BEING PROMETHEUS IN 1943: BRINGING PENICILLIN TO THE WORKING MAN

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In 1943 the United States was engulfed in World War II, which had forced the American people to make sacrifices. The limited availability of gasoline and certain foods became commonplace nuisances, but by reserving all manufactured penicillin to care for injured soldiers the American people put their own health and safety at risk. Penicillin, which later became known as the "Wonder Drug," had the ability to cure many life-threatening infections for which there was no other therapeutic option. The ability to manufacture penicillin on a major scale was hindered by the belief that the drug could only be grown in a completely sterile environment at academic hospitals. On November 10, 1943, Julius A. Vogel, a plant physician at the Jones and Laughlin Steel Plant in Aliquippa, Pennsylvania, discovered a method for creating usable penicillin in his kitchen. What became known as "kitchen" penicillin would change an entire nation's view about this medication and help to treat infection in the United States as well as across the globe.

In the fall of 1928, penicillin was accidentally discovered in London by Dr. Alexander Fleming.[1] An airborne mold found

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its way into his basement laboratory at St. Mary's Hospital and landed on one of Fleming's purest staphylococci cultures. Only when he was about to discard the culture did he realize the staphylococci had died around the invading mold.[2] Fleming discovered that the fungus that killed his staphylococci was penicillium mold, thus he called the substance responsible for the effect "penicillin."[3]

After many tests Fleming discovered that this new mold also had the ability to prevent the growth of streptococci and pneumococci, two organisms that caused many infectious fatalities. Unfortunately after the discovery, the greatest challenge that faced researchers in penicillin was the inability to make the material in large quantities. By 1938 the threat of a second world war halted research on all antibacterial agents in England.[4]

Howard Florey, an Oxford University professor of pathology, contacted Fleming and had some of the original strain of penicillium transferred from St. Mary's Hospital to his pathology laboratory.[5] In February 1940 Florey treated a London police officer who was dying of blood poisoning from a shaving cut. Florey injected penicillin into the man's bloodstream and by the fifth day the man, who should have died four days before, seemed on the road to recovery. Unfortunately, Florey had exhausted his penicillin supply before curing the man's progressive infection and the police officer ultimately died.[6]

Florey traveled to the United States in July 1941 to explore interest in meeting the needs of larger-scale production of penicillin.[7] His effort resulted in the formation of the Committee on Medical Research in the summer of 1942. One of its main purposes was streamlining the production, synthesis, and clinical investigation of penicillin. Despite all this organizational progress, the production of penicillin remained minuscule. All available supplies were reserved for the war effort, creating a desperate need for the "Wonder Drug" domestically.[8]

The War Production Board realized the importance of penicillin and decided to focus on its large-scale production in 1943.[9] On October 8, 1943, George Robinson and James Wallace, working in the Singer Laboratory at Allegheny General Hospital in Pittsburgh, Pennsylvania, reported a new method of growing penicillium.[10] This consisted of placing gauze saturated with penicillium mold in an agar-filled petri dish and allowing it to grow for four to five days. Their method of treatment focused on caring for infections on top of the skin, such as cuts or abrasions, where a gauze pad could be directly applied. Robinson and Wallace's innovation became a turning point

in overcoming domestic production restrictions, but even though medical research discovered a way to produce penicillin, the amount that was being created was still very small and reserved for war casualties.[11]

Robinson and Wallace's method was Dr. Julius Vogel's foundation for the experiments he did to create "kitchen" penicillin in his home. Vogel located the platinum loop-holder that he obtained in medical school, contacted his friend Dr. Robinson on October 11, 1943, and asked for a sample of his penicillium.[12] He received the sample the next day and by the evening of October 13 Vogel was already creating penicillin in his kitchen.

Over the next several months, the Vogel family became completely involved in making penicillin for use in Beaver County steel mills. Dr. Vogel's wife, Eunice, even agreed to do the agar production and petri-dish sterilization. Jules trained her to culture the penicillium as well, and soon Eunice was the penicillin assistant at the Vogel home on Davidson Street in Aliquippa.[13]

Julius Vogel had been born on November 23, 1901, in the Grant Avenue/Millvale section of Pittsburgh. He was the ninth of eleven children of German immigrants Kaspar and Adelinde Pfaff Vogel, who ran a large slaughterhouse and butcher store in that neighborhood. After attending his Catholic parish school for eight years, he graduated from Millvale High School in 1919.[14] Julius was a stern man who had survived a life-threatening infection in his right knee as a child. That infection could have probably been treated successfully with penicillin, but at the turn of the century no penicillin existed. Vogel was bedridden as a child for several months as the infection, osteomyelitis, ate away at the bone on his right knee. As a result, Vogel was left with a right leg that was several inches shorter than his left and had a frozen knee joint. He had to walk by throwing out the leg from the hip and would appear to sway up and down because of the difference in leg length. Throughout his life, he remained very sensitive to his deformity and talked of childhood taunts in school of "peg-leg."[15] Vogel's reports of using penicillin would focus on the healing powers of the drug for superficial infections—much like the one that had started the infectious process that had crippled him as a child. His research notes would also comment on the fact that the treatment prevented a disabling result. His work stressed the avoidance of the kind of disability he had struggled with for his whole life.[16]

Julius Vogel graduated from the University of Pittsburgh in June 1923 with a degree in bacteriology. He continued his education at the University of Pittsburgh Medical School and became initiated into the honor medical society,

Phi Beta Pi, before receiving his medical doctorate in 1927.[17] After completing his internship at St. Francis Hospital in Pittsburgh, Vogel started a private general medical practice at 353 Franklin Avenue in Aliquippa late in 1928.[18]

In 1905 the Jones and Laughlin Steel Corporation (J&L Steel) built a newer and larger plant near the town of Woodlawn (later Aliquippa) in Beaver County close to the Aliquippa Rail Stop. This site on the Ohio River became the location of the J&L Aliquippa Works.[19] The J&L Corporation, which began by producing iron, switched to steel in 1886; the transition from iron to steel led to an increase in factory-related accidents with the introduction of the required new equipment.[20]

Before 1909, steel companies would contract with private medical practitioners in communities near the mills. Typically, the method of payment would be through the steelworker's personal pay. In 1909 this system changed when U.S. Steel decided to contract with physicians and nurses in steel towns to become employees under the supervision of a company-hired chief surgeon. Soon, every steel mill had guidelines to properly equip medical staff and supply dispensaries to treat work-related accidents.[21] In the 1930s steel corporations searched for physicians who chose to specialize in the new field of industrial medicine. Julius Vogel was one of the first such doctors hired by Jones and Laughlin Steel Corporation's Aliquippa Works.[22]

Working conditions for the individuals employed in steel mills were hazardous. This fact had been brought to the attention of the Pennsylvania state legislature as early as 1905. However, only after 1908, when the Pennsylvania state legislature began raising concerns about worker health, did steel mills start to install safety devices. Still, only a tiny decrease in the overall number of work-related accidents occurred.[23]

As the physician at the Aliquippa steel mill, Julius Vogel could easily test his homemade penicillin on those of the plant's 10,000 workers who suffered accidents on the job.[24] The majority of the twenty-nine workers he treated during the first two weeks experienced marked improvement with the gauze treatment; three cases resulted in "astonishing recoveries." The treatment was done applying 4cm by 4cm gauze pads that were previously growing penicillium in sterile petri dishes. The mold was grown on the surface and at the point that the mold had matured and produced active penicillin; it was placed on top of the superficial infection and then the gauze was held in place with a light, air-permeable gauze wrap. The gauze and all equipment were obtained from Aliquippa's Woodlawn Pharmacy, owned by Dr. Vogel's brother-in-law.[25]

One of those three "astonishing recovery" cases was a sixteen-year-old boy who suffered a cut and deep infection on his left middle finger. Typical treatment would have been admitting the boy to the hospital for surgical care. However, Vogel drained the finger of pus in his clinic and applied a dressing of his "kitchen" penicillin. The young man made a full recovery. In his report, Vogel stated: "Thus it required but eight days to clear up and heal this finger with a perfect result. Previously acceptable therapy would almost certainly have resulted in an impaired finger."[26]

Vogel provided penicillin-impregnated gauze for other steel mills throughout the Beaver Valley for the duration of World War II. On November 11, 1943, at a conference sponsored by the Department of Industrial Research at the University of Pittsburgh, he presented his research on "kitchen" penicillin and its results.[27] The department had been established in 1911 by financial giants Andrew W. and Richard B. Mellon to advance scientific research, university education, and commercial technological development.[28]

While Julius Vogel's penicillin had its advantages, it also had limitations. It could only be used after it had matured for four to twelve days. This required physicians to plan ahead so that they had a steady supply needed and that the supply was used up before it expired. The second and probably most significant problem was that in its crude state homemade penicillin could only be applied on the surface of the skin.[29] The only infections it could treat occurred from surface wounds. "Kitchen" penicillin could not treat infections like septicemia or pneumonia, although it was ideal for injuries typical in manufacturing.[30]

Once news broke that Dr. Vogel had created penicillin in his kitchen, he started to receive letters from all over the United States as well as England and Mexico asking for his production method. The authors offered to pay him for sharing his method or giving interviews.[31] But Vogel believed that it was unethical to accept any money for his discovery and would send cultures away for the price of a posted note. At one point *Look* magazine offered Julius A. Vogel a large sum of money if he agreed to let them interview him about creating "kitchen" penicillin.[32] He turned this down because he believed that drawing attention to himself for his discovery was unprofessional.

After Julius Vogel's success in creating usable penicillin in his kitchen he was beset by individuals in the medical field who criticized his work. Prior to "kitchen" penicillin the drug was mainly created in an academic lab and many doctors believed that creating penicillin outside a laboratory was dangerous. They insisted that the only way to create a pure sample was if trained

professionals used strict sterilization procedures. Other criticisms originated from companies with government contracts in mass-producing penicillin for the war. Bacteriologist Dr. Edgar B. Carter insisted that penicillin not grown in absolutely sanitary conditions would become impure and unsuitable for patient use.[33] Carter was employed by Abbott Laboratories, one of twenty-one companies hired by the War Production Board (WPB) to manufacture penicillin on a large scale.[34] Carter probably made this claim because Vogel's discovery would seriously affect the government's desire to pay these companies for something that could be easily produced in anyone's home.

So why was Julius A. Vogel's role in creating "kitchen" penicillin significant in addition to that of Robinson and Wallace's, whose method he used? After discovering that his penicillin was successful, Vogel visited George Robinson to show him his case reports. Robinson was intrigued and informed Vogel that it would take him six months to accumulate the amount of clinical data Vogel had obtained in two weeks. While Robinson and Wallace increased the volume of penicillin, they still shared the medical profession's general fear that creating penicillin anywhere outside a laboratory could result in contaminating the culture. Vogel's method proved that clinically useful and pure penicillin required only basic bacteriologic processes; it allowed for mass production on a large scale for the first time.

Dr. Vogel had only a rudimentary grasp of mass-production sterilization procedures. However, he discovered that such measures were unnecessary to grow penicillium mold on gauze in agar plates. Because penicillium is a mold, it is not necessary to create it in a sterile environment. Penicillin had not yet been well studied by the 1940s. While Fleming proved that penicillin had a low toxicity level it was still common procedure to give an individual a dose of the drug every three to four hours.[35] Not until 1943 did studies prove that penicillin could have negative side effects if used too often.[36] Another significant advantage of Vogel's method was the amount of money needed to create penicillin. Besides a small area, an oven, and a kitchen coffeepot to grow the mold, the product required little expense. Julius A Vogel was able to start producing significant quantities of penicillin for five dollars.[37]

The introduction of "kitchen" penicillin changed the academic understanding of both the amount of money and skill needed to create what people called the "Wonder Drug." When physicians realized that a sterile environment was not difficult to create, they started to replicate Vogel's process and supply penicillin to nonmilitary patients. The amount of pharmaceutically produced penicillin increased after 1943 when the

United States was producing 21 billion units, virtually all reserved for the war effort. In 1944 that amount jumped to over 1 trillion units. By 1949, just five years after Vogel's discovery, the amount of penicillin produced in the United States was more than 133 trillion units. That is over 6,000 times more than the amount made in 1943.[38] Julius A. Vogel brought the hope of affordable and effective treatment of severe, debilitating infections to the common medical practitioner. His discovery of a simple method of producing penicillin prevented many infectious deaths and disfigurements through the United States and the world. His desire to make penicillin as cheap and available as possible is best expressed in the *Industrial Hygiene Association* in November of 1943:

> Dare any man say that penicillin is scarce? Certainly money can't buy it, but each and everyone here present can easily produce his own penicillin in his own family kitchen at an initial outlay of less than five dollars, and at a production cost of less than five cents per petri dishful.[39]

In March of 1959, Julius Vogel's daughter Marilyn had vision problems, and a large tumor, thought to be cancerous, was detected. Vogel took her to the Cleveland Clinic where he knew the anesthesiologist and the pathologist who would assist in her operation. The anesthesiologist allowed him to scrub for his daughter's surgery and sit with him in the operating room. It was quite a messy and tense affair. The pathologist said he would do immediate sections and call Julius Vogel at the hotel that evening. He called and Dr. Vogel and spoke to him: he seemed quite relieved and hung up the phone, saying to his wife, Eunice: "Thank God it [the tumor] is benign." Vogel then immediately fell over in a fatal cardiac arrest. Marilyn's husband, John Ronald Molter, whose father had died in the same manner, knew CPR and tried to resuscitate him. He failed and Julius Vogel was pronounced dead at the scene. Marilyn came out of the anesthesia to find out that her tumor was benign but her father had died.[40]

NOTES

1. Alexander Fleming, "Antibacterial Action of Cultures of a Penicillium," *British Journal of Experimental Pathology*, May 10, 1929, 5.
2. Ruth Fox, *Milestones of Medicine* (New York: Random House, 1950), 223.

3. Julius A. Vogel, "Growing Penicillin at Home," Aliquippa, November 10, 1943, 1. Copy of original paper used for his presentation at the Industrial Hygiene Foundation meeting, in the personal possession of Suzanne Vogel-Scibilia.
4. Fox, *Milestones of Medicine*, 226, 227.
5. "The Progress of Penicillin," *Illustrated London News*, March 4, 1944.
6. Fox, *Milestones of Medicine*, 230.
7. Ibid., 233.
8. Vogel, "Growing Penicillin at Home," 1.
9. David Wilson, *In Search of Penicillin* (New York: Random House, 1976), 202.
10. George H. Robinson and James E. Wallace, "An Inoculated Science," October 8, 1943, copy of paper given by Dr. Robinson to Dr. Julius A. Vogel Sr. at presentation, October 8, 1943, in the personal possession of Suzanne Vogel-Scibilia.
11. Vogel, "Growing Penicillin at Home," 2.
12. A device intended to spread bacteria or mold onto some type of growing media.
13. "Aliquippa Doctor 'Manufacturing' Penicillin on Investment of $5," *Pittsburgh Sun-Telegraph*, November 10, 1943.
14. James Hoffman, Hoffman Family Tree_2010-06-09, http://trees.ancestry.com/tree/18634560/person/688806742.
15. Suzanne Vogel, interview with Anthony Julius Scibilia, March 9, April 5, and December 29, 2012 (hereafter Vogel interview).
16. Original patient research records of Julius A. Vogel Sr., October–November 1943, in the personal possession of Suzanne Vogel-Scibilia.
17. Hoffman, Hoffman Family Tree.
18. Vogel interview.
19. Ibid.
20. David H. Wollman and Donald R. Inman, *Portraits in Steel: An Illustrated History of the Jones & Laughlin Steel Corporation* (Kent, OH: Kent State University Press, 1999), 3–7, 41–43.
21. T. Lyle Hazlett and William W Hummel, *Industrial Medicine in Western Pennsylvania* (Pittsburgh: University of Pittsburgh Press, 1957), 72–73, 74.
22. Vogel interview.
23. Hazlett, and Hummel, *Industrial Medicine*, 124, 99–100.
24. Vogel, "Growing Penicillin at Home," 2.
25. Vogel interview.
26. Vogel, "Growing Penicillin at Home," 5.
27. Vogel interview.
28. Carnegie Mellon University, Center for Molecular Analysis, http://www.chem.cmu.edu/cma/mi.html; University of. Pittsburgh, Mellon Institute, http://www.tour.pitt.edu/tour-410.html.
29. *Science Service*, November 19, 1943, press release.
30. "Aliquippa Doctor 'Manufacturing' Penicillin on Investment of $5," *Pittsburgh Sun-Telegraph*, November 10, 1943.
31. Letter from Instituto De Biologia, Casa del Lago, Chapultepec, Mexico, D.F., June 8 1943; *London News Chronicle*, November 12, 1943, no. 30,422, "US Doctors Claim—Penicillin Made for 3 Dollars in Kitchen."

32. *Life* magazine letter and Theodore Irwin, science editor, to Julius Vogel, *Look* magazine, November 12 1943, in the personal possession of Suzanne Vogel-Scibilia.
33. "Doubts Penicillin Making Method," *Reading Eagle*, November 12, 1943.
34. Charles R. Drew, letter to Edgar B. Carter, The Charles R. Drew Papers, Profiles in Science, National Library of Medicine, http://profiles.nlm.nih.gov/ps/retrieve/ResourceMetadata/BGBBHP.
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36. David P. Adams, *The Greatest Good to the Greatest Number* (New York: Peter Lang Publishing, 1991), 154–55.
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38. George Urdang, "The Meaning and Purpose of "Pharmacy," *History of Medicine and Allied Sciences* (1951): 388–405, especially 403.
39. "Homemade Penicillin," *Fusion Newsletter* 10 (October 2011).
40. Vogel interview.