***Intervals* - Episode 13**

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Introduction

CHRISTOPHER BRICK: Hello everyone and welcome back once again to the *Intervals* pod. We are a public humanities initiative of the Organization of American Historians and I am here on behalf of the OAH Committee on Marketing and Communications. My name is Christopher Brick and I am your host.

I wanted to just say a quick word about our guest lecturer today who is joining us from the departments of history and art history at George Mason University where he's currently a visiting scholar affiliated with both departments. His talk, "The Origins of Aerobiology and Airborne Disease Research in the United States," tracks a 25-year period of time, during which time public health expertise and the military became increasingly connected and intertwined in the project of aerobiological research.

Gerard's research focuses on the work of William Firth Wells of the University of Pennsylvania Medical School who discovered droplet nuclei in 1934 and who was central to the evolution of aerobiology during this time. And so this is a bit on the science-heavy side and so for those who have a listening ear for that I think you'll enjoy this episode, as did I.

And with that I want to turn it over to Gerard Fitzgerald on "The Origins of Aerobiology and Airborne Disease Research in the United States, 1930-1955."

Lecture

GERARD FITZGERALD: Turn on the Light, William Firth Wells' aerobiology and the evolution of airborne infection research in the United States, 1930 to 1965. In these early winter months of 2021, we're living in the age of the COVID-19 pandemic. As I record this podcast, many of the world's leading biomedical scientists, epidemiologists, biophysicists, and public health experts are focused on understanding and hopefully containing the spread of the various strains of this deadly and highly infectious airborne virus. While most people had given little thought to airborne infection until the onset of this global outbreak, airborne disease study and airborne disease containment protocols and technologies are not a 21st century invention. Serious scientific research on the phenomenon of airborne disease and airborne infection was an exciting, if little known, part of public health research in the United States beginning in the 1930s with the creation of a new biological research field called aeromicrobiology, better known today as aerobiology. Much of the research being carried out today by the world's leading scientists is based, in part, upon decades of earlier research by an older generation of airborne disease specialists.

My brief talk today will open a window into the work of one scientist in particular, a man whose research began in the 1930s and whose career overlapped with many of the leaders in the field. By following his work, we'll meet others who helped define and drive his important public health research. In addition, we will see the impact of militarization on public health brought on by World War II. Finally, we will see historical links between biomedical and public health research conducted in the 1930s and 40s and similar research being conducted today.

A useful place to begin is the January 23, 1937 issue of Collier's Magazine. That issue contained a short feature titled "Turn on the Light: An Overview of the Biomedical Research of Professor William Firth Wells." At that time, Wells was an assistant professor at the Harvard School of Public

Health. He was studying the air we breathe for evidence of infection and disease. Wells, a public health engineer, spent the majority of his academic career at the Laboratory for the Study of Airborne Infection at the University of Pennsylvania Medical School. Wells was trained as a sanitary engineer in the years between 1906 and 1910 at MIT, where he was also part of a special joint MIT-Harvard sanitary engineering program. His classroom and laboratory studies at the beginning of the last century, exposed him to the cutting-edge research of his day. Work that focused primarily on water-based purification systems for urban and rural public health.

Wells' research in the magazine article showed his increasingly sophisticated approaches to studying and trying to contain the spread of airborne infection through the use of ultraviolet light. The Collier's article, written by J.D. Radcliffe, wittingly encapsulates Wells' laboratory work to elucidate and contain airborne disease through a jury-rigged sneezing machine used in combination with a new form of an experimental lamp, which emitted UV radiation, and approach extending and expanding upon the early research of late 19th century German bacteriologist and hygienist Carl Flügge. Flügge had studied the biophysics and aerodynamics and possible infectious nature of airborne droplets. Written in a positive and jazzy patois of the time, the Collier's article succinctly captures the spirit and culture of technological optimism that drove much of the

American aero-microbiology research in the years prior to the outbreak of World War II.

The Collier's article begins with a German phrase for "now sneeze", recreating the earlier experimental research of Flügge. In his laboratory, Flügge had studied airborne infection by instructing volunteers to sneeze on glass slides, which had been lined with a sterile gelatin that could later be incubated and studied to search for infectious microorganisms. In the course of his work, Flügge plotted the downward parabolic airborne flight path of those droplets of water released by the human nose during a sneeze. According to Flügge's meticulous research, larger and heavier droplets fell to the ground quickly due to gravitational forces. However, questions remained about the existence of lighter, smaller droplets that might drift on currents of air much farther than their larger cousins. Wells is especially interested in these lighter dried particles and began publishing papers in 1934 on the difference between large and small droplets, later which he christened droplet nuclei.

Wells' research was focused on not only understanding the dynamics of the spread of airborne disease, but also in creating the technological means to control the spread of infectious airborne bacteria and viruses. Like many of his colleagues, Wells might be described, in part, as an optimist. He believed that, if successful, his work and that of his various academic and corporate colleagues might well create a world where airborne infection was limited--was no longer a major medical or public health concern. This American vision of a future free from airborne disease and infection, implied in Collier's article, a future made possible through direct and skillful technological invention, was, of course, never fully realized. Nevertheless, it reflects the vision of a diverse and focused group of interdisciplinary practitioners at a specific moment in American history. A transitional period that moved away from the pessimism of the Great Depression, while simultaneously having this optimism only slightly checked--initially, by the possibility, however remote, of a return to global war.

This scientific and technological optimism perhaps reached its zenith at the Westinghouse pavilion at the 1939 New York World's Fair. There at the Sterilamp's display, which featured a new UV lamp system capable of killing airborne microbes, which was created by Westinghouse physicist Harvey C. Rentschler. Westinghouse promoted a future of germ-free living for all those willing and able to install this technological marvel in their homes and schools and hospitals or in factories. The commercial viability of the Sterilamp would, however, prove to be fleeting. War time research conducted on Westinghouse would provide a large catch of epidemiological data that would divide the medical and engineering communities in the early post-war years. In fact, by war's end, the militarization of aerobiology had the unforeseen consequence of providing the theoretical and instrumental means to produce a new weapon of mass destruction--the airborne biological weapon. That is a story for another day.

The onset of World War II greatly complicated the trajectory of research in aerobiology, which is especially interesting considering the changing nature of evolving research programs at that time. Much like other scientific fields such as meteorology, oceanography, or nuclear physics, World War II decisively influenced research carried out in aerobiology, resulting in both positive and negative impacts on the growth, direction, and success of the field. The ideological commitment to technological and scientific progress that drove many American aerobiological researchers in the late interwar period, helped them find a new niche in increasingly militarized research culture brought about by the war. Expanded funding opportunities from various governmental sources and, perhaps more importantly, the war time emergency that made large numbers of military human test subjects available--provided academic and industrial researchers with the economic and material resources that accelerated and expanded the growth and depth of research on both airborne disease and containment and control containment technologies.

Five years after "Turn on the Light" was published in Collier's and nine months after the nation entered World War II, a select group of more than fifty scientists, engineers, physicians, and public health practitioners, including William Firth Wells and his wife, Mildred, who was a Johns Hopkins-trained epidemiologist, traveled to Chicago for the first major symposium on aerobiology in the United States in late September 1942. Held at a meeting of the American Association for the Advancement of Science, the symposium was sponsored in part to commemorate the 50th anniversary of the founding of the University of Chicago. Organized by both the Committee on Aerobiology of the National Research Council and the section on medical sciences of the American Association for the Advancement of Science, the symposium was led by Dr. Elvin C. Stakman, a professor in the Department of Plant Pathology and Botonny at the University of Minnesota. And by Dr. Stuart Mudd, Wells' colleague and boss in the Department of Bacteriology at the University of Pennsylvania Medical School.

At the time of this meeting, airborne infection research in the late 1930s grew out of earlier success in two seemingly unrelated public health research programs. First, bacteriologists and sanitary engineers had conducted successful research to control the outbreak of disease in contaminated water supplies through the late 19th century. This research paradigm got in much of the early research of Wells and his fellow MIT classmates. Second, studies begun in the 1920s on inhaled materials spurred increasing epidemiological and instrumental sophistication on the part of public health officials and their search for inorganic and organic non-living airborne matter in workers' lungs such as silica and granite. Research on the public health implications of the inhalation of particular matter, in addition to the dangers presented by diseases such as tuberculosis, accelerated interest in maladies associated with the lungs and breathing. This research was carried out in a host of academic, industrial, and government laboratories. In the preceding decade, organizations such as the American Public Health Association in 1936, the National Academy of Sciences, the National Research Council in 1937, and the American Society for Heating and Ventilating Engineers in 1940 set up research committees to coordinate and investigate the relationship between airborne bacteria and airborne infection. Scientists sought to limit airborne infection by integrating engineering technologies including ultraviolet light, air conditioning, chemical germicides, and mechanical barriers in hospitals, schools, orphanages, factories, and military barracks. In the ten or more years since aerobiology researchers started to publish their work, exchange findings, and communicate with like-minded investigators, the field had split in half between those like Stakman who worked on extramural aerobiology, which dealt primarily with agricultural questions, and those like Wells and Mudd, who focused on intramural aerobiology, a human disease-based approach focusing on the built environment.

This division within the field was reflected in the publication of the proceedings of the Chicago meeting. Published that same year, 1942, the volume simply titled “Aerobiology” was divided into two sections. The first section, consisting of eight research papers focused on air-based life found in the atmosphere, examined the agricultural and ecosystem evolution and reflected the research of scientists like Professor Stakman. The destructive echo of the dustbowl drove many of these investigations, especially research universities in the Middle West. These papers on the biology of the atmosphere dealt with studies of insect populations, plant pathogens, fungi, spores, and pollens. Any and all forms of life, both plants and animals that are born aloft by the air and are either deposited locally or transported over distances ranging up to hundreds and even thousands of miles. The second, much longer section, consisted of twenty-nine papers on the topic of human infections in a built environment. This reflected the research carried out by scientists, physicians, and engineers like Wells and his Penn colleague Professor Mudd.

Considering the ongoing pandemic, it's useful to examine in more detail exactly what Wells and his colleagues were looking at. These papers examine the problem of contagion by airborne infectious materials. The scientists investigated the expulsion of secretions from the mouth and nose in the acts of sneezing, coughing, and talking. The behavior in the air of organisms of whatever origin. They studied airborne pathogenic organisms in operating rooms, in hospital wards, in nurseries for newborn infants, in classrooms, and finally even in the home. They examined the method of the spread of epidemics of children's diseases. In addition, they investigated methods for producing UV radiation and to study its bacterial set of clinical and physiological effects, another means to providing barriers to the spread of infection.

I should note, there were two important individuals who were unable to attend the Chicago meeting for vastly different reasons. While their work was extremely important in provided data and generally interest in funding aerobiology during the 1930s.

The first was plant mycologist Fred Myer. Myer had died tragically in 1938 during a Pan-American Hawaiian clipper crash in the Pacific, a flight lost with no survivors having gone down somewhere near Guam. Meyer was on his way across the Pacific on a mission for the National Science Foundation National Research Council to scout sites for future aerobiological investigations on a planetary scale. At the time of his death, he was simultaneously a Harvard graduate student, a USDA plant pathologist, and a ranking National Research Council member dealing with the topic and problem of aerobiology. Under Fred Meyer's guidance, the National Academy of Scientists National Research Council Honorary Biology sought to create a centralized laboratory to promote and coordinate research. This ill-fated trip to the Pacific was the first step in organizing a series of aerobiological tests and experimental monitoring stations across the globe to track the movement of pollen and various airborne microorganisms.

The second person who was not in attendance was a research associate of Meyer, one Charles Lindbergh. Charles Lindbergh was not only the most famous aviator in the world at the time-- he was arguable, one of the most famous people in the western world, period. Lindbergh had conducted past breaking exploratory field work at altitude across the world, taking airborne samples in collaboration with Meyer. This followed Lindbergh's earlier work in biomedical engineering at the Rockefeller Institute with Nobel Laureate Alexis Carol. Lindbergh's surprising interest in the biological sciences, his engineering acumen, and, perhaps most importantly, his unique access to high performance military aircrafts of all types, gave microbiologists and plant pathologists the technological means to sample airborne microbes at high altitudes over large geographical expanses and return them safely to earth for scientific analysis. Lindbergh moved away from aerobiology after Meyers untimely death. Sadly, he would quickly evolve into one of the most infamous and controversial people on the American political stage. However, years before he was famous for his isolationist, racist, and fascist proclivities, Lindbergh assisted in publish with Meyer an aerobiology scientific prospecting. Much like William Firth Wells, Fred Meyers struggled to build various disciplinary boundaries, to bridge various disciplinary boundaries while building a new biological subfield during the 1930s—a difficult task even while bringing together like-minded researchers from different scientifical, medical, and engineering backgrounds.

This is similar in many ways to the multifaceted attack on the COVID-19 virus today--biomedical scientists, engineers, neurologists, and epidemiologists. The aerobiologists interested in public health aspects of airborne infection and control during this earlier time period work both across and through disciplinary boundaries to frame and solve the complex research issues of the day. Public health is, by definition, a multidisciplinary field and has been recognized as such, or at least encouraged to be so since the days when William Firth Wells was an undergraduate sanitary engineering major at MIT. Understanding the multidisciplinary nature in the field of aerobiology, which employed researchers from science, medicine, and engineering, provides useful historical insight in the parallel evolution of public health research itself.

On September 7, 1910, Dr. William T. Sedgwick, Professor of biology at MIT, wrote a paper entitled "On the Proper Correlation of Physicians, Engineers, and other specialists in Public Health Work" at the 38th annual meeting of the American Public Health Association held that year in Milwaukee, Wisconsin. Sedgwick was one of the foremost public health practitioners in the nation. He was also a firm advocate of a multidisciplinary approach to the field. Sedgwick saw the field as not only involving physicians, biologists, chemists, and engineers, but also including architects, physicists, geologists, and any other specialists who might bring expertise to a problem that can impact the health and well-being of human populations. Wells, a student and disciple of Sedgwick, had graduated from MIT earlier that same spring and quickly embarked on a life of laboratory and field based public health research. While Wells embraced a multidisciplinary approach to framing and studying public health problems in a manner similar to Sedgwick, he moved beyond studying water-based ideology, the anchor of Sedgwick's and MIT departmental research, and instead focused on the possibility of airborne based disease sources.

Within twenty years, Wells emerged as one of the earliest, most successful American practitioners in aerobiology, the science and technology of aeromicrobiology. Wells' training as an engineer at MIT and Harvard, in addition to his mentorship under biologist and public health researcher William T. Sedgwick, shaped his laboratory-based research program which ultimately led to his identification of droplet nuclei in 1934. Wells' approach to disease was predicated by his earlier success as a sanitary engineer interested in water-based disease ideology. This engineering approach led Wells to create an instrument he called the air centrifuge to capture, isolate, and identify the possible sources of airborne infection. As a result of his earlier work with the air centrifuge and the subsequent discovery of droplet nuclei, Wells' research became useful to numerous practitioners within this new field. After his successful invention and deployment of the air centrifuge, Wells began experimenting with UV lamps as a means to probe the dynamics of airborne infection movement and also as a possible instrumental means to curb their existence.

At the same time Wells was working on his understanding of this bit of infectious airborne droplets and bacteria and their possible elimination through the use of ultraviolet radiation, Dr. Harvey C. Rentschler, leading physicist at the Westinghouse lamp research laboratory in Bloomfield, New Jersey, was working on a commercially viable ultraviolet lamp to place in public spaces to accomplish many of the same goals as Wells.

A Princeton and Johns Hopkins training physicist, Rentschler had left an associate professorship in physics at the University of Missouri to lead the research program at Westinghouse’s lamp division from 1917 until 1947. Ultraviolet lamps were one of the key technological tools necessary to study and control airborne bacteria and viruses. While such instrumentation was crucial for Wells’ research program, the large-scale production of such UV lamps was well beyond the capabilities of his laboratory.

The Westinghouse Sterilamp was introduced with great fanfare at the Westinghouse pavilion at the

1939 World's Fair in New York City. Ensconced within a forty-six thousand square foot pavilion resembling the Greek letter Omega, Westinghouse presented audiences with a carefully constructed corporate image of progressive scientific and technological achievement. Through the whimsical guise of cigarette smoking robots, giant talking germs, and a seventy-foot singing tower of light, the results of Westinghouse research and development delighted audiences from around the world.

The Sterilamp was introduced to audiences with both an animated movie and a live demonstration. The film entitled, "The Bugaboo of Bugville," was a whimsical military drama that pitted the heroic Sterilamp against an army of disease carrying microbes led by malaria, scarlet fever, strep, and cold. At the film's conclusion, a death ray in the form of light from the Sterilamp destroys and eviscerates the entire Bugville army and saves mankind from the dangers of various infectious diseases. The film was followed by a live demonstration in which Westinghouse micro projectors magnified the world contained within a small petri dish of pond water, to demonstrate the possibilities of UV radiation. The Sterilamp was then turned on and the bacteria on screen released a lethal dose of ultraviolet radiation. Sound effects and lighting in the studio heightened the effect, which in many ways was more theatrical than scientific. But the demonstration, nevertheless, conveyed to the assembled international audiences that a powerful new public health technology was available from the fine people at the Westinghouse Corporation. Like many of the Westinghouse exhibitions at the World's Fair, the Sterilamp demonstration was informative, and it relied on the drama of the event to promote interest in science and technology.

In terms of actual science, the biophysical utility of the Sterilamp in containing airborne infections is still somewhat of a puzzle to the physicists and microbiologists in the Westinghouse lamp division in 1939. The Sterilamp had been marketed in 1936 as an experimental instrument. At the time of the instrument’s introduction at the World's Fair, despite all the hype, many questions remained about the instrument’s potential, both for markets for being sold and a possible health risk to human beings.

Between 1936 and 1942, Rentschler expanded the Westinghouse lamp division research programs to include bacteriologists, biochemists, and biophysicists to conduct experiments to test the limits and utility of the Sterilamp. The development of the Westinghouse micro-UV lamp was based on what one could call an engineering model of disease, rather than an epidemiological one. Rentschler and his associates at Westinghouse determined their success by eliminating bacteria from experimental spaces in the built environment, rather than using an epidemiological model that linked the lamps to eliminating or reducing the spread of contagious diseases, an approach used by medical infectious disease specialists. Westinghouse researchers would have needed to conduct large scale epidemiological studies on human test subjects to fully probe the technical and public health limitations of the Sterilamp, something that was far beyond the scope of their traditional, engineering-based research program. This was a type of research that had never been done before in the history of the company. World War II would provide Westinghouse with a unique opportunity.

American entry into World War II provided Westinghouse with a large-scale testing program that probed not only the limits of the bacterial radiation technology, but also provided, at least in theory, the experimental evidence for the greater underlying medical phenomenon involving the ideology and aerodynamics of respiratory disease.

The massive mobilization of manpower in the United States through the Second World War involved the passage of large numbers of recruits through military training centers, all of whom were potential candidates for spreading or contracting infection. These training centers offered a particularly unique and potentially useful site for experimentation for a number of reasons. The large number of potential subjects, the turnover of these subjects on a regular schedule of six weeks, the immediate availability of subject medical records, the ability for continuous monitoring and control of subject movements, the possibility of immediate and regulated onsite medical care if needed; and, perhaps most importantly, active participation by research subjects regardless of their interest, willingness, or legal rights offered researchers an ideal site for study.

Which brings us to research project #X231. X231 was a joint United States Navy, National Institutes of Health, Westinghouse, and General Electric field trial that was held between 1943 and 1944. X231 was a part of a much larger series of studies being conducted across the country at various military facilities by both the Army Epidemiological board and the Department of the Navy. They studied the possible effectiveness of various technologies to eliminate, or at least contain, the outbreak of infection using ultraviolet radiation, chemical germicides and oils within a built environment.

X231 was carried out at Camp Sampson, a United States Navy training facility in Upstate New York. Given unfettered access to a large number of human subjects in the form of naval recruits to study the prevention of airborne disease in barracks, X231 provides a useful case study for understanding research on UV radiation and containment technologies for airborne respiratory disease.

The military environs also skirted various procedural questions that would trouble bioethicists today. X231 project investigators noted that "the semi-isolated military community such as Camp Sampson offered advantages for controlled epidemiological studies which are not to be found in most civilian groups.” To make a long story short, X231 produced a great deal of epidemiological data on the relationship between UV radiation and airborne bacteria. It also produced a wealth of data of the apparent rate of illness between those naval recruits who lived in barracks which contained various UV lamp configurations, barracks where disease spread should, in theory, be less severe, compared with data of those recruits who lived in barracks that were free of UV lamps.

The interpretation of that data, however, differed greatly among engineers who thought the lamps were useful and epidemiologists who felt the utility of lamps were problematic because of the complexity of understanding the intricacies of airborne disease transmission, something they thought was still beyond the grasp of biomedicine, even with these new large-scale studies.

This interpretation was codified in a 1947 Public Health Association committee report. This report doomed the commercial viability of the UV-based containment technologies and forced Westinghouse to focus on smaller, often highly specialized niche market in medicine and industry in the post-war period. The 1947 American Public Health’s committee concluded the following: “Conclusive evidence is not available at present that the airborne mode of transmission of infection is predominant for any particular disease. There is need for more precise knowledge regarding the epidemiology of acute infectious diseases in crowded populations.” By concluding that the airborne mode of transmission of infection did not predominate for any particular disease, the American Public Health Association committee raised serious questions about the public health phenomenon the Sterilamp was designed to contain in the first place.

Although the Westinghouse engineers and scientists understood the Sterilamp could destroy airborne bacteria, the more significant and unsubstantiated causal relationship between airborne bacteria and airborne respiratory disease and infection, limited the claims researchers could make for their technology. Westinghouse would pivot quickly and move from a marketing campaign urging a Sterilamp in every American home, not to mention supermarket, bus station, bowling alley, school, and baseball stadium, to a more limited industrial market. The field of airborne disease would continue to attack the biophysics of airborne transmission, but it would not be until the 1960s and 1970s that researchers would begin to reach some form of consensus. Even then, the complexity of understanding airborne disease transmission remained an extremely difficult research pursuit involving public health specialists, engineers, biomedical scientists, and epidemiologists.

I was struck last year, while watching a COVID-19 research meeting sponsored jointly by the National Academy of Sciences, Medicine, and Engineering, on the current complexities of phenomenon today. including some nomenclature issues which are similar to things that happened in the 1930s and 40s, and the difficulties of working on a complex, interdisciplinary research problem. Luckily for the world, airborne disease research has made significant progress, but the work remains difficult.

Let me conclude by noting that one of the most significant contributions to airborne disease research was carried out by William Firth Wells and his colleague Dr. Edward Riley in the early 1960s, after Wells moved to the Bloomberg School of Public Health at the Johns Hopkins University Medical Center. Wells’ last research project was a landmark study proving the airborne mode of transmission of tuberculosis.

While he served with distinction during the Great War as a public health and sanitary officer, Wells set out in World War II in a military capacity, unlike many other aerobiologists working on public health research problems. Working with his wife, Mildred, at the laboratory for the study of airborne infection at the University of Pennsylvania Medical School’s Henry Phipps Institute, Wells conducted a controversial experiment dealing with measles and the ultraviolet radiation of primary schools in the Philadelphia suburbs in 1942.

A large measles outbreak in a control school, which did not have a UV system, contrasted sharply with those schools with both an operational UV system and, correspondingly, few to no cases of measles during the outbreak. This study is histographically intriguing because acceptance of utility of these UV radiation containment systems and their disinfection protocols as a means to check airborne infection was difficult for those in the medical community who did not already accept the airborne transmission of measles.

Much like the later interpretation of the X231 data, the medical community was not convinced with that mode of transmission of viruses and bacteria was understood, and thus it could not be successfully contained or controlled. The ambivalent reception by the greater medical community of the 1942 Wells' study stands in stark contrast to Wells' final laboratory investigation, which began in 1955, on the dynamics of the airborne spread of tuberculosis.

This final set of experiments, carried out with his colleague Dr. Riley, were conducted in a special experimental ward at the Veterans Administration Hospital in Baltimore, Maryland. This experiment employed Guinea pigs, in lieu of human subjects, housed in a special experimental apparatus linked to the ward's ventilation system to elucidate the airborne transmission of tuberculosis. Tragically, Wells died during the end of the study and when the study was completed, his name did not appear on the paper that would have further cemented his scientific legacy in the field of inter-aerobiology and airborne disease studies.

That said, what William Firth Wells is today, held in the highest regard by the current generation of airborne disease researchers who continue to cite his earlier work and follow in his legacy. Professor Wells also provided public health historians, such as myself, a rich and rewarding research subject, whose career opens a window into the complex and fascinating history of modern public health and biomedical research across the last century.

Q + A

[segue from lecture]

CHRISTOPHER BRICK: Now wasn’t that just tremendous? So too the Q+A. And here it is.

[beginning of group conversation]

CHRISTOPHER BRICK: Gerard Fitzgerald, welcome to the podcast!

GERARD FITZGERALD: Happy to be here! Very excited to talk about public health today, not a topic that gets a lot of interest by historians—unless there's a public health crisis, like we're having right now.

So why was this aerobiology practice important for public health in the 1930s and why was the makeup of the field composed of such an interdisciplinary mix of researchers from medicine, engineering and science?

GERARD FITZGERALD: [inaudible] is a pretty complex biomedical phenomenon. I was struck listening to a recent--back in October, the National Academy of Scientists is doing a series of lectures and symposia on Covid and the coronavirus. And I was really struck by the fact that right now we have a mix of scientists, engineers and public health people, that-- very similar to people I'm studying in the 1930s and 40s-- they're asking the same types of questions and sort of having some of the same problems framing the question of how to solve the problem. And there were questions about nomenclature, but it's interesting… Airborne disease involves-- its very complex-- you have to basically frame the problematically, there's a biological aspects which involves science, and then you basically there's an engineering aspect to it too. so you basically want to develop things like infrastructure or instruments to sort of allow you to either understand something or contain things.

So, the reason I talked about both Wells and Rentschler was I wanted to show that we both had laboratory based people that were in one hand framing the problem at the University of Pennsylvania. Then the people of Westinghouse were actually building instruments. Like right now during Covid were finding out we need to scale things up in a war time basis. We need vials-- we need glass or vials to basically put the vaccine in and we need to make vaccines.

There’s an infrastructure aspect to public health which people find sort of boring, but it's actually very crucial to people being healthy. Mark Pelosi wrote a great book called *The Sanitary City* and it basically traces public health infrastructure from the colonial period through the 20th century.

And I joke with people, public health isn't something people are intrigued about until it's missing and then people get very excited about it. Like right now, people want a vaccine, but all of the things leading up ??? to get a vaccine you have to identify the phenomenon. William first Wells is one of the people who in was foundational for basically framing the questions and building instrumentation to sort of try to solve the problem.

But the problem is so complex that it really didn't get solved till almost to his death. Wells is also an interesting guy because he graduates from MIT with joint MIT-Harvard program in 1910, and he's trained by sort of 19th century public health foundational people and so Wells is sort of a transitional figure and he bridges from the 19th century into the 20th century. He’s a very interesting guy to look at.

CHRISTOPHER BRICK: Yeah, and we get to know him a bit in the talk that you gave.

GERARD FITZGERALD: Yeah, some of the people with the National Academy--we're actually citing Well’s paper on October podcast that I listen to, they were citing the 34 paper on droplet nuclei-- one of the people that Well’s studies with is Charles V. Chapin, who along with Cedric, is probably the two most importance of public health people in the United States.

In 1910 Chapin writes a foundational--a very important book called T*he Sources and Modes of Infection* and it has a chapter on airborne disease. He basically says that airborne disease doesn't really exist because we can't find a way to explain it phenomenologically.

So, they basically think possibly dust particles may infect people, but there's a real limit with respect to, like how far something can move. And something Well's is fascinated by looking ???'s work was can something float around in the air for a long time? And according to what was the accepted practice in 1910, people just didn't think you could infect someone at a distance of more than a couple of feet.

And Wells didn't disbelieve that, he just wanted to know if that was actually true, so he started basically trying to study microbes in the air and then things got really complicated.

But they were sort of asking the same things earlier, it was a lot of discussion where the early part of last spring about whether COVID was airborne and people talking about droplets for the first time, and I was really interested because they were talking about droplets and gaseous diffusion models in the same way people were talking about in the 30s. But right now, the science and technology instrumentation is a lot more advanced, but they're sort of taking his research and taking it down another level to sell some other level of problem.

CHRISTOPHER BRICK: So it's still with us. I mean, it's almost 100 years later, so there's a cumulative aspect to what you're describing that we need to connect back to this moment. And obviously, I mean, one of the premises of this whole series is that these responses and the technologies we're able to use to respond to them are themselves historically contingent and shaped by choices that individual actors facing and confronting public health emergencies in the past have made.

And back then, in the 1920s, a actual Academy of Sciences had a had a committee called Borderland Science. What they were trying to do is to get people to think outside the box and think about things like oceanography and what became aerobiology.

And what's interesting about that back then--and what’s interesting today--is when you get trained in a specific field like history or sociology, or, say, biophysics or engineering or medicine, you basically learn to look at the world a certain way and you have a different kind of you have a specific kind of vocabulary.

But even when people are brought together to work on the same problem and they sort of view things the same way--and back then you had engineers, biologists, microbiologists, public health people, physicians looking at this problem of airborne disease--they all sort of come at it in a slightly different way, so when they're trying to reach consensus, it gets kind of difficult.

And I was intrigued looking at Well’s as someone who basically does this for life of his career. But he's trained as an engineer, but he spends his entire working life in medical schools at the

University of Pennsylvania and Johns Hopkins—you don't normally think anymore of engineers working in medical schools, he's like one of the first generations of people to do that, because you need basically the tools of engineering to sort of solve part of the problem.

Which is also why the guys at Westinghouse are involved, because we need the scalp instrumentation. So it's very interesting to me how people are trying to reach consensus and frame problems and solve problems--and these are very, very complex problems.

So, it's very interesting to me to watch how people work through these kinds of things. And there's a lot of historical similarities between what's going on in, say 1930 or 1942 and what's going on in 2021, so it's very interesting.

CHRISTOPHER BRICK: I find in reading the work of historians who aren't entrenched in the scientific literature is that SCI-tech or scientific innovation, technological innovation, often shows up or is introduced in the narratives that we produce, as something semi-exogenous. You know, it's kind of like "Oh well, the cotton gin came along and then, therefore, the South was transformed and so was the southern labor economy" and the technological innovation itself is often sort of lacks context, is decontextualized, is kind of of presented as this external intervention that, that is disparate or separate from the broader story in which it's embedded. Could you respond to that a bit? I mean, is that something that your work is trying to unpack at all, or is that present in this story?

GERARD FITZGERALD: No, it is. It's something historians in technology has sort of always struggled with, so I'm going back to that when the field begins over in the 1970s. People sort of-- the cotton gin is a nice example-- people basically want this very sort of clear, almost binary explanation. Like you invent the Internet then like the world changes, or you basically you invent the vaccine in the world changes. And these things are, as people are seeing right now with Covid, it's really complex what's going on.

There's multi dimension to the how things, how these problems are solved. And it's also, I think, a narrative where people--engineers and scientists, I think, have actually sort of bought into this narrative themselves-- where people have this light bulb moment where basically the persons sitting on park bench and they discover something and then "Oh, that's how you invent the light bulb!" Then you basically build one and everything changes.

As I tried--as I show in my book, Westinghouse has some really interesting technology, which is sort of partially developed by Wells, but getting it's getting it to work in laboratories once they're getting it to work in your house is totally something different.

And then what that actually means once you turn this lightbulb on, it means different things to doctors, or housewives, or scientists, or other people, or politicians, or economists. So, it's actually very, very complex, which is why history of technology is a really cool field. But I think people--I think nonspecialists sort of have come to expect a really sort of simplistic narrative that you, basically, something gets invented and then X happens. And the reason history is interesting is 'cause X is always very complex, what actually happens later.

And my guys, that I study in my book, it takes an entire almost like 50, 60, 70 years to get this to be fully solved, actually.

An interesting example is; people won the Nobel Prize a couple years ago for gravity waves. Well, gravity waves were basically suggested by Einstein and special relativity. It takes until the late 20th-early-21st century to build the technology that tests it. So, a lot of times, instrumentally it's really hard to basically test certain theories, and this is sort of a really tough biomedical phenomenon to test, actually, then to solve.

CHRISTOPHER BRICK: Your talk also transcends two periods that often are connected in the way that the American History Survey is told and reported to students, and social studies textbooks, and the like, which is sort of New Deal/World War II.

They're kind of, you know, doctor; New Deal. Doctor; win the war--

GERARD FITZGERALD: We go from black and white to color from 1930, 1940, the world changes. It's like the Wizard of Oz, actually, a fairly distinctive change between 1930 and 1940.

CHRISTOPHER BRICK: Right. Is it, 1929, we have talkies for the first time, right? So audio tracks connected to film that you can hear, and then by 1939 we do get color in cinema and… Which changes the way that people are able to interact with technology. What kinds of changes--I mean, there's so much social transformation that occurs across the space of the 1929 through 1945 period that what changes do we see in the story you tell?

GERARD FITZGERALD: One thing, I'll start to just say funding.

Actually, when I talk to students today, students always assume you get funding from the government. This is this is a time period where scientific research is sort of changing from a philanthropic model-- We get money from the Rockefeller Foundation or Carnegie Foundation-- they're getting money from the government for the first time. So just actually getting funding for stuff is changing, which means people have to define the work they're doing it in kind of a different way.

One of the other things that I talked about-- It's reason I brought in the world fair-- was it was this concept of optimism.

1930s were, you know, fairly serious, dark time in American history, but the scientists and engineers and physicians I’m looking at are really optimistic people. I'm often sort of surprised that they think they can solve this problem. And they think they can solve it and make the world better, which is, I think what good people in engineering and science and medicine try to do.

But the coming of the war changes things. I mean, getting back to the funding question, people aren't throwing a lot of money at Aerobiology questions. The Dust Bowl, as I talked about briefly, changes a little bit of things. There's two kinds of people studying aerobiology.

There's public health people, which is what my most of my books about, and I spend a little bit of time talking about the agricultural questions which comes out of the Dust Bowl and just a general question of our microbiology is; are there basically things up in the atmosphere? until the 1920s and 30s, I mean, you couldn't actually access anything. Louis Pasteur and John Tyndall in Europe when they wanted to do airborne studies they literally have to walk up a mountain with a test tube to basically get a sample of something. And the reason I bring in Charles Lindbergh is Charles Lindbergh has access to military aircraft, so for the first time you can start to take airborne samples and start to think of beyond this is an ecosystem for the global system.

The people I'm looking at, I'm looking at the built environment, which is much smaller, but these two groups are actually talking to each other and are working together. And they're also sort of at odds with each other. But this concept of optimism is interesting. The reason I found the 1939 World's fair really intriguing is the Westinghouse display by the stirlock is really only displays-- in fact, might be the only display—at the ’39 World’s Fair that actually deals with warfare at all.

America is basically in an optimistic, isolationist mindset at this poin—at least, a large majority of people are until Pearl Harbor. American attitudes change between December 7th and December 8th rather dramatically.

But the world fair is about the future, and it's intriguing that people are not seeing global war. I mean, the world fair begins on April 30th, 1939 and four months later Nazi Germany will invade Poland and the and the world will change.

But the people looking at it are seeing a world of like sort of a Jetsons view. I mean, people find the World's Fair interesting from a standpoint of studying majority, and you're talking about flying cars and cities and bubbles and things and the Westinghouse, people are certainly in that model.

But there's this interesting tension between this optimism is there about trying to solve this really difficult phenomenological problem in biomedicine, and this also optimism about can you really change the world? Which is another reason I talked about X231 because they're trying to make the world better you get into these human test subject studies, and that's really problematically ethically.

So, you get into this tension between the dark and the light. It's why I like the term “turn out the light” because it actually talks about things about like-- the light itself to me is both scientifically and, actually, ethical and moral to about what these people are trying to do, actually.

It's not a straight road to trying to solve this problem, you’re basically use using human test subjects.

Wells does it actually too. So of the 1930s, 1940s, are really this amazingly interesting part of American history. And my guys are sort of, like many scientists kind of walled off from the world too. They're paying attention to things, but they're not paying attention to things.

When suffering comes militarized most of them jump on the bandwagon because a lot of funding floods in because the militaries are interested in controlling outbreaks of disease among troops and things.

CHRISTOPHER BRICK: It does seem to me right now compared to, say 20 years ago, where the idea was particular that information technology was going to kind of yield all this democratic transformation that would remake everything, and of course in many ways it has remade quite a bit. But a lot of that optimism has shifted into pessimism, concern about surveillance, capitalism, big tech, monopoly, power at Amazon, Google, Facebook… And when we talk about optimism, it seems like you're talking about a kind of *social* sort of sense that that that these technologies can transform standards of living and outcomes for the better. Was that present in the work that these scientists specifically are doing? Like did they have some kind of social justice agenda that they were pouring into this work?

GERARD FITZGERALD: I haven't seen--talking about optimism, but I say I think I'll talk at one level about just are optimistic about how they're optimistic they can solve this problem, which in hindsight is actually very impressive, 'cause it's a very difficult problem to solve.

Most of the people I'm studying in my book don't talk about social justice questions the way we think about them today.

I mean there are papers that they leave behind, don't talk about anything except the science, and I don't have access to some of the personal papers for people to talk about this… But one of the underlying foundational structural things about history of technology is basically the unintended consequences, which we're living out with.

I think people think about that with respect to Internet. People thought if you go back and read the stuff in the 60s… the idea that you could have a phone and you can, you can get all this information on your phone and learn everything you would think about the thing from a Star Trek standpoint they will think “Well, that's great! Everyone is going to be learning stuff.” Then, basically, considering the current state of our nation--what happened on January 6th-- information flow is more complicated.

So it's not to take away from the people who invent these technologies, and these scientific instruments and their approach to things, but as history keeps telling us over and over again, things don't always turn out the way you want them to and life is really complicated.

And even if the science-- you can actually sort of solve a scientific problem, whatever that may mean, whether we can basically try to curb the spread of airborne disease or invent the Internet. How that's going to basically evolve is very complicated actually.

CHRISTOPHER BRICK: Does the appearance of antibiotics in the war period. Mentioning as antibiotics begin to become more conventionally available beginning in 1944, right, penicillin. Does that change does the trajectory of this research moving forward? Because the bigger scope of your project takes us all the way into the 60s.

GERARD FITZGERALD: That's the major-- that's the major work right now. Actually, penicillin actually does make the projects well after World War II error interest.

Aerobiology tends to say Dawson actually becomes. It's actually pretty small dirt before World War II. It gets kind of big during World War II. Then it's becomes goes back to the small group of practitioners. What's ironic is when the sterile app market sort of collapses, one of the few places that Westinghouse and General Electric can sell ramps to is the Pharmaceutical industry.

So basically, when the first one, the only place that knew actually thing or two about light activity is actually in the manufacture of early pharmaceuticals, which actually is undermining their market in in a sort of strange way.

But those are those are very separate research projects, and they're sort of like they're in parallel each other, but they're also very separatCHRISTOPHER BRICK: How much of the aerobiological research that you document in this story ends up becoming tied in any way, shape or form to an agenda, for what, colloquially, I guess we would call biological warfare.

GERARD FITZGERALD: Well, that's very, very directly tied. That's one section in the book, which I'm not talking about right now. But actually, yes, actually there there's a person at Notre Dame called James Rainier. He's actually works with wells under nursery in Chicago and he actually winds up going into the biological weapons research program and after World War II there's this sort of global view of arrows of aerobiology and the atmosphere becomes part of the way people are trying to make biological weapons.

It's not until like the late 60s and 70s people get some of this stuff to work, but there's definitely a darker side to neurobiology. Getting militarized. Actually, that's actually trends. It's foundational for basically making airborne biological weapons, unfortunately, and that's not something that Cedric or Chapin or Wells would have envisioned. But, as I said, you never quite know where these things are going to go, actually.

CHRISTOPHER BRICK: You had mentioned-- this brings me back to something you had mentioned earlier, about the use of human test subjects in human experimentation. This is, I assume, occurring before there's real standardized kind of IRB procedures for the review of that sort of research. There is, as we know, I mean there's experiments getting conducted at Tuskegee--

GERARD FITZGERALD: Tuskegee starts in '32.

CHRISTOPHER BRICK: --there's stuff going on in Central America and Europe. I mean this is happening in a variety of different settings in really, really problematic ways, and dehumanizing ways. How is it look in with respect to the research that is going on?

GERARD FITZGERALD: I have two chapters to do with World War II. Once the program that's the talk about X 231, that's Westinghouse based. And once our program that's through the Army epidemiological board, that's actually added nearly Chicago. And what's really interesting is if you look at the Nuremberg code, which comes out in 1947, which is which is the foundation is how we look at human subject testing by electric standpoint, the United States is actually doing a lot of human testing during World War II, but that's something that's been really studied a lot.

In by so into biomedical medicines we haven't found a lot of things. I found some stuff, but we get to decide after the war we set the guidelines at Nuremberg, which were fine because what the Nazis did was evil by definition. I think what happened to Tuskegee was evil by definition for an ethicist. But we did already basically rules for this until 1947.

I actually wound up getting a bioethics degree next year at Johns Hopkins employed right now, so I'm actually very interested in learning more about this, but you'd be surprised there's sort of frightened to know how late it is in the 20th century that some of this stuff becomes canonized-- becomes law. Actually, it takes a long time for musicians to talk about this during World War II.

People just don't conceptualize this as something you have to worry about. 'cause it's not illegal and it's not really considered to be immoral per se, but that's-- I'm using some couch language here, but their World War II, they could use military test subjects and they did and it wasn't, it wouldn't occur to a doctor sort of asked him about it, I mean.

CHRISTOPHER BRICK: Right, there's like 0 expectation of--

GERARD FITZGERALD: No, in fact it's not something people are not really talking about, yet it's something it's not been formalized yet. It's not something that people have been to have to do during World War II and in Washington. I have one quote from, uh, I'm thinking of… I can't remember it. It comes up at one point in one sentence, in one large document that I read and it's just not something people think about at the time.

CHRISTOPHER BRICK: Could pick back up on this? What you were saying about there was a lot of human testing going on that hasn't really been his fleshed out historically, yet that there's a lot more research to get done in that in that space, in that area.

I think there are probably some grad students out there. You know, hearing this and thinking to themselves “Oh, maybe you know where is this in the National Archives?” and like which agencies are there any particular people associated with what you're describing? Or things that might not be as conventionally… There a pretty good historical memory of Tuskegee outfit that has been, that has been able to--

GERARD FITZGERALD: Yes, Tuskegee is a textbook case.

CHRISTOPHER BRICK: You know instantiate itself kind of within more conventional kind of social studies, curricula and even in sort of public memory. Public recollection of the period. There's, of course, other incidents of very egregious stuff that there's less awareness of. It has ministers. You're suggesting that there's other stuff out there that we really don't have a good handle on?

GERARD FITZGERALD: I'm trying to. I'm trying to cover this in the book--in two chapters their epidemiological board does a series of studies I think in about 8 different military bases in the United States, so I thought I'd get my map out, but the army, the Navy are very interested, after the flu pandemic in 1918, to prevent large spread outbreaks in these.

So some of these we have lots of young men and, actually, young men are very actually infectious or are prone to infection at that time, so they're very interested in making sure that the fleet can go to sea, and that no one is going to get sick, so.

The Aerobiology people like at Westinghouse and GE want to study, see if their technologies work, and the military basically wants to make sure nobody gets sick. So they sort of come together and say, well, "We have all these recruits, why don't you study these people?" And it was-- it's striking to me because you don't really see an echo loose in Nuremberg because we were the victors in World War II.

And to the victors go the spoils lots of different ways, but I think my research is going to show that while not as egregiously evil as anything was going on at like Auschwitz or something, that there were there were, like, thousands of individuals being part of human testing programs. But because the programs sort of ended the Second World where people move on it doesn't really get out to be a problem, and Tuskegee will go on for 40 years.

And people don't--I mean, essentially, it's sneaky. Actually been the people who know more about Tuskegee like 1935 or 1940. I'm not sure they would have responded the same way that they did in 1972.

So the way people even responding in the '40s were like, "Well, at least this is part of the war effort. So people have to you signed up to serve your country. So this is part of what you signed up for!" So it's very, very interesting. Actually. I'm sort of puzzled by some of the things I've been studying, but it's a different mindset and the physicians just had a different way of looking at human subjects and testing biomedicine. And we do.

Now it's just a different world. I have an article right now in environmental history about Covid. They asked some of this to do like a think piece, and I wrote a think piece about sing Carter Lewis book Arrowsmith from 1934, and I was intrigued by the fact that there's even testing a section of that at the end where he goes to this island in the Caribbean, and he basically attempts to test his cure for bubonic plague, and it's just a different time actually.

I mean he's. I mean if you read Aerosmith. It's very interesting how there's conceptualizing things when Sinclair Lewis wrote that book. He originally was gonna write a book about a labor leader and he decided they want to write about a doctor or biomedical research.

He thought that was that he felt a biomedical researcher defined the concept of the heroic at that time period, so that I'm really intrigued by that. You always get back to this idea of trying to make the world a better place, trying to make the world better, and that's a good thing, but then you get into things like these human testing projects and things go off the rails really quickly. So it's always the technology and the science and the ethics and the culture mixed together.

And it tells a very different story about what our what our country was like at this time, and what we're like now, how we look at things. Looking back, actually.

Americans don't like sort of see the connection and so is there ever really fantastic work on Tuskegee and on what happened in Guatemala? I want to join that so it all seems to be part of one story now.

CHRISTOPHER BRICK: I'm glad you brought up Guatemala because that is one of those examples, I think that's much less pronounced in, you know, the--when we have this conversation at all it's very rarely, you know, in a public space. If you see journalism when this comes up, in more general readership type settings.

GERARD FITZGERALD: I think it's problematic that we can see, not tend to sort of see these things as disconnected from culture, and that's a follow up to that. But there's a process that you go from there are varying degrees of how dark this is, but to go from Auschwitz to Tuskegee, the camp Sampson to broader. But it's all part of the same sort of spectrum of activity and it..

CHRISTOPHER BRICK: Well, and it seems to reflect a certain degree of conviction or certitude about which people are more disposable than others. Kind of, you know what I mean, and so we would seem to be perfectly on this continuum you're describing where they're interconnected. Probably some of these people who are engaging in this work studied in some of the same places were influenced by the same research. Are they like-- are they going to the same conferences in the 1930s and that sort of thing? Are they engaged in…

GERARD FITZGERALD: Yeah, they are. So, things like actually I have a-- I'm not sure if this will be the book-- I have a picture of a group of African American soldiers that they've recruits at Camp Sampson, and one of the ways that they actually try to reduce airborne infection, which actually sort of works, is the oil thing. You actually take, like, your barracks, you take your bedroll and you're filled with oil, and the oil actually catches the dust motes and actually everything settles down and things can't really spread.

And when the job of the African American recruited, this plan was to apply the oil and basically use brooms to basically oil the floors.

African Americans were conceptualized nothing to be part of these studies, as far as I know, there are no African American research subjects because all of the subjects are basically… right, so they weren't even considered part of the spectrum at this point for infection. They were sort of so off the grid.

I'm not saying they weren't worried about African Americans being sick, but they weren't even part of the research topic as far as I know. They were just basically people who oiled before so they could actually test the white recruits.

But I'm not-- I haven't actually seen anything about, and I have pretty voluminous notes in this, I wasn't talking about racial in prod racial differences, but African Americans aren't even part of this story. That's how off the map they are to some of these researchers.

At this point, it actually took--Wells actually tests some research on measles in 1942. He actually test some middle class white children in Philadelphia--outside of Philadelphia and in a pretty ritzy suburb, which I find really interesting. And I'm trying to contrast that with what's going on with the military people, but, yeah, the racial implications here are sort of not there. It's except people are not listed, but even the fact that they could test children during World War Two is interesting. This is a non military assistance conducted by the University of Pennsylvania. There are some problems with this study.

But again, like you talked very eloquently about the fact about human subject testing and how things are basically with Arbs, that just wasn't part of the process of biomedical research. Then it was going to be very soon, but it was just a different mindset. I'm sure people minds that.

CHRISTOPHER BRICK: Yeah, it sounds it sounds too like there's a lot of authority invested in experts to make the right judgment calls. And if without accountability, either to testing subjects themselves or to some kind of like external, you know stakeholder or a supervisory body like what we would think of as an IRB today, I mean. Who were these people accountable to?

GERARD FITZGERALD: The people that run the Department of the War. I mean, you don't see it. It's just not part of what they're talking about. I mean, it's not. I don't want to condemn these people, it just wasn't… I think like 100 years from now--assuming we still exist as a species--people will look back at our animal testing the same way we look at human testing. Now I think people will be like why were you testing guinea pigs or why were you testing rabbits? I think will people be confounded on what we're doing now? I think back then it just wasn't something people…

CHRISTOPHER BRICK: Yeah, there it was, just completely different. Kind of like ethical calculus that they were operating in.

GERARD FITZGERALD: I think it's right when you use the term authority. I think there's a very interesting question here about authority and about expertise, which is something I'm interested in. And when you start to militarize things like authority and expertise, things can get really problematic really fast.

CHRISTOPHER BRICK: Yeah, what do you do? You get any sense about what the non-scientist authorities in this conversation are, you know, in this space, how are they acting? I mean are they are they pushing? I'm thinking particularly of the military researchers and people who would have been interested.

The military obviously assumes a much greater degree of prominence in American Society beginning in 1941, and there's a very strong interconnection that's really only deepened in the year, since between the private sector, right? So we think about today, like military contractors and aerospace researchers, and the, like, a huge Pentagon budget. I mean, there's a huge economy that I'm--you're in Northern Virginia, I mean--you know, right? I mean, that's a huge part of the regional economy here in the Washington area.

GERARD FITZGERALD: This is sort of like, I think, when the--I used to have academic military industrial complex, they put the academic in here 'cause it's actually part of the parts of this military industrial academic building industrial complex.

This is sort of where things sort of start their own roles were one in our country, but role in the war for like less than eight for a year. During this time period you start to see the foundations and that's why it's so I have a chapter about the militarization of aerobiology is similar to like meteorology, oceanography.

You start to see a different way of doing science and people in some ways are when the military and the government and sometimes use this term interchangeably throws a lot of money at a research topic that changes the evolutionary trajectory of how things work out. And I think we're-- I think it's certainly talked to students, now students have a very future, often certain surprise to find out how science was conducted in the 20s and 30s.

But it's very different than it's conducted now. It's back then. It wasn't like all government research roles of government money. The military was actually very small at that point, the military becomes gigantic during World War II and keeps getting bigger during the Cold War and and science actually in technology for better or worse-- often worse-- actually becomes part of that of that culture. But this is when that changes.

Actually, that's why I think that Aerobiology is interested in case studies as part of how one can militarize public health, 'cause these people are all trying to make the world a better place to buy weapons guys and even, I guess, they're theoretically trying to make the world a better place by preventing the spread of fascism. But I don't really give them--I'm not really too impressed with those people per say from ethical standpoint.

But they're actually founding the modern scientific enterprise we see now, and I think that's why our biology is something people will think about. We bring in Westinghouse and Charles Lindbergh, and all these people, you see how there's multiple parts to how you basically have to conduct this research and things are… If World War II doesn't happen or II doesn't happen, obviously this would be different, but people were having trouble making progress and I think they would have made less progress without the human subject research stuff, and it takes them another 30 years to do some other things.

But it's just a different world back then. I mean, we're talking about like Philip Roth book. I mean, it's a different... It's an interesting book to read because things could have gone very differently, and right now the country is under presidents too, so things can always go differently.

CHRISTOPHER BRICK: And by progress you mean advance of the discipline itself? Of aerobiology of kind of you know, control over these pathogens, understanding the ability…

GERARD FITZGERALD: I'm very interested in narratives of control, because control is very slippery as a technological idea, and I did that and I'm always when I'm writing this and always sort of torn between this idea of control and optimism and unintended consequences always. Those are the three I think subthemes of my work. I like in this book is how these three ideas keep evolving and interchanging it, and they're basically morphing together.

And these people do want to make the world a better place, and I think they eventually do make the world a better place. But if you take in things like X 231… The price that was paid is problematic.

CHRISTOPHER BRICK: Is vast, yeah. Was there any attempt to apologize to the people who were used in this way? Or attempt to get towards some kind of--

GERARD FITZGERALD: Not that I've seen. I mean, no one was really injured, sorry. So basically the UV light didn't actually really affect people and no one was as far as I know, nobody was actually injured.

The Wells research, similar to the chapter on Wells in Philadelphia in Philadelphia, that's actually pretty complicated, but the military research probably doesn't result in any deaths, but the idea that people would actually just be part of a research subject hard research project without their consent is very eye opening to us. I did find this statement once Vanderbush and James Conant pretty much ran military research in the United States or World War II. And I got to find my notes but there there's… Bush at one point talks about whether there could be some problems after the war with respect to this research project and just sort of just sort of like pass it over it.

Like, well, no. I mean, there's gonna. It's not considered to be a problem, but they think about it. I mean, it's not something that people spend a lot of time worrying about. People are worrying about whether they can solve the problem, not what's going to happen.

CHRISTOPHER BRICK: Yeah, well and I think we see that very much in the in Los Alamos story, and the Oppenheimer story, which is to say that there's a need to expedite this technology, and they're aware that there are all kinds of it. Seemed like they were more aware, or perhaps of the ethical implications of what was going on or the potential for real disaster to be unleashed by the development of these weapons, as opposed to, seems like there's a bit less of a restraint going on in the in the space that you're describing, but it's absolutely there.

I think the sense that, well, you know the most unethical thing we could possibly do in this moment is not do what we *must* to defeat these enemies.

GERARD FITZGERALD: In time they have a wartime emergency. I'm also I'm halfway through the book on World War I and reading the history of World War I, and it's interesting in this country 'cause I think America is a reactive country when it comes to like scientific problems.

I think like we react to things about like I think the way we're reacting or not reacting to Covid situation is a useful example to that. Americans, when you when you ring a wartime emergency bell, people just react in a very different way, and you can do things like human experimentation, you can spend billions of dollars on things. You can do all sorts of things, and it's not what happens during normal life, but I when I look at in the book when you look at the 30s and before you see this very interesting economy between peacetime research and wartime research.

And they're the exact same people, most of all these are university professors, some of whom entered this service, some of whom just basically working under military contracts, but they're doing this same research, but they have access to other things because it's a government. And other things I tell my children--I tell my students is this concept of trust. You've talked a lot about this, sort of, underlying interest like between optimism and control. People back then really trusted the government.

I mean if you think about the about Los Alamos, I mean thousands of people worked at Los Alamos who worked at Oak Ridge and worked in Washington state and nobody-- people like went to work and they were told not to talk about this project even it was actually compartmentalize and people didn't talk about that and students today just find that really interesting.

And people wouldn't… like they said, OK, I mean, it's obviously not whether or not you trust the government, whatever that may not mean is a loaded sentence, but people did really trust the government back then.

CHRISTOPHER BRICK: Well people, political scientists in particular, I feel like historians are doing more of this now. But political scientists particular have been working with this concept of social trust for some time now and kind of doing work that enables us to understand how much that shapes, you know, what policymakers are allowed to do and how effective they are doing it, just that the simple baseline reality of do people trust one another-- even people they don't know-- to basically do the right thing in most situations? and I think we don't have the kind of data we have now to measure that like in the present. From, you know, going back to the 1930s…

But it does seem that having worked in that period quite a bit myself, uh, there was much more confidence in institutions. I mean, it's a period of tremendous institution building and this is such a good Q&A and--

GERARD FITZGERALD: I think people like to talk about it. I know that your question right? If you think about the 30s people think about building like the Hoover Dam or something. Or people think about the New Deal and I think that. I think people like to talk about it. I know your question right, if you think about the 30s people think about building like the Hoover Dam or something. Or people think about the New Deal and I think that.

Students--I'm gonna talk about undergrads. I mean like, I think sometimes they think people were naive back then and I'm not sure if that's true or not, but people thought that government could work for that. FDR like they built all these things to sort of save the nation from that or before they shouldn't be too revolution or something, but people like built roads and built dams and did things and it was interesting and there was like, we talked about airplanes and things.

These you know, the building of airports and all these large structures which also can get there's a fascist aspect of building large structures problematic too, but people just had a different view of the world then, and I've actually sometimes trying to get my head into a 1930s and 1940s space to understand what my what my people are doing actually.

CHRISTOPHER BRICK: Yeah, yeah, I think I think the sense you get--the 19th century we talked about internal improvements, right? You know, in the 20th century, stop using that language. But to seem like there's a, uh, an impetus that's unleashed in in that depression era kind of World War II. Or a moment where an enormous amount of state power and state resources are being leveraged and invested in the creation of infrastructure to support things like disease monitoring and aero biological research.

GERARD FITZGERALD: You can still ask… this has been lots of fun. You ask fantastic questions by the way.

CHRISTOPHER BRICK: Oh, thank you! Yeah, well this was a great talk and great... You taught me a lot today, which is always what I look for you. Gerard Fitzgerald, thank you.

GERARD FITZGERALD: Well, thanks for having me on the show. I'm looking forward to hearing what all the other public health historians are talking about. This would be a great thing for early [inaudible] Thank you very much.

CHRISTOPHER BRICK: It'll be out real soon. Take care.

Conclusion

CHRISTOPHER BRICK: And that's a wrap. Thank you again for joining us this time and come back for the next one when Prof. Ken Marcus will invite us to consider some difficult stories about public health, civil rights, and the incarceration of Japanese Americans during World War II. We'll catch you then.