Linus Ghanadan

HIST 405

Professor Zeller

November 1, 2022

Ecology and Human Health in California's Central Valley: Historical Perceptions of a Complex Relationship

Introduction

Historian Linda Nash, in her book *Inescapable Ecologies*, examines the evolving views of health and disease in California's Central Valley during the 19th and 20th century. For example, Nash discusses the two competing historical attitudes of miasma theory and germ theory, both of which attempted to explain the cause of disease. First advanced by Ancient Greek physician Hippocrates, miasma theory posits that disease is caused by inhaling "bad air" emanating from putrefying organic waste. Underlying this theory was an "ecological" conceptualization of the human body, meaning that the body was perceived as being a part of one's environment. Conversely, germ theory, which arose to prominence at the end of the 19th century, asserts that disease is caused by pathogens within the human body. Germ theory allowed for a more rigorously scientific understanding of disease, leading to many medical advancements in the 20th century. However, Nash's analysis emphasizes how the resulting abandonment of miasma theory disconnected humans from the natural environment in the minds of health professionals, leading them to undervalue the environment's role in disease.

In this essay, I draw on two examples of how shifting understandings of disease impacted decisions by the California State Board of Health to alter the physical environment of the Central Valley during the 20th century. Firstly, I look at the Board's sanitation regulations in the 1910s

and argue that their strategy combined elements of miasma theory and germ theory to combat typhoid and malaria in the Central Valley. For my second example, I consider the Board's attitude toward the use of organophosphates (OPs) as pesticides in the 1950s, which I contend demonstrates a marked shift towards an over-emphasis on germ theory among public health professionals. After this discussion, I explain how 1910 represents a turning point in how public health practitioners conceptualized health and disease in the Central Valley, as the establishment of a permanent division for sanitary engineering within the Board of Health led to a division of labor that increasingly alienated public health professionals from environmental considerations, leading them to over-emphasize the new insights of germ theory.

Sanitation Regulation in the 1910s

The California State Board of Health's decision to introduce sanitation regulations during the 1910s stemmed from a growing emphasis on germ theory among public health professionals, yet aspects of miasma theory remained influential as well. During the 1910s, the Board began taking more active approaches to attempt to mitigate typhoid and malaria, both of which were significantly more prevalent in the Central Valley compared to California's large cities.[1] As a result, the Board's efforts to curb typhoid and malaria targeted the Central Valley and other rural communities, mostly taking the form of education and exhortation regulations. Such regulations included "local cleanup weeks, lectures to schoolchildren, tracts aimed at farmers, and traveling exhibits".[2] Reflected in these sanitation regulations was an emphasis on germ theory, which had recently become the new predominant intellectual framework for understanding health and disease. By the end of the 19th century, there was a clear consensus among health professionals that germ theory should replace miasma theory, representing a massive change in how health

[1] Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (Berkeley: University of California Press, 2006), 87.
[2] Nash, *Inescapable Ecologies*, 116

professionals viewed all diseases, particularly typhoid and malaria. Scientific research from the 19th century allowed health professionals to diagnose diseases with more specificity. In 1880, typhoid and malaria became distinct diagnoses, as the both bacterium that causes typhoid and parasite that causes malaria were discovered that year.[3] The 1890s brought more significant discoveries, such as the realization that polluted water supplies play a role in typhoid transmission.[4] Perhaps most notably, scientists established in 1897 that mosquitos were responsible for the transmission of malaria.[5] These discoveries were on the forefront of the minds of public health professionals at the Board of Health when they decided to enact sanitation regulations. From germ theory, health was now perceived as the absence of disease-causing pathogens, which justified the government programs aimed at motivating locals to undertake new hygiene and sanitation practices to rid their environment of these pathogens. The fact that these programs were designed based on recent scientific discoveries further validated the educational approach. After all, it would be unreasonable to expect locals in the Central Valley to immediately understand the recent science of germ theory without the proper education.

However, the framework for understanding disease put forth in miasma theory was still very much relevant in the minds of health professionals at the Board of Health when crafting sanitation regulations in the 1910s. In 1913, the Board hired Edwin T. Ross, the first staff engineer to ever be hired by the Board.[6] In his role, Ross mostly inspected sewage and the rural water supply, providing numerous recommendations to locals. These recommendations included keeping animals away from water that was also used for drinking, removing slimy vegetation lining the banks of reservoirs, and mitigating the prevalence of flies and other insects by properly

[3] Nash, *Inescapable Ecologies*, 88
[4] Nash, *Inescapable Ecologies*, 88
[5] Nash, *Inescapable Ecologies*, 88
[6] Nash, *Inescapable Ecologies*, 103

disposing of dead animals and garbage.[7] While Ross was brought to the Board to help reduce typhoid, the Board managed malaria almost entirely through the work of one man, parasitologist William Brodbeck Herms.[8] From Herms' inspections, he advocated that mitigating malaria was a matter of refining irrigation works and ensuring soils were adequately drained.[9] Throughout their time at the Board of Health, Ross and Herms each conducted numerous inspections to offer critiques of the physical environment that they felt were likely to be causing disease. In this sense, their hard work was largely justified by a miasmatic view of disease. Unlike the education and exhortation programs that focused on encouraging people to be cognisant of disease-carrying bacteria and mosquitos, Ross and Herms sought to inspect and remake landscapes as a way to reduce disease in the Central Valley.

Organophosphates in the 1950s

Contrary to sanitation regulation in the 1910s, the stance towards OPs taken by public health professionals in the 1950s exemplifies a perception of disease based exclusively on germ theory, as the California State Board of Health was oblivious to the dangers these chemical pesticides posed, despite such dangers being conspicuous from a miasmatic view of health and disease. This mistake on the part of health professionals stemmed from the fact that they incorrectly applied previous occupational health methods to the issue of OPs in agricultural working communities. In the late 19th and early 20th centuries, occupational health research regarding chemical exposure risks focused on the factory environment. In particular, a great deal of this research focused on risks faced by factory workers involved in the manufacturing of leaded materials, and such research posed occupational health risks as emanating from the

[7] Nash, *Inescapable Ecologies*, 104
[8] Nash, *Inescapable Ecologies*, 107
[9] Nash, *Inescapable Ecologies*, 110

inhalation of airborne contaminants.[10] As a result, early research on the risks of pesticide exposure were designed in a similar manner. In the 1940s, experiments testing the safety of using OPs in agriculture were based on measuring the levels of airborne residues, and these studies found such levels to be low, which the public health community took to mean that these pesticides were safe to be handled by agricultural workers and applied to crops.[11] To say that health professionals were incorrect in their assessment of OPs would be a gross understatement, as the 1950s came to be marked by continuous incidents of OPs poisoning among agricultural workers.[12] In addition, evidence presented in Rachel Carson's groundbreaking 1962 book *Silent Spring* demonstrated that OPs like DDT were also likely responsible for cancer among agricultural workers.[13] Nonetheless, with the approval of the State Board of Health, the physical environment of the Central Valley was overhauled to optimize agricultural production at an industrial scale, with OPs at the center of this new development.[14]

Underlying the mistake among health professionals regarding OPs was their refusal to consider the miasmatic model of understanding disease. Had they considered the link between disease and one's environment, scientists would have studied other potential ways of being poisoned by OPs besides just inhalation, as doing so seems obvious considering the nature of the agricultural work environment. For one, agricultural workers work outside, where the risk of inhalation is significantly lower than in the stuffy confines of a factory. Secondly, unlike factory workers who typically do not make skin-to-skin contact with the chemicals they deal with, agricultural workers frequently touch crops sprayed with pesticides. Given this fact, it is not at all surprising that skin exposures were in reality the most significant pathway by which workers

[10] Nash, *Inescapable Ecologies*, 148
[11] Nash, *Inescapable Ecologies*, 148
[12] Nash, *Inescapable Ecologies*, 139
[13] Nash, *Inescapable Ecologies*, 156
[14] Nash, *Inescapable Ecologies*, 132

were poisoned by OPs.[15] However, such logic was not apparent to health professionals. In spite of these seemingly obvious environmental factors, scientists studied occupational risks faced by agricultural workers in the same way as factory workers, ignoring the fact that the two environments are extremely different from one another.

A counterargument to this line of reasoning might be that it is unfair to harshly criticize the mistakes of health professionals who did not know the facts that scientists know today. However, such a counterargument is extremely difficult to justify considering the large number of health professionals who had the correct intuition regarding OPs early on. Rather than being completely erased from the field of public health, Nash states that those investigating environmental approaches to disease were "marginalized and, to some extent, rewritten along more modern lines".[16] Hence, it appears that health professionals were set on their intent to cast all ideas associated with miasma theory into the past, even if it meant ignoring the basic implications of the environment on disease. During the 1950s and 60s, health professionals such as Dr. Irma West and Dr. Thomas Milby would finally begin to more thoroughly investigate the use of OPs in the Central Valley in terms of their environmental risks.[17] In spite of the efforts of scientists like West and Milby, regulation regarding pesticides would take quite a long time, with the first protective law for California agriculture workers not being enacted until 1971.[18]

Turning Point

From comparing the California State Board of Health's decisions regarding sanitation in the 1910s and OPs in the 1950s, what stands out is a substantial change in the attitude towards the role of the environment in disease. Even though germ theory was certainly prominent in the

[15] Nash, *Inescapable Ecologies*, 148
[16] Nash, *Inescapable Ecologies*, 141
[17] Nash, *Inescapable Ecologies*, 141
[18] Nash, *Inescapable Ecologies*, 166

1910s, the Board's approach towards managing disease in practice still considered the role of the environment, as figures like Herms and Ross played a considerable role in the Board's strategy for managing typhoid and malaria. However, jumping to 1950, basic considerations of the environment's impact on disease were ignored when it came to pesticides. As I have discussed, one key reason for this change in thought was the evolution of germ theory, which came to replace and dominate miasma theory to the point where health institutions were too hesitant to consider the environment's impact in even the most conspicuous of cases. While it is true to a certain extent that this change was gradual, it is also true that the change appeared to accelerate after 1910. To me, the accelerating change after 1910 seems largely attributable to the division of labor between public health and sanitation engineering that occurred at precisely this time, for it was in 1910 that the Board of Health established a permanent division of sanitary engineering.[19] Prior to this establishment, public health and sanitary engineering were more or less within the same professional domain, but the information gap between these fields expanded increasingly over the following decades. After the establishment of a separate division for sanitary engineering, public health professionals were increasingly expected to emphasize the new insights of germ theory into their work, while more "old-school" environmental considerations were left to sanitary engineers. This division of labor led the field public health to become too far removed from sanitary engineering in how its professionals conceptualized the cause of disease, and the consequences became clear later in the 20th century, when public health regulators failed to reel in the economic interests brought forth by industrialized agriculture.

Conclusion

Ultimately, Nash tells a complex tale in *Inescapable Ecologies*, and digesting the story requires navigating a fine line between acknowledging when scientists made mistakes and when

[19] Nash, *Inescapable Ecologies*, 94

they simply had a difficult time making sense of the issues they faced. While there is certainly a "gray" area here, I think Nash's evidence does demonstrate that public health institutions went too far in over-emphasizing the new framework of germ theory to the point where they largely ignored environmental considerations remnant of the outdated miasma theory. For California, 1910–when the division of sanitary engineering was established–appears to be a turning point, after which the over-emphasis on germ theory became increasingly apparent and impactful. Concerning sanitation regulation in the 1910s, this over-emphasis was somewhat subtle, likely in large part because OPs did not exist at this time. However, by the 1950s and certainly by the 1980s, this over-emphasis was at least partly responsible for perhaps the greatest environmental health disasters in American history. Even today, OPs and other chemical contaminants continue to pose risks to food, water, and air throughout the U.S., making Nash's analysis all the more important.