Parkinson's disease, Langmuir took over full time. Beginning in 1947, Langmuir also served on the Army Chemical Corps. Administrative Council, the organization involved in offensive biological weapons research and production. By 1949, he had a higher security clearance than the surgeon general (Etheridge 1992, 41–42). [3]

[3] In later years (after the developments of interest in this paper), Langmuir also became assistant to the secretary of defense for research and development (1953–1959) and served on the DOD Committee on biological and chemical defense (1959–1961).

Biological weapons research in the United States skirted a fine line between defensive and offensive possibilities. The earliest investigations into the potential for weaponized diseases were undertaken in 1941 in response to fears that Axis powers already possessed usable biological weapons. From the beginning, research was justified by Secretary of War Henry Stimson "because of the dangers that might confront this country from potential enemies employing what may be broadly described as biological weapons" (quoted in Moon 1999, 218). Early responsibility for the research agenda was placed under the newly formed War Bureau of Consultants (WBC), a civilian organization made up of academic experts in microbiology, many of them taken from the major research universities. The WBC concluded in its first report [19 February 1942] that "biological warfare is distinctly feasible. We are of the opinion that steps should be taken to formulate offensive and defensive measures. [...] There is but one logical course to pursue, namely to study the possibilities of such warfare from every angle, make every preparation for reducing its effectiveness, and thereby reduce the likelihood of use." (Moon 1999, 219). And to blur distinctions between offense and defense further:

"It is obvious that preparation for defense necessitates a knowledge of offense, and if this knowledge is not available from experience, it must come from the results of careful investigation." (Ibid.)

In 1942, President Roosevelt created the War Research Service as a department within the Federal Security Agency, the agency whose responsibilities were in social planning and public health. Roosevelt assigned pharmaceutical entrepreneur George Merck to direct the WRS in the research, development and production of biological weapons. The military took control of production once preliminary research seemed promising. In fact, as Stimson reported, "when War Research Service was first established, the primary considerations were research and secrecy so far as military participation was concerned. Therefore, this activity was placed in a civilian agency for more perfect cover" (quoted in Moon 1999, 232).

By the end of the war, the U.S. biological warfare program had investigated eighteen diseases for possible weaponization. While many diseases proved promising, only a few were proposed for mass production (anthrax and brucellosis in particular). These successes paved the way for an expanding program in the postwar period, especially before and during the war in Korea (Dando 1999, 49).

A contradiction plagued the biological weapons program, however. Throughout the 1940s, the program was justified as a method of heightening defensive capability against enemy use of biological weapons. However, while numerous offensive weapons, distribution mechanisms, and deployment strategies were developed, little success was achieved in the defense sector. In particular, although the very first report of the BWC had highlighted the potential enemy use of biological weapons against civilian populations (Moon 1999, 219), none of the biowarfare program's technical innovations (beyond the application of already existing vaccines and antibiotics) were designed for mass populations. Physical protection such as masks and clothes were unwieldy, expensive and probably ineffective outside the laboratory. Decontaminants, such as bleach and methyl bromide, were effective but obviously only in controlled or limited spaces (Ibid., 243–244).

Langmuir was well aware of this contradiction. He soon began to propose national notifiable disease surveillance as precisely this missing piece: a biological weapons defense system at the scale of the national population. In March 1951 he authored a piece entitled "The Potentialities of Biological Warfare Against Man". The article set out to provide a "logical statement of a 'theory of biological warfare'" that would supersede debates and controversy over the reality of the threat (Langmuir 1951, 387). He wanted to complement the broad strategies of the Health Services and Special Weapons Defense manual with concrete technical proposals. Many scientists at the time were skeptical about the feasibility of turning microbes into weapons. Langmuir bemoaned the lack of scientific appraisals. He wrote:

"Several hundred scientific papers have been published from Camp Detrick. These have direct application to our problem. The author is unaware, however, of any comprehensive scientific statement of the broad aspects of the problem that has been published from an official source."
(Ibid., 388)

Most importantly, Langmuir's theory defined the scope of biological warfare as a problem for public health. He wrote that "the problem may be limited to known disease agents and the potentialities of their use, whether by inhalation or ingestion" (Langmuir 1951, 389). He set aside the threats of the "super agent" and the "uncontrollable epidemic," arguing that there was no means of rationally preparing for them. Building on the claims made in Health Services and Special Weapons Defense, Langmuir argued that an extension of existing public health practices could ensure preparation for biological weapons attack.

At the same time, Langmuir worried about existing capabilities for epidemic intelligence and vigilance. In a second article, Langmuir outlined the vulnerabilities of an unreformed notifiable disease system. He described a scenario of potential biological attack:

“Medical care facilities would be grossly overtaxed early in the epidemic. Emergency medical services would have to be organized as rapidly as possible. Laboratories would be swamped with specimens, but except in a few places personnel and facilities would be grossly unprepared to provide a prompt specific diagnosis. Depending on the agent used in the attack, it might be days or weeks before an etiologic identification could be made.” (Langmuir 1952, 236)

And in the absence of etiologic identification, therapy and prophylaxis through anti-microbial drugs or vaccines would be ineffective (Ibid.). Through the scenario, Langmuir laid out the core elements of a public health response to biological attack: (1) the early detection of the beginning of an epidemic, and (2) the identification of the causative pathogen.

In addition to conceptualizing the problem, Langmuir described two institutional reforms, which he believed would improve vigilance. Langmuir argued that “any plan of defense against biological warfare requires trained epidemiologists alert to all possibilities and available for call at a moment’s notice” (Langmuir/ Andrews 1952, 237–8). This idea was realized in the Epidemic Intelligence Service. First organized by Langmuir in 1950, the EIS trains an annual class of epidemiologists and places them “on call” for epidemic alerts. Once an epidemic is reported, EIS officers are rapidly deployed to the site where they investigate and attempt to determine the etiology of the disease. After identification, they assist states in the implementation of control measures and, when the epidemic subsides, return to CDC headquarters (Langmuir 1980). Today the “disease detectives” of the EIS are involved in epidemic response activities around the world, and many countries have developed field epidemiology institutions modeled after the EIS.

Second, Langmuir also proposed building a new national morbidity reporting system. He wrote that “[...] with a strong intelligence system, based on prompt morbidity reporting, the beginning of the epidemic might be appreciated hours or even days before it was clearly apparent to any single physician.” (Ibid., 237)

Morbidity reporting, he emphasized, was necessary to guide immediate interventions, rather than for long-term archival research. He wrote, “morbidity reports are indispensable for immediate

recognition of a disease situation which requires public health action. [...] The protection of our communities depends upon immediate notification of the occurrence of these [notifiable] diseases so that, once a diagnosis is made, proper measures may be instituted.” (Langmuir/Sherman 1952, 1250)

Langmuir’s concept of a “strong intelligence system” was the blueprint for the Public Health Service’s reform of national morbidity reporting. Following the pivotal meeting regarding biological weapons, the PHS organized a Committee on Communicable Disease Reports to consider reforms. The Committee presented its proposals to the Association of State and Territorial Health Officers (ASTHO), the primary body for coordinating interstate health affairs, that fall. The plan outlined a number of arguments in favor of a standardized and intensified national notifiable diseases system. Along with the archival collection of vital statistics, the committee argued that “civil defense against biological warfare requires immediate central notification of outbreaks of disease” (Public Health Service Committee 1951, 5). Rapid reporting and analysis would be essential for national defense as well as public health:

“Biological sabotage by water or food supplies or by aerial contamination of strategic buildings might produce serious consequences. Adequate defenses against such attacks are difficult to visualize but the importance of ‘epidemiological intelligence’ and the thorough investigation of all epidemics as they occur is patently necessary. The proposal for regular reporting of epidemics and outbreaks has, therefore, not only a solid justification in the logistical development of the peacetime health program but also peculiar significance in the defense of the Nation.” (Ibid., 11)

The Committee presented to ASTHO four major recommendations: 1) universal national reporting by States to the National Office of Vital Statistics, 2) a standard list of minimum notifiable diseases, divided into groups requiring immediate, weekly, or annual reports, 3) a “new mechanism” for the weekly reporting of epidemics and outbreaks, and 4) recommendations for a standard morbidity report card collected by the states from physicians (including a model card) (Ibid., 5).

Langmuir convinced the ASTHO to call a special conference in order to enact the federal recommendations. Langmuir appointed himself general chairman of the subsequently formed Conference of State and Territorial Epidemiologists [4] and his CDC colleague Dr. R. E. Serfling as executive secretary. While ostensibly the state epidemiologists held authority over morbidity reporting procedures, they were largely inexperienced and under the sway of the federal experts (Etheridge 1992, 32). Heavy lobbying by PHS included at least two presentations on civil defense and biological

[4] Later called the Council of State and Territorial Epidemiologists.

weapons (Flinn/ Kiefer, 1951). The final report of the Conference in September, 1951 enacted all of the federal proposals (CDC 1951).

Enquiring of today's oracles

Struggles over Langmuir's legacy are also struggles over the meaning and direction of contemporary public health. How do these histories reconstruct the relationship between Langmuir's life work and our contemporary world? Laudatory hymns to Langmuir the great man are built on a developmental history of linear progress. Using the metaphor of "passing the torch," they describe the persistent forward march from William Farr to John Snow to Langmuir and then to today. Langmuir's influence is truly global, the memorialists point out: in 1968, he organized the Technical Assembly of the WHO, producing "for the first time, an explicit global agenda for disease surveillance" (Thacker/Gregg 1996).

Brown and Fee use a second metaphor to provide a critical lens on both Langmuir and present day public health: the image of *déjà vu*. They argue that certain mistakes made in Langmuir's time are being repeated today. The alleged threat of bioterrorism is being exploited in order to build public health capacity, but at a serious cost. Funding to public health for bioterrorism prioritizes surveillance for "exotic" infectious disease threats at the expense of treating the existing social determinants of disease. All of this bears a "clear historical parallel" to Langmuir and his time, Brown and Feewarn.

In this paper, I have argued that Langmuir and his work do not fit into either narrative. He neither simply extended public health, nor distracted public health away from the real causes of disease. Langmuir's world brought together military defense and social planning, the dangers of enemy sabotage and contagious disease, and the tools of emergency response and epidemiology into a space of common problems. Doing so ultimately transformed the disease epidemic as a scientific object.

For the moral epidemiologists, the disease epidemic was a consequence of pathological and dangerous conditions of life. Epidemiology was the science that aimed to identify these pathological conditions and disseminate norms of health to society. But in the framework of epidemic intelligence, the epidemic was an event extrinsic to conditions of life. While the actual instigator could be either natural or human, the figure was best captured by the image of the saboteur. Although the saboteur takes advantage of conditions of life (water sources, food supply chains), in fact he is always foreign to these conditions. The goal of epidemic intelligence is to quickly identify

the appearance of an epidemic, trace the causal “saboteur,” control and eliminate the discovered vulnerability. Langmuir built an infrastructure of epidemic intelligence that enabled ‘the epidemic,’ whether natural or deliberate, to be conceptualized anew: as the appearance of a discrete event.

SARS disappeared as unexpectedly and mysteriously as it began. In the summer of 2004, new cases simply stopped appearing. Experts debated, without conclusive findings, what factors brought the outbreak to a close; whether the intensive quarantine and social distancing measures employed by some governments, or a simple rise in temperature with early summer. However, although no longer causing disease, the moral efficacy of SARS remained strong. China rebuilt its disease surveillance infrastructure, using computers and internet to connect every local health department and county hospital to the national health authorities in Beijing. In collaboration with the U.S. CDC, China is developing a field epidemiology training program modeled on the Epidemic Intelligence Service. Communication with international health institutions is also now frequent and continuous. The WHO, for its part, overhauled the International Health Regulations, strengthening the reporting requirements of member states. The new IHR (2005) shifted reporting requirements from specific pestilential diseases (cholera, plague, yellow fever) to a decision instrument defining “public health events of international importance”.

Although SARS could be called the “specific cause” of these transformations in public health practice, I argue that it is the logic of epidemic intelligence that made surveillance a dominant solution to emerging infectious disease problems. A reconstruction of the historical development and globalization of surveillance practices from Langmuir’s time to our own are beyond the scope of this paper. Further research must investigate the concrete historical process of this global transmission, as well as the myriad new forms of surveillance deployed to monitor animals, news reports, rumours, pharmaceutical sales, and so on. However, Langmuir’s life and words address an epistemological question fundamental to an understanding of today’s epidemic order. The development of epidemic intelligence makes clear one domain in which the problem of epidemic disease came to be distinguished from the analysis of social and environmental pathology. And across the world today, disease surveillance systems, these modern oracles, maintain constant vigilance for the next epidemic event.

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