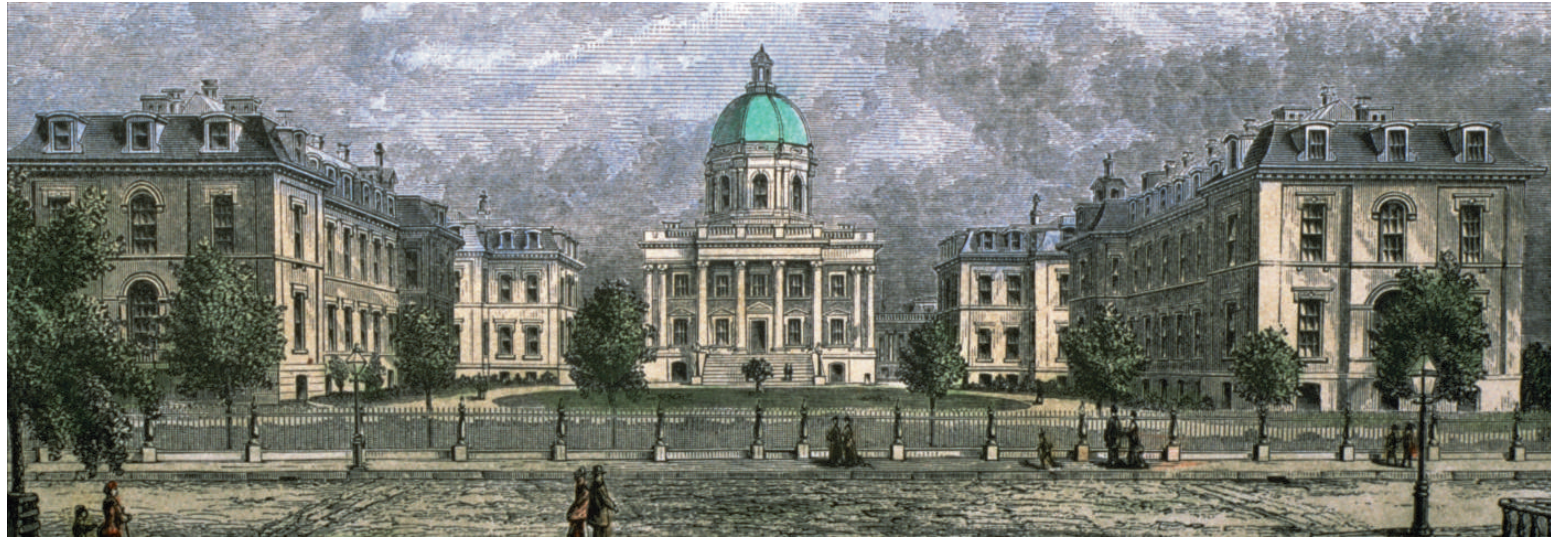


ACESO

JOURNAL OF THE BOSTON UNIVERSITY SCHOOL OF MEDICINE HISTORICAL SOCIETY

Fall 2016





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Fall 2016 Volume 4, Issue 1

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About the Cover

Signed Portrait Photograph of Chester Keefer
1950's, Courtesy of Boston University School of Medicine.

Dr. Chester Scott Keefer (1897-1972), nicknamed the "penicillin czar," played a key role in the distribution and allocation of penicillin for civilian use (more on page 8).

Less know about him is that he began working at BUSM in 1940 and became Dean from 1955 to 1960, where he continued to build the academic reputation of BUSM and the Evans Memorial Research Institute. Thanks to his contributions to the medical school, an auditorium and one of the school's four academies is named after him. He was a well loved and respected Dean, and even today, he continues to teach and inspire future generations of physicians. As second year medical students, we spend almost every day in the Keefer auditorium, learning about all branches of clinical medicine.

JOIN THE ACESO STAFF

Interested in getting involved with *Aceso*? We are actively looking for new Editors and Graphic Designers to join our staff. We are recruiting for this upcoming semester so spread the word!

Editors take part in shaping the overall direction of *Aceso* and review the articles submitted by our writers. This position requires the staff member to have excellent writing skills.

Design Editors and graphic designers create the cover, layout the format, and manage the artwork of *Aceso*. This position requires either some art or design experience.

If you are interested in applying for one of these positions, please email us at aceso@bu.edu and let us know what position you are applying for.



About Aceso

This journal is named for a Greek goddess, Aceso, the daughter of Asclepius and sister of Panacea. Her name comes from the Greek word *akéomai*, which means "to heal." She represented the act of the healing process itself. Unlike the other gods, she personifies medicine from the patient's side, a process that involved both the ill and the

physician. Rather than a magic cure, personified by Panacea, Aceso symbolizes a more holistic approach to health care, understanding that the path to wellness takes time and effort.

Letter from the Editor

The Things We Take Away:

It is my pleasure to introduce the fourth edition of *Aceso: Journal of the Boston University School of Medicine Historical Society*. As the new editor-in-chief, I had the pleasure of reading every submission and working with the authors. This issue is filled with unique and outstanding articles, two of which have won national awards. The topics this year range from rhinoplasty in ancient Iran to the reproductive rights movements of the 1900's and its impact on modern society. I also had the delight of reading the continuation of Dr. Beazley's work on Scurvy, discover something new about the homeopathic history of BUSM, learn about Dr. Keefer's regulations, and share my own thoughts on fungi and witches. Finally, for the first time, we have an article that does not talk about history as a study of the past, but rather, the history of a present illness, the dialogue between patient and physician.

For me, the field of medicine has always been intricately connected to the past. It is a field that constantly learns and draws inspiration from the past in order to improve the future. For example, Marshall and Warren's discovery of *H. pylori* as the source of gastritis was possible in part because previous scientists had visualized the bacteria and had attempted to culture it. Likewise, the creation and use of aspirin as a therapeutic

agent was inspired by the Ancient Greeks, who used salicylic tea made from willow branches to treat fevers. Medical knowledge is passed on from generation to generation, sometimes in the form of textbooks or atlases, and sometimes in intangible ways such as skills or teachings. On a more individual level, all physicians train under a mentor; and it is the mentor's responsibility to pass on their skills so that one day the apprentice can become a mentor himself. See one, do one, teach one.

Boston University School of Medicine Historical Society is a student group that provides four to six lectures every year on the history of medicine. These events cultivate opportunities where individuals can appreciate and contemplate on the past, and perhaps even become fascinated by the advancement of medicine. In addition to these events, Aceso was created to further provide historical perspective on modern medicine. It is a medium where both writers and readers witness the marriage of humanities and science. It, once again, allows us to step away from our fast-paced lives, and reflect on the past.

Teng J. Peng
BUSM Class of 2017

About the Art

Unless noted, pictures throughout this issue are from the archives of the Alumni Medical Library of Boston University School of Medicine or the Boston City Hospital collection (7020.001). Special thanks to A'Llyn Ettien and the City of Boston Archives, for allowing us to access the archives.



Boston City Hospital physicians and patients enjoy Thanksgiving Dinner in Ward "T" (1897)

Antiquity

Rhinoplasty and the Roosari:

How Cosmetics and Plastic Surgery have flourished from
Ancient Persia to Modern Day Iran

Ryan B. Cohen, B.S.
Boston University School of Medicine
Class of 2017



Ryan B. Cohen was born and raised Los Angeles, California in the suburb of Encino. After high school, Ryan got his B.S. in Biology at UC Santa Barbara. He then moved to Boston, MA to earn his medical degree at Boston University School of Medicine where he is currently a 4th year student. He is interested in pursuing a residency in orthopedic surgery. In his free time, Ryan enjoys playing basketball, watching movies, and writing.

Roosari is the Farsi term used for a “head-covering.” The famed Iranian veil is the most conspicuous feature of a modern Iranian woman’s ensemble. However, wearing the Roosari was not always the norm. Only a generation before, the country had banned this staple of Iranian wardrobe in the name of westernization.[1] From ancient Persia to the modern state, the people of Iran have had an enigmatic relationship with aesthetics and the expression of beauty. Here lies the interesting role of vanity in Iranian culture. From meticulously embroidered rugs to tales of beautiful Persian princesses, Iranian history and culture is romanticized for its extravagance and lavish qualities. Yet, showcasing beauty in modern day Iran is often scoffed under the rule of modesty and tradition, that so embodies the modern state. This dichotomy sets up a fascinating backdrop for the development of cosmetic surgery, a field of medicine that has flourished at an uncanny rate in this unlikely setting. In today’s Iran, you can find a plenitude of women fashioning their traditional head-coverings with a bandage covering the nose, evidence

of a recent cosmetic intervention. In fact, Iran, deemed by some the “nose job capital of the world,” has become a world leader in the research and clinical practice of cosmetic surgery.[1-4]

The establishment of Achaemenid Empire in the 6th century BC afforded huge advancements to medical innovation in Iran. Herodotus mentions the Persian practice of dressing wounds with clean bandages during combat. It is believed that the daughter of Cyrus the great was cured of breast cancer by surgical intervention.[5] Darius I recruited physicians from throughout his vast empire to debate modern medical practice of the day; what we might call surgical societies today.[6] By the 3rd century AD, Iran was home to the greatest medical university in the world, and what some historians consider the first ever hospital, the “Academy of Gondishapur.” It is thought that surgical operations were performed routinely in an extensive network of such hospitals in ancient Persia. Some attribute our modern hospital systems to the Persian groundwork of the age.[7, 8] By the 3rd century AD, Iran found itself in the center of culture

and art, as well. There are countless masterpieces recovered from the era, including mosaics, grand palaces, and carvings of Iran's great rulers.[9] Carpets crafted at the time show meticulous detail of impressive patterns that showcased elegance and creativity. Fabrics with a variety of colors were worn to exude grandeur and class. The Persians of old had a preoccupation with cosmetics as well. Face powders, eye shadow, lipstick, and perfumes were applied liberally, as the Persians of antiquity advertised their beauty and splendor.[10]

The Arab invasions of Iran, in 630 AD interrupted this atmosphere of development. Places of learning, including universities and libraries, were largely destroyed. Fortunately, some ancient Greek, Indian, and Persian scripts were translated into Arabic, which replaced Farsi as the academic language of Iran. [6, 11] However, the pause was short-lived. As tensions quelled, the Persians once again reclaimed their prowess of old. Iran, between the 8th and 13th century, ruled by various caliphates, enjoyed a period of vast scientific, economic, and cultural developments – the advancement of medicine and surgery was not lost. The “Islamic Golden Age” had arrived.[12]

A group of Persian scholars worked to systematize all known medical knowledge from the medieval world. Avicenna wrote hundreds of medical texts still used as standard medical reference as late as 1650.[6, 12, 13] Rhazes described how incisions made in parallel aligned with the natural contours of the body can accelerate healing and improve scarring. This concept is well known in modern cosmetic surgery as “Langer’s Lines.” [6] Ancient Persian texts from 1000 AD mentioned the use of cannabis and poppy for pain control during operations. Another scholar, Masoudi, wrote a concise encyclopedia named “The Complete Art of Medicine,” which is perhaps the first account of craniofacial and limb anomalies.[6, 11, 12]

The world of art and culture made strides as well, albeit under firm oversight. The Arab invasion of Iran brought with it a new set of rules with Islam at its center. Veiling of women and segregation of the sexes became common-place. Women could not wear overly gaudy clothing and could not expose parts of their bodies in public.[14] None-theless, Persians of the time remained an artistic and ostentatious people. Accounts of the time describe elegant living and an atmosphere of opulence. There are reports of hugely extravagant weddings, where grand princes married beautiful princesses. Perfumes were in high demand and make-up was widely used. Writing and art of the time offered the ideal of perfected beauty in women: long curly hair, long arched eyebrows, large eyes, and beauty marks. Under the guise of the Islamic invasion, Persian self-expression in beauty, vanity, and art endured.[10]

The modern history of cosmetic surgery in Iran began with innovation from west. On the world stage, plastic surgery made its initial leaps in Europe during World War I. The conflict provided western powers the

opportunity to advance surgical innovation, as the many thousands of wounded soldiers were treated from the front lines. As the war concluded, a whole generation of soldiers had suffered injuries with pronounced cosmetic consequences. The landscape of surgical intervention in Europe expanded from reconstructive to include the aesthetic as well. The first societies of Plastic Surgery developed in the 1930s and the European Society of Reconstructive Surgery was founded in 1936.[6, 15]

The 1950’s marked the beginnings of modern cosmetic surgery in Iran. Dr. Siroos Osanlou is known as the first Iranian plastic surgeon. After studying general surgery in Iran, he traveled to the UK where he trained in plastic surgery under Sir Harold Gillies, considered the father of modern plastic surgery.[15] In 1949, after his return to Iran, Osanlou established a unit of reconstructive surgery. In 1955, the Society of Plastic and Maxillofacial Surgeons of Iran was founded. Between the 1950’s and 1970’s Iranian surgeons made significant strides in plastic surgery including reconstructive rhinoplasty, facial plastic surgery, and craniofacial surgery. By 1979, which introduced the modern Islamic Revolution of Iran, multiple plastic surgery and burn centers, as well as, a residency program had been established in the country.[6]

From ancient Persia to the modern state, the people of Iran have had an enigmatic relationship with aesthetics and the expression of beauty. Here lies the interesting role of vanity in Iranian culture.



Dr. Siroos Osanlou (1910-2005). Founder of Iranian Plastic Surgery.

This set the stage for the Iran-Iraq war, perhaps the biggest spark for surgical advancement in Iran’s history. Much as World War I had done for Europe, the bloody war between Iran and Iraq accelerated progress in surgical reconstruction and cosmetics. The now capable plastic surgeons of Iran showcased their abilities by treating the Persian soldiers suffering from

battle wounds. Their experiences culminated in enormous growth in the field, ushering in the modern Iranian cosmetics boom.[6]

In a 2013 study, Iran ranked 4th of all countries where most the most rhinoplasty operations are performed.[16] This did not include a vast underground network of practitioners that are known to operate in Iran.[17] The Rhinology Research Society of Iran found

The obvious truth is that under a veil, the nose is the only anatomical feature open for improvement.

that the rhinoplasty rate per capita in Iran is seven times that of the US.[2] Some estimate Iran has the highest rate of rhinoplasty operations in the world today. Other cosmetic procedures are on the rise as well. Additionally, research in plastic surgery is currently one of the most dynamic and accomplished fields of Iranian medicine.[1] The cosmetics industry is likewise booming. According to market research, Iran is currently the 2nd largest cosmetics market in the Middle East and ranked 7th in the world.[18, 19]

Iran's plastic surgery craze seems odd, considering neighboring countries are far behind in surgical progress, nonetheless in a field devoted to the aesthetics. Why is a traditional Islamic country so bent on cosmetic enhancement? Vanity and allure are hardly tenets of piety. Looking at the history of head-coverings in the last several decades offers a telling account of these opposing forces. Iran banned veiling in 1936, under the ruler Reza Shah, in an attempt to modernize the country. Reza Shah and his son after him, wanted to bring Iran into the 20th century, stripping the modesty of strict Islamic law. Several decades later, after the Islamic revolution of Iran in 1979, wearing the veil became compulsory in the name of religious piety. From centuries ago to the modern Iranian state, this contrapuntal give-and-take has persevered.[1, 10]

The peculiar landscape of Iran today may actually parallel Persia of old. The ancient Iranians, under the rule of an Islamic invasion, remained an expressive, brazen, and progressive people. Modern Iranians live in a similar clash: a religion steeped in modesty with a cultural psyche that appreciates modernity, progress, and the outward expression of beauty.

The obvious truth is that under a veil, the nose is the only anatomical feature open for improvement. Perhaps, in cosmetic surgery, the Iranian people have found a way to tackle their age-old dilemma. Has rebellion found its voice in plastic surgery? One can interpret the plastics boom as a small gesture to reclaim a storied history that time and time again was at the center of worldwide progress - a country that only several decades ago was trying to regain its modernity. In a broader sense, it points to a culture of self-expression and beauty that has always been central to the Iranian soul. Regardless of the reason, the rhinoplasty and Roosari seem to create a fitting picture for the modern Iranian woman, an unsuspecting harmony between opposing forces.

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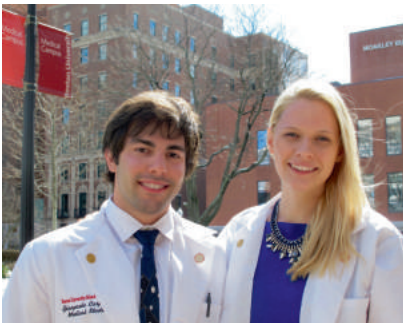
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Health Policy

A Brief Era of Rational Therapeutics: The Trials and Regulations of Chester S. Keefer M.D.

This essay won the Massachusetts Medical Society's 2016 Annual Medical Student History Essay Award.
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Danielle Eble.

Gianpaolo Carpinito and Danielle Eble
Boston University School of Medicine
Class of 2019



Danielle Eble is from Saranac Lake, a small town in the Adirondack Mountains of Upstate New York. She graduated from Boston University's Sargent College of Health and Rehabilitation Sciences in 2014 with a Bachelor of Science in Human Physiology. Danielle then spent a year working on traumatic brain injury research at Boston University School of Medicine, where she later matriculated into medical school in 2015. At BUSM, she remains involved in her research and serves as a co-leader of the Association of Women Surgeons, the American Medical Women's Association, and the Historical Society. In her free time, she enjoys painting, medical illustrating, and eating ice cream.

Gianpaolo Carpinito was raised in Wellesley, Massachusetts and is currently a 2nd year medical student at Boston University School of Medicine (BUSM). He graduated Phi Beta Kappa and summa cum laude from the University of Pennsylvania in 2014 with a B.A. in English Literature and Poetry. Before matriculating to medical school, he was for one year involved in research on induced pluripotent stem cells. At BUSM, Mr. Carpinito was elected the Dean's Executive of his Class of 2019, serves as a chairman of the BUSM Historical Society, and is involved in research on traumatic brain injury. His historical interests lie specifically in the fields of medical, military, economic, and diplomatic history and more generally in the geographic areas of European and North American history. In his free time, Mr. Carpinito enjoys playing ice hockey and playing the piano.

Several recent publications have lamented that aberrant prescription practices have contributed to the rise of yet another antibiotic-resistant strain of *Neisseria gonorrhoeae*. Now, unless this strain is contained, only one antibiotic, ceftriaxone, remains to treat it. This latest headline in the modern media's ballad of "superbugs," however, stands in stark contrast to the predictions of physicians some seventy years ago. Many clinicians practicing during the middle of the 20th-century foresaw a bright future in which a new "wonder drug"

– penicillin – would easily control the disease.[1] Yet, due to the inappropriate prescription of penicillin, gonorrhea rapidly acquired resistance to it. This is an unfortunate tale not only repeated several times in the story of gonorrhea but also in the stories of many other drugs and diseases throughout the past century. Another, if often forgotten, layer of irony emerges when we consider that for a short while during WWII, Massachusetts physician Chester S. Keefer orchestrated a national program that effectively guaranteed the rational prescription of penicillin. In historical context,

Keefer's program presents itself as a logical continuation of advances made in the rational prescription of antibiotics one decade earlier, but the government eventually discontinued his program. We subsequently argue that Keefer's trials and regulations of penicillin during World War II embody a brief era of rational therapeutics situated between the progressive regulation of medicines in the 1930s and the reemergence of problematic prescription patterns of the 1950s.

To place Keefer's story in context, we must first begin with descriptions of "rational therapeutics" and the history of penicillin. In his book, *The Progress of Experiment*, Harry Marks discusses the movement of "rational therapeutics," which began in the second half of the 19th-century. The architects of this movement encompassed a number of physicians who held that "the laboratory study of drug action was the engine of future therapeutic progress." [2] This view hatched a new generation of physicians in the early 20th-century who insisted on "the use of therapeutic agents whose mechanism of action were scientifically established prior to their introduction into clinical practice." [3] The rationalization of therapeutics at this time, therefore, meant the promotion of scientifically proven drugs over the "irrational," ineffective, and often unsafe "elixirs and pills of medicine show fame." [4] Fortunately, such efforts proved successful. By the time of a 1956 lecture, Keefer himself could confidently claim that medical practice had over decades become "less dependent on tradition and... more and more on the application of science throughout its entire range." [5]

As American physicians witnessed the specters of magical medicine recede into the past, efforts at rationalization transitioned from the promotion of proven, effective, and acceptably safe therapeutics to the rational application of a growing arsenal of antibiotics in particular. The focus shifted to, in Keefer's words, "people... being treated on a more rational basis with less empiricism." [6] No incident epitomizes this transition more accurately than the Elixir Sulfanilamide episode of 1937, at which point over one hundred companies freely advertised and sold various, untested mixtures of sulfanilamide and derivative compounds. One such mixture included a sulfanilamide syrup buffered with diethylene glycol, a toxic solvent used in antifreeze. Consumption of this product caused 105 deaths and precipitated a thorough investigation by the Food and Drug Administration (FDA). On one hand, the investigation led the U.S. Government to empower the FDA to regulate medications based on safety, and so ended the era of such irrational concoctions. On the other, the investigation identified that in 100 of the 105 incidents of death, physicians had actually prescribed the poisonous drug, but no legislation addressing this issue

ensued. Moreover, in a number of these cases, the physician had prescribed the elixir for conditions such as "bichloride mercury poisoning, renal colic and back ache" that had no "connection to the infectious diseases for which sulfa drugs were known to work." [7] Still more troubling, physicians prescribed the elixir in spite of recommendations that sulfanilamide – known to cause dangerous disorders of the blood – only be used while under close medical supervision to treat life-threatening conditions for which it was effective. Consequently, the aftermath of the Elixir Sulfanilamide crisis addressed the arm of rational therapeutics dealing with the safety of medication, but it failed to address "irrational" prescriptions by physicians. [8]

Progress later in the century did provide some solutions to the problems left behind by the Elixir Sulfanilamide crisis, but in many ways the irrational application of antibiotics persisted. As medical historian Scott Podolsky aptly illustrated in his book *The Antibiotic Era*, physicians of the postwar era did further the cause of rational care in a number of ways. Prominent examples include the establishment of the controlled clinical trial as the scientific gold-standard in medicine and the passing of the Kefauver-Harris drug amendments (1962) that empowered the FDA to stop the pharmaceutical industry's common practice of marketing drugs for diseases against which they were ineffective. The champions of rational therapeutics, however, did not complete their program during the

postwar era. In particular, "concerns with diagnostic specificity and the inappropriate prescribing of appropriate drugs" [9] remained. In 1954, Ernest Jawetz, a key proponent of a rational therapeutics, claimed that 95-99 percent of antibiotic prescriptions were given inappropriately. Exactly twenty years later, in 1974, another proponent of rational medicine, James Visconti, cited before the Senate Subcommittee on Health a "recent hospital study [that deemed] 73.6 percent of all antibiotic use... irrational or questionable [and] only 7.2 percent of the prophylactic... antibiotic rational" [10] – unacceptable figures by any standard. Indeed, efforts to rationalize prescription patterns would fail in the face of a majority of physicians who opposed

what they saw as an undesirable overregulation of their profession. [11]

Nevertheless, for a brief respite in the 1940s, unique circumstances necessitated exactly this type of undesirable overregulation. On the eve of World War II,

...the aftermath of the Elixir Sulfanilamide crisis addressed the arm of rational therapeutics dealing with the safety of medication, but it failed to address "irrational" prescriptions by physicians.

The time of Keefer's leadership demonstrated the only period in American medicine during which every dose, let alone a majority, of a given therapeutic was prescribed based on the best available knowledge. Hence, we see that Keefer's program rested on two individual but interrelated pillars: the generation of reliable clinical knowledge and the systematic application of that knowledge...

researchers had just begun to explore penicillin as a potential treatment for infection in man. Preliminary trials suggested that penicillin was effective against several highly prevalent – and as of yet uncontrolled – strains of bacteria. Hoping the drug might prove useful to the war effort, the U.S. military expressed interest in organizing large-scale manufacture of penicillin by private industry. Even as American pharmaceutical companies hastened to efficiently mass-produce penicillin, however, overwhelming barriers to efficient synthesis and storage resulted in limited supplies of the drug for the entirety of the war. These circumstances necessitated rationing: a task delegated to Massachusetts-based physician and the Director of the Evans Memorial Department of Clinical Research at Boston University, Chester S. Keefer, M.D. As the appointed Chairman of the National Research Council's Committee on Chemotherapeutics and Other Agents (COC), Keefer executed the unenviable and controversial task (the appointment would earn Keefer the title "Penicillin Czar") of approving or denying thousands of both "rational" and "irrational" requests for the drug. It was in this context that he accordingly defined the early, rational application of penicillin in the clinical setting in order to narrow demand for the drug.[12]

Keefer's place in this narrative becomes quite interesting when we realize that his task was incidentally ahead of its time. To be sure, Keefer was not at the forefront of the successful innovations of the postwar era. In respect to the rise of the controlled clinical trial, for example, we might better situate Keefer as the last of the old guard – conducting trials that would today be considered scientific but rather haphazard. Instead, he was instrumental in achieving, if only temporarily, what rational therapeutics failed to achieve both in the postwar era and up to this date. The time of Keefer's leadership demonstrated the only period in American medicine during which every dose, let alone a majority, of a given therapeutic was prescribed based on the best available knowledge. Hence, we see that Keefer's program rested on two individual but interrelated pillars: the generation of reliable clinical knowledge and the systematic application of that knowledge, which we will consider in that order.

Employing the best-accepted methodology at the time, Keefer directed studies on penicillin's usefulness in clinical cases of infection. As supplies of penicillin grew throughout the war, however, Keefer intermittently adapted his research program. From autumn 1941 to summer 1942 only enough penicillin to treat ten patients was manufactured. Though sufficient amounts of clinical data could not possibly be collected at this time, Keefer realized the significance with which every dose of penicillin must be treated. As he remarked, "dealing with an extremely limited supply of such valuable material it [was] necessary to restrict its use to the cases that would yield the maximum

Keefer wrote, "it was absolutely essential that all penicillin that was made available be used with the greatest of care and with thoughtful planning... it was necessary to set up priorities for use."

information... and to those [cases] in which the drug was considered likely on the basis of preliminary tests to be of therapeutic value." [13] Therefore, Keefer wrote, "it was absolutely essential that all penicillin that was made available be used with the greatest of care and with thoughtful planning... it was necessary to set up priorities for use." [14] The studies that he directed during this phase accordingly yielded "fundamental information about absorption and excretion, the best methods of administration... the necessary dosage [and] the frequency of administration" [15] that would define the framework of further investigation.

In June 1943, expanded production of penicillin ushered in a new phase of Keefer's research that facilitated substantial clinical investigation. Wasting no time, Keefer organized a massive cooperative trial involving twenty teams of investigators. By August 1943, he had already assembled and published a report of 500 cases in which penicillin had been used to treat infections resistant to sulfonamides and those likely to occur in the armed forces. The investigation produced the first set of validated criteria for preparation, dosage, administration, and clinical application. For example, it was confirmed that intramuscular or intravenous routes were preferable to oral administration, as "gastric juice destroys penicillin rapidly at body temperature." [16] Most importantly though, Keefer's study defined the spectrum of the drug's effectiveness: "Penicillin has been found to be most effective in the treatment of staphylococcal, gonococcal, pneumococcal and hemolytic streptococcus infections," he wrote, "it has been disappointing in the treatment of bacterial endocarditis. Its effect is particularly striking in sulfonamide resistant gonococcal infections." [17]

The data from Keefer's studies became of particular use when production of penicillin had grown large enough that the COC could allocate some portion to the treatment of civilian cases. Keefer became inundated with requests for the drug from hopeful patients and physicians alike (see Figure 1 attached). To illustrate the sheer volume of such requests, Adams offers that Keefer had received roughly ten thousand from physicians alone between July 1943-April 1944. As it were, this overwhelming population of cases demonstrated a spectrum of disorders. On one end of this spectrum, many cases naturally included infections known or suspected to be penicillin resistant. On the other, as Adams pointed out, numerous patients and physicians requested the drug for diseases such as glaucoma and cancer, against which there was no reason to believe penicillin might be effective. Instituting a rational approach to the prescription of penicillin, it seemed to Keefer, offered the best and fairest way of rationing the medication. [18]

This leads us to consider the second pillar of Keefer's rationing program: the fact that information from Keefer's research program governed his methodic and rational allocation of penicillin. Take, for instance,

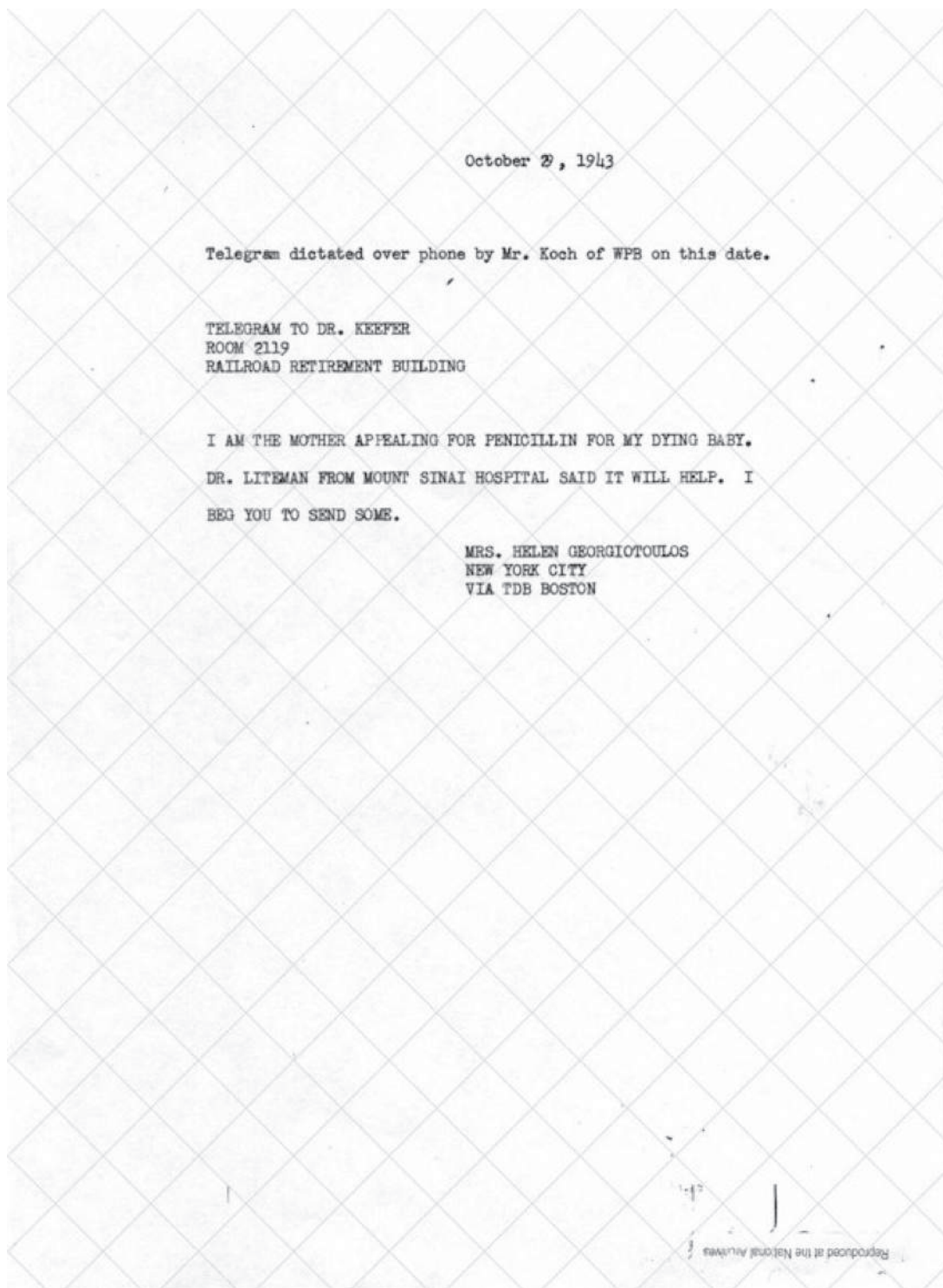


FIGURE 1. A letter from Mrs. Helen Georgiotoulos to Chester S. Keefer M.D. urgently requesting penicillin for her ill child. ("Golden Age of Medicine?":

<http://ccat.sas.upenn.edu/goldenage/state/pub/letters/pages/georgiotoulos.htm>)

Keefer's recommendations for treatment and dosage. In an effort to use every unit of penicillin with the utmost care, these recommendations reached astounding levels of specificity based entirely on information acquired from his studies. In the treatment of gonorrhea, for example, he noted that if penicillin were prepared in oil and wax, one should have administered "three hundred thousand units as a single injection of 200,000 units as an initial injection followed by 100,000 units in twelve hours, or three injections at eight hour intervals of

100,000 units each." [19] If prepared in aluminum hydroxide gel, however, "a single injection of 100,000 units followed no later than two or three hours by oral doses of 40,000-50,000 units every two or three hours for six doses per day for one to two days." [20]

In similar fashion to his recommendations on dosages, Keefer informed his judgment of requests for penicillin with information gathered from both his bacteriological and case studies. On the most basic level, Keefer implemented a heuristic defined by the results of

his clinical trials. It placed civilian cases in three groups: "1) those to be denied the drug, 2) urgent cases with penicillin-sensitive conditions, and 3) 'cases in which penicillin might be of value.'"[21] To reliably categorize these cases, Keefer also demanded a "complete medical and bacteriological case history." [22] Under this rubric either Keefer himself or his associate at Boston University School of Medicine, Dr. Donald G. Anderson, would decide whether to approve treatment of a case with penicillin. "All requests received from physicians and others were carefully considered," [23] Keefer remarked, based entirely on whether a case was penicillin-sensitive or presented any value to his research program. In many ways, Keefer's systematic approach reflected a concern that penicillin might be squandered on untreatable cases. Through this "top-down" approach, he assured that physicians would use penicillin only against penicillin-sensitive illnesses (see Figures 2, 3 attached). [24]

We anticipate several objections to the rationality of this program. For one, by 1944 it became known that penicillin was in fact effective against subacute bacterial endocarditis (SBE) even though Keefer's initial studies denied this. Also, despite this new finding, his policy remained unchanged. While these facts are troubling, one should recall the circumstances. First, to reiterate a previous point, Keefer sought to gather a vast array of clinical data with great urgency and little time. Additionally, Keefer used the best accepted methods of his day, and in some ways even innovated upon them. His methods were greatly in-

Now, with new, multi-drug resistant "superbugs" on the horizon and the onset of a "post-antibiotic era" declared by some, the fact that at least some aspects of Keefer's remarkably successful system were never permanently adopted appears one of the great tragedies of 20th-century medicine

formed by scientific principles, which allowed him to make decisions based on the best available data. Second, as Adams described, Keefer refused to change his policy on SBE for reasons of scarcity and perceived fairness rather than on account of obstinacy. One might also object that the system did not prevent physicians from disobeying Keefer's policies once those physicians acquired penicillin from the COC. Although such instances did occur, they occurred very rarely. The reasons why few abuses transpired are beyond the scope of this paper. Suffice to say, factors may include that Keefer very clearly expressed his expectations to physicians and that he very carefully preserved the authority of the COC. [25]

The great ironies in this narrative remain that the U.S. Government entirely discontinued Keefer's regulation of penicillin and that problematic prescription practices returned to medicine shortly thereafter. The penicillin shortage accordingly served as the turning point in the movement of rational therapeutics that never really turned. At a key moment in history, infections were treated with government

regulated and scientifically validated antibiotics. Additionally, the use of bacteriological studies to confirm every diagnosis before the prescription of penicillin illustrated a great advance in rational therapeutics. Yet, no less than a decade after the discontinuation of Keefer's rationing system, a clinician would lament that "this type of [antibiotic] therapy demands a painstaking search for the specific offending organism and in no way justifies [the] 'shotgun' treatment without an etiologic diagnosis" [26] that abounded once again. Now, with new, multi-drug resistant "superbugs" on the horizon and the onset of a "post-antibiotic era" declared by some, the fact that at least some aspects of Keefer's remarkably successful system were never permanently adopted appears one of the great tragedies of 20th-century medicine.

At this point, it is obvious what can be learned from Keefer's rationing of penicillin, but which lessons ought to be applied remains a harder question to answer. To place this information in context, we briefly highlight two broad strategies that have been employed to address irrational prescription patterns during the past century: education and regulation. As described by Podolsky, educational approaches have aimed to preserve the physician's autonomy in the medical decision-making process but have left no incentive for physicians to follow recommendations. Thus they have proved largely ineffective. On the other hand, regulatory approaches like Keefer's have historically achieved great success. These efforts, however, have met considerable opposition from the U.S. medical community due to negative consequences on physician autonomy and the timely delivery of healthcare. [27] While the authors of this essay agree that a rationing system identical to Keefer's is undesirable and unnecessary, today's rising frequency of antibiotic resistant microbes demands intervention. As antibiotics progressively lose their efficacy against currently treatable diseases, so vanishes a pillar upon which so many of our medical procedures and treatment plans rely. It is, therefore, worth considering whether the adoption of certain aspects of Keefer's system are necessary in order to preserve the practice of modern medicine as we know it today.

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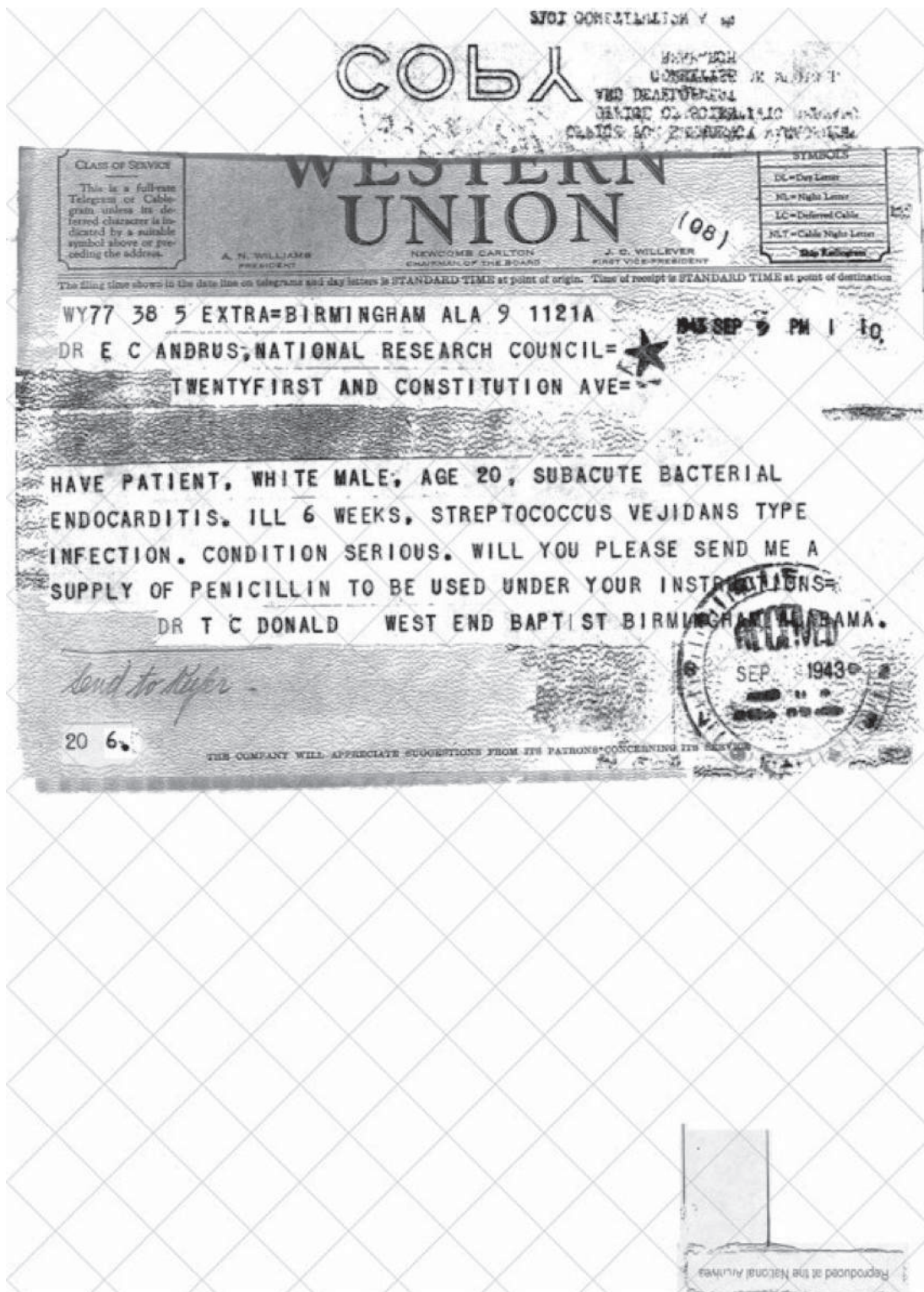


FIGURE 2. A telegram from one Dr. T.C. Donald of Birmingham Alabama requesting penicillin for a patient afflicted by subacute bacterial endocarditis. ("Golden Age of Medicine?":
http://ccat.sas.upenn.edu/goldenage/state/pub/letters/pages/donald_telegram.htm)

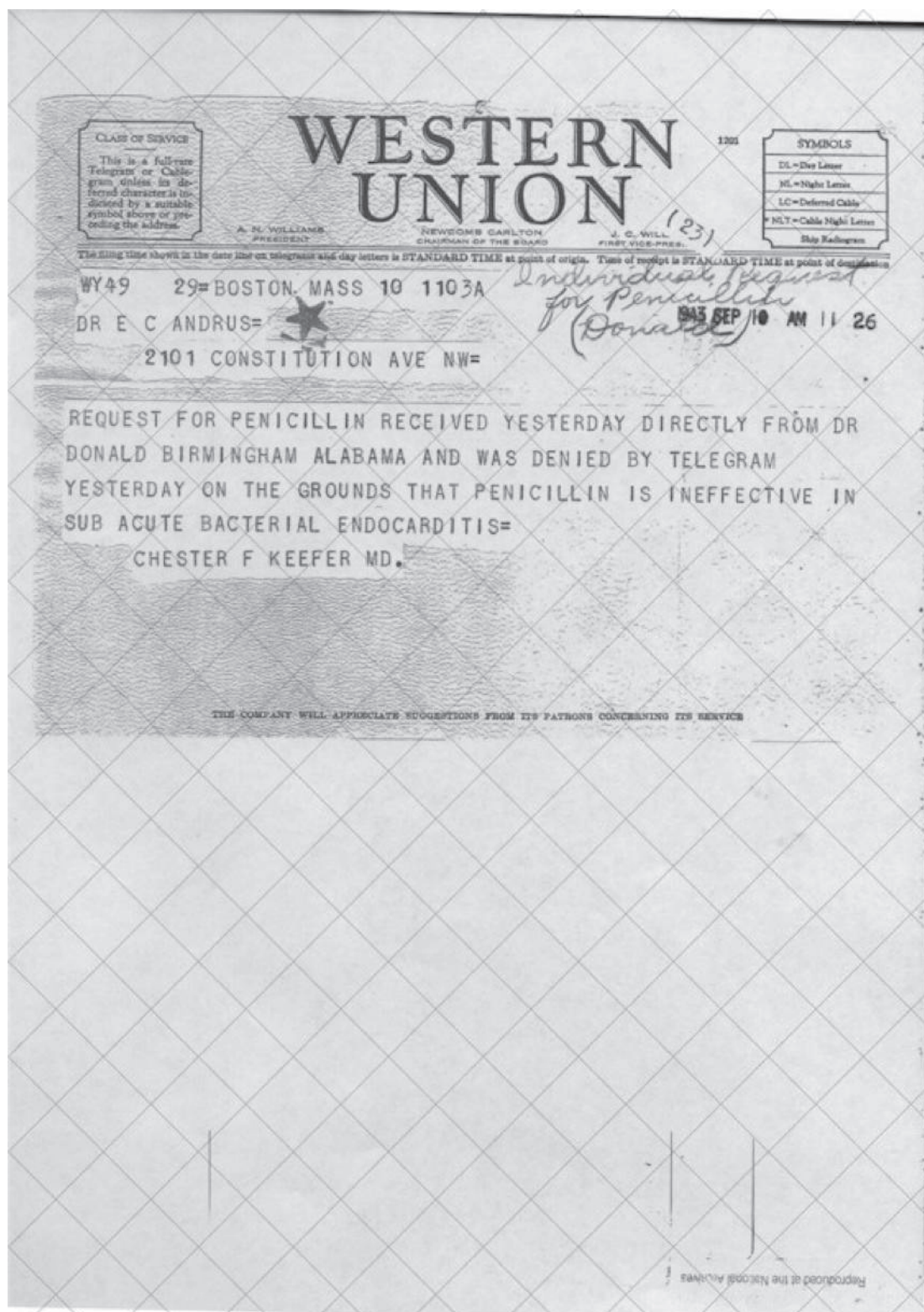


FIGURE 3. A telegram from Chester S. Keefer confirming his denial of Dr. T.C. Donald's request from Birmingham, Alabama. ("Golden Age of Medicine?:
http://ccat.sas.upenn.edu/goldenage/state/pub/letters/pages/telegram_re_Donald.htm)

Health Policy

The Medicalization of Reproductive Healthcare:

Has it Helped or Hurt the Movement? A Commentary

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Reproductive healthcare continues to be one of the most controversial areas of medical care. While the medical field is intimately involved in the revolution of women's reproductive healthcare, there is reluctance in the field to support these efforts. For example, physicians perform approximately 1 million abortions in the United States every year, yet only 1720 physicians in the country are identified as abortion providers and 89% of state counties lack a provider [1]. Organizations like the American Congress of Obstetricians and Gynecologists (ACOG) and the American Medical Association (AMA) currently support reproductive healthcare. Yet, doctors also played a role in making abortion illegal in this country in the first place.

It is unclear if the relationship between women's rights advocates and physicians (and their organizations) advanced women's reproductive healthcare forward. Has the medicalization of abortion or the professionalizing of birth control helped improve access, reduce stigma, or improve quality care? How does Margaret Sanger's attempt to incorporate

professionals in reproductive health go against the trends to push over the counter birth control? This article reviews the history of this multifaceted association, evaluates the effectiveness in this collaboration, and outlines what steps both sides need to take to improve reproductive health.

Women have used birth control and abortion for as long as they recognized that they could become pregnant. In the first two centuries of the United States, Victorian ideals framed values about reproductive health. Women healers passed down birth control and abortion practices to local women. Meanwhile, as Christian religiosity increased, indecency laws became more popular, culminating in the Comstock Act (1873) that prevented the use of birth control as part of preventing the advertising or sales of "obscenities" [2].

In the 1910s, as women suffragettes pushed towards the right to vote, others advocated for reproductive control. Margaret Sanger was one of the most prominent leaders in the development of public interest in contraception, coining the term "birth control" in 1915 [3]. Her goal was to make birth control

a human right to advance the political status of women. The idea of birth control became so popular that women started to take action, opening illegal birth control clinics where information could be distributed and diaphragms fitted by nurses [3]. At its origin, these efforts combined a multifaceted approach of providing factual information about birth control as well as a grassroots effort to spread the word about this women-centric reproductive need.

While she placed diaphragms herself, Sanger knew that partnering with physicians was crucial to legally maintaining her clinic. She gained favor by promoting birth control as an essential part of medical care, controlled solely by physicians [2]. Many opposed Sanger's proposal. Her opponents advocated that it was not yet proven that birth control was safe, and while they harbored her social conservative views; they ostracized doctors associated with her as "quacks" [3]. However, by framing the conversation that doctors should be in charge of birth control distribution and giving physician autonomy in reproductive healthcare, people credit Sanger as the beginner not only of "birth control" but in reframing control from being in the women's hands to doctors'.



FIGURE 1. Photograph of Margaret Sanger (1879 - 1966). Jan 1917. Courtesy of George Grantham Bain Collection (Library of Congress)

While Sanger played a prominent role in bringing doctors into reproductive healthcare through contraception, the official medicalization of reproductive healthcare can mostly be attributed to the development of the birth control pill in 1957. Funded by

Katherine McCormick, a wealthy woman very interested in promoting women's interests and good friend of Margaret Sanger, scientist Gregory Pincus developed Enovid, the first birth control pill [4]. While it was initially marketed to help with infertility and menstrual irregularity, Pincus used grassroots methods to allow women to spread the word about its contraceptive benefits until demand was so high that he could approach the FDA for approval and market it as such [4]. Doctors and women's grassroots activists both benefited from pushing women's reproductive healthcare forward - women had little political power to get the pill outside of a medical field where doctors could provide it for them. Thus the struggle to provide contraception solidified the relationship between advocate and physician.

Doctors took a very different stand in abortion care than they did contraception. Earlier versions of the Hippocratic Oath mention abortion directly; however, many argue that this translation of the text is improper; others attest that Hippocrates owned his own set of dilators [5, 6]. In the early 1900s, Grassroots provision by both doctors and other practitioners like midwives and local healers made abortion incredibly accessible and abortion was legal under common law until 'quickening' or the sense of fetal movements [7, 8]. However, things quickly changed with the establishment of medicine as a more exclusive profession.

In the 1850s, the United States became more industrialized and urbanized, shifting the practice of medicine from local healers that could provide basic medical care to the development of medical schools and licensing medical professionals. The newly formed AMA aimed to bring professionalism to the field and make medicine more exclusive to drive down competition from local healers [8]. Physician organizations used abortion as a wedge issue to establish themselves as the elite providers of medical care, with the president of AMA leading a mission to promote the criminalization of abortion in 1857. Physicians argued these laws protected women from "quack" abortionists, petitioning state legislatures to pass anti-abortion laws. With this shift, doctors successfully transformed the conversation about abortion into a moral and medical debate at once.

After this point and until Roe v Wade legalized abortion in 1973, performance of abortions became increasingly more dangerous. People in the medical field played varying roles. Midwives and homeopaths continued their practice of abortion care but became more ostracized. Even physicians that provided safe abortions were labeled as "quacks" [7, 9]. This also led to the concept of the "back-alley abortionist", which continues to remain a polarizing image of the type of doctors that perform abortions [9]. However, through this came underground networks, women's rights

It is unclear if the relationship between women's rights advocates and physicians (and their organizations) advanced women's reproductive healthcare forward. Has the medicalization of abortion or the professionalizing of birth control helped improve access, reduce stigma, or improve quality care?



FIGURE 2. Photograph of Margaret Sanger, surrounded by twelve other women. Underwood & Underwood Studios. N.Y. Courtesy of Margaret Sanger Papers (Library of Congress)

FIGURE 3. Photograph shows women and men sitting with baby carriages in front of the Sanger Clinic. 1916 October 27. Courtesy of the New York World-Telegram and the Sun Newspaper Photograph Collection (Library of Congress)



groups and physicians collaborated to send women seeking services to safe places. These examples showed how women's advocacy groups and medical professionals could come together and provide care to women, despite its illegality.

This is in stark contrast to the medical professionals who would provide abortions. Hospitals would generate "therapeutic abortion committees" where physicians seeking abortions for their patients would present their cases and seek approval by the board [9]. Doctors were also legally obligated to both report their patient and the provider of her abortion care to the police if she was one of the thousands of women presenting with post-abortion complications [9]. This medicalization of abortion care in a sense turned its back on women, whether they wanted to or not. So doctors on both sides created narratives that would later be used on both borders of the current abortion debate.

Doctors did play a symbolical role in the decision in *Roe v. Wade*. Justice Blackmun, who wrote the *Roe v. Wade* decision, had a health law history and was profoundly interested in protecting the rights of physicians. If you read the *Roe v. Wade* decision, it is

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clear that he sees abortion as part of a right to privacy between the doctor and patient and should be made with the physician's best judgement [10].

Since *Roe*, a common argument in the prochoice movement is that abortion should have the same respect and political standing as "any other medical procedure". This medicalization of the abortion procedure itself has had benefits and problems. If we consider that abortion is a surgery performed by a doctor, it makes sense that it should fall under the same restrictions as a colonoscopy. The problem is that now the social meaning of pregnancy is so deeply personal that it fuels pro-life rhetoric and does not allow one to separate the two (despite the legality of separating beliefs from legislation). Secondly, pro-life proponents utilize this concept against pro-choice advocates in the form of TRAP laws (Targeted Regulation of Abortion Providers), with pro-life legislators arguing to place the same ambulatory surgery regulations even if these laws are not medically necessary.

While individual providers may already feel isolated in their provision of abortion services, it is exacerbated by the lack of support by national organizations like ACOG and AMA. ACOG, for



FIGURE 4. Photograph shows women and men sitting with baby carriages in front of the Sanger Clinic. 1916 October 27. Courtesy of the New York World-Telegram and the Sun Newspaper Photograph Collection (Library of Congress)

example, historically opposed abortion provision prior to Roe. The ACGME issued requirements that OB/GYN residencies must make abortion training routine, and even though this was supported by groups like Medical Students for Choice, there was backlash leading to Congress passing the Coats Amendment—essentially cancelling out the ACGME’s requirement [11]. The University of California San Francisco established two training programs with private funding, the Ryan Residency Training Program in Abortion and Family Planning as well as the Fellowship

in Family Planning, to give further training in clinical, research, and advocacy skills related to reproductive health [11]. Other medical specialties like Family Medicine and Internal Medicine as well as advanced practice clinicians are expanding training as well [11].

While there is much change and hope in the medical field, women are not waiting for medicine to help advance the cause of reproductive health. In fact, women’s advocates have formed different organizations to continue the fight for

reproductive healthcare access. A major advancement in the movement is the concept of human rights and the reproductive justice framework. While Sanger and advocates of her day may have understood birth control as part of increasing rights of women, the framework of human rights allows advocates to express the importance of control over one’s reproduction in a

broader context. “Reproductive justice”, coined by SisterSong, a reproductive rights advocate group, brought the racial issues of black women into the. Verging information about reproductive coercion, for example, shows the intersection between this new reproductive justice framework and physician roles in reproductive health. As Gomez puts it when discussing Long Acting Reversible Contraception (LARC) and coercion, “persistent racial and socioeconomic inequality colors the daily lives of both providers and patients, and is inextricably embedded in clinical encounters” [12]. With such a miscommunication or even directly contradicted goals, perhaps doctors should be left out of the equation.

It seems that after all the work Margaret Sanger did to promote birth control through medicalization, the tide is turning backwards. Activists are bringing reproductive healthcare back into women’s hands. Over the counter birth control has recently passed in California and Oregon, supported by an effort for women to access the most common forms of birth control including the pill [13]. Similarly, there is increasing support to allow women to self-induce abortion using medication. With more abortion restrictions targeting abortion providers and forcing closure of clinics, women are seeking alternative means to abort a pregnancy. It’s interesting to think Sanger’s approach for medicalization took the exact opposite approach. Could this tactic have worked in her time? Unlikely. Women at that time had little to no political authority to protest to get a professional organization to change policy. Sanger garnered political support through relentless grassroots efforts with local doctors, not a strategy attacking legislation altogether. Moreover, while some doctors hesitate about safety, groups like ACOG support the move [13].

The question remains as to whether the

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medicalization of reproductive healthcare was beneficial. Women have held onto reproductive healthcare as folklore and intimate family traditions for centuries only to have medicine take over. Yet it's unclear if birth control would have advanced if it did not have the support by medical professionals leading to the birth control pill. But doctors' support of coercive birth control practices illustrates the need for women's reproductive justice advocates to remind the medical field of their role. The AMA and ACOG significantly affected abortion rights, initially with criminalization followed by their silence when women fought to improve abortion access and quality of care. While there is still not a great support network for those fighting for abortion care in areas where these services are marginalized, there is hope. Physicians are increasingly becoming public advocates in an effort to provide voices for their marginalized patients. One could see the AMA and ACOG's joint amicus brief in support of overturning HB2 in Texas as extending an olive branch to those in reproductive justice advocacy [14].

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The next step to mitigate the complex relationship between the medicalization efforts of doctors and reproductive advocate's grassroots may actually be very simple. They need to talk to each other. The forging of the alliance benefits both sides by forming a larger voice to help promote women's reproductive issues. Women advocates could speak to the human rights struggles of women trying to use reproductive control as a means of leveling the playing ground and ask physician groups to help support better access to normalize this care in their practice. Physicians in turn could speak to the struggles of obtaining training in these practices, the lack of support from the big professional organizations, and ask their partners in the reproductive justice advocacy to bring their protests to improve support and safety of providers. It seems that women and doctors have a lot to learn from each other. If the two would make an effort to learn from each other's perspectives, they could work more jointly to make quality and accessible reproductive healthcare a tangible reality:

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Disease

Scurvy in the 19th and 20th Centuries

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Dr. Robert Beazley was educated at the University of Maryland completing his Surgical Residency at Maryland and the University of Edinburgh. An academic surgeon since 1970 with a major interest in surgical oncology and endocrinology, he retired from BUSM in 2004.

During his military service time, 1964-65, he served as the Medical Officer and Officer in Charge of the Amundsen-Scott South Pole Station, Antarctica. Historically, scurvy was extremely common in most polar expeditions. Yet, Beazley has never seen a case of scurvy, which raised his historical curiosity about this mysterious and ancient malady.

At the beginning of the 19th century the accumulated empirical knowledge concerning prevention and treatment of scurvy was truly remarkable. Sir Gilbert Blane's work demonstrating the dietary effectiveness of citrus and fresh vegetables both in the prevention as well as the treatment of scurvy, combined with his astute political skill in convincing the British Admiralty to utilize antiscorbutics on naval vessels freed the British Royal Navy of this centuries old scourge. This remarkable feat was accomplished solely with empirical observation and basic data collection without understanding the causative mechanisms which would remain elusive until the early twentieth century. However, in the interval, for the common man, scurvy would flourish, as the nineteenth century accomplice of the "four horseman of the Apocalypse."

Scurvy and Famine

By 1850 steam propulsion was successfully competing with sail power, allowing more direct and shorter voyages so that seamen were not at sea for months and

thus less libel to incur scurvy. Nonetheless, cases occurred among merchant seamen as there were no British laws requiring merchant vessels to provide citrus and fresh vegetables for their crews. Ship owners avoided the provisioning expense until 1848 when a law was passed requiring antiscorbutics be provided on merchant vessels.

In 1822, British prison officials, responding to taxpayer's outrage that prisoners were fed better than the honest poor, sharply reduced rations of fresh vegetables and potatoes. The new National Penitentiary at Milbank, London (present site of the Tate Museum) reported in 1825 that over one half of their 860 inmates had signs of scurvy. Restoration of the previous diet with the addition of three oranges per day quickly resolved the outbreak. In 1843, Baly studied a subsequent outbreak at Milbank among a group of military prisoners provided an especially harsh diet which did not include the standard civilian ration of meat, 5 pounds of potatoes and one onion per week. This outbreak was easily controlled by the weekly addition of 8 pounds of potatoes (one potato contains

about 18 mgm. of ascorbic acid). Baly proceeded to survey a number of county jails and found scurvy where potatoes had been eliminated or restricted. He observed that scurvy usually occurred in prisoners whose sentences were longer than 3 months and was most commonly seen in those incarcerated for longer than 6 months. [1]

Two years later, in the summer of 1845, Northern European potato crops were attacked by a fungus of the genus *Phytophthora infestans* causing

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devastating crop failures which would continue until 1849. "Land scurvy", as it was known, was unusual in Scotland and Ireland following the introduction of the potato in the early 17th century. Subsistence living of Irish peasantry was heavily based on the potato and while occasional crop infections had occurred in the past they had been localized and of limited duration. This "blight" involved the entire country as well as much of Northern Europe "A

situation of the kind such as developed in Ireland, had not been experienced in Europe since the Black Death. While some of the rich may have become poorer, the entire poor of the country were left completely destitute.[3]" The poor, weakened by famine and scurvy, became subject to other diseases such as relapsing fever, dysentery, cholera and typhus. The Irish population fell from 8,175,121 in 1847 to 6,552,235 in 1851 as a direct result of famine and disease. The Census Commission calculated that had the calamity not occurred, the total population in 1851 would have been 9,010,798. As a result of the potato famine, scurvy and accompanying diseases, Ireland was poorer by nearly 2 ½ million people.[4]

Interestingly, scurvy occurred in the United States during same time (1848-1850) in the many thousands of migrants who travelled to the California gold fields especially by the land route while existing on a diet of flour biscuits and salt pork.

Scurvy and War

Scurvy joined war and other three horsemen of the Apocalypse in 1854-56 during the Crimean War. Initially, British troops suffered from scurvy while 20,000 pounds of lemon juice lay in the holds of supply ships waiting to be off loaded in the harbor at Balaclava. Between December and February 1854, there were 1,600 hospital admissions for symptoms of scurvy. [5] However, French allies suffered

more bitterly. Of 4,000 sailors manning six French warships, 1,000 became scorbutic, while on the land, French hospitals were crowded to the "point of suffocation, with scurvy accounting for five cases out of six". [6] The French authorities did not subscribe to scurvy prevention and continued to provide foods which had been deemed antiscorbutic by Napoleon's armies; vegetables, fresh bread, fresh meat, wine and coffee. [7] At one point, French soldiers were instructed to pick dandelions and make salads in order to stave off scurvy. The French military authorities persisted believing that citrus was not a scurvy preventive even up to June, 1917 when a serious outbreak occurred on the Western Front. [8]

In the next decade, scurvy would appear in the camps, the prisons and on the battlefields of the American Civil War. Union Medical Director Jonathan Letterman wrote of scurvy, "This disease is not to be dreaded merely by the numbers it sends upon the reports of sick. It goes much farther, the causes which give rise to it undermine the strength, depress the spirits, take away the energy, courage, and elasticity of those who do not report themselves sick, and yet are not well. They do not feel sick, and yet their energy, their powers of endurance, and their willingness to undergo hardship are in a great degree gone, and they know not why. In this way it had affected the fighting powers of the army, and much more than was indicated by the numbers it had sent upon the reports of sick." [9]

Scurvy was also especially virulent with a high mortality in the prison camps of both combatants. Scorbutic prisoners provided prophylactic smallpox vaccinations were observed to develop vaccination site infections, which progressed to sepsis and death. Scurvy was often associated with common camp diseases like malaria, cholera, typhoid fever, typhus, diarrhea and dysentery.

General W.T.Sherman wrote in his autobiography "The railroad taxed to its utmost capacity to provide necessary ammunitions, food, and forage while it could not be possible to bring us an adequate supply of potatoes and cabbage, the usual anti-scorbutics, when providentially the black berries ripened and proved an

Union Medical Director Jonathan Letterman wrote of scurvy, "This disease is not to be dreaded merely by the numbers it sends upon the reports of sick. It goes much farther, the causes which give rise to it undermine the strength, depress the spirits, take away the energy, courage, and elasticity of those who do not report themselves sick, and yet are not well

admirable antidote, and I have known the skirmish line, without orders, to fight a respectable battle for possession of some old fields which were full of black berries. Soon, there after, the green corn or roasting ear came into season, and I heard no more of the scurvy. Our country abounds with plants which can be utilized for the prevention of scurvy; besides the above, persimmon, the sassafras root and bud, wild mustard, the "agave", turnip tops, the dandelion cooked as greens and a decoction pine leaf". [10]

Scurvy next surfaced in the Franco-Prussian War during the siege of Paris which commenced in mid September 1870 and ended in

February 1871, a period of 4 ½ months. The disease was initially seen in the Parisian prisons and hospitals where records were kept, and subsequently in the general population because fresh vegetables and fruits were unobtainable. Potatoes and onions were quickly replaced by white rice and beans and meat was unavailable. The epidemic subsided at the end of the siege with the availability of fresh vegetables and potatoes.

Polar Scurvy

From approximately 1850 until 1915 explorers regularly explored polar regions by ship. Scurvy was a constant escort on these expeditions. Even the British Navy, despite their previous successes with scurvy prevention and treatment, suffered severely from the malady. If antiscorbutics were regularly employed, most British expeditions remained relatively free of scurvy for up to about two years. In 1850, as a cost saving move, the British Navy switched from Mediterranean lemons to limes, grown in West Indies. At that time, it was not known that limes contain less ascorbic acid than lemons or oranges. Also the preparation of the lime juice was not as tightly controlled. These factors definitely confused the scurvy picture towards the latter half of the 18th century.

The Franklin expedition, seeking a Northwest Passage, embarked from the Thames River in 1845 and was never heard from again. For years, search and rescue missions were repeatedly plagued by scurvy. In 1984, a Canadian team found human bones from the Franklin expedition which showed "areas of shallow pitting and scaling" on the outer surface of the bones like those seen described in cases of scurvy. [11] The team also unearthed graves of three of the Franklin crew, whose autopsies revealed lead levels twenty times that considered a safe upper limit. Presumably the lead came from the solder used in sealing the tinned food containers. At the time a prevailing scurvy theory was related to tinned meats, which might harbor bacteria capable of making toxins that could cause scurvy, the "ptomaine" theory. The Norwegian explorer, Fridtjof Nansen spent three years in the Arctic with his last year on Franz-Joseph Land living entirely on fresh meat without experiencing scurvy. Scurvy did not occur among the Greenlanders who had no access to fresh green vegetables, lemons or oranges but instead lived on large quantities of uncooked or lightly cooked fresh meat. Authorities began to seriously question the effectiveness of lemons and limes. Up until this time, many had considered lemons and limes as interchangeable. Finally in 1913 major antiscorbutic differences between the two fruits were revealed which went a long way in explaining the unsolved Arctic mysteries. But up until then, the "ptomaine theory" seemed to best explain the clinical observations. Most expeditions used "tinned" meats as food which some held could be theoretically "tainted" with bacteria capable of producing toxic products that cause scurvy.

Subscription to the "ptomaine theory" would spell disaster for the famous 1901 and 1910 Antarctic expeditions of Captain Robert Falcon Scott. Numerous

members of his 1901-04 expedition suffered from scurvy including the leader, Robert Scott. Ernest Shackleton, together with Captain Scott and Dr. Wilson managed to get close to the South Pole (82° 17'S) but were forced to turn back when all three became scorbutic. Shackleton was so severely afflicted that following his recovery, Scott ordered him to return to England. The 1912 Antarctic expedition was somewhat similar with Scott insisting on using tinned meats (after inspection for "ptomaine" by the Expedition's physician) chiefly because he had strong feelings against killing seals and penguins for food - seal liver is now known to be high in Vitamin C. While on the trail men ate a diet of white biscuits and pemmican which consisted of grain, oil and sugar, high in calories but devoid of any ascorbic acid and very low in B Vitamins as well. Their daily intake was 4,400 calories although they realistically would have required 6000 calories while man hauling their 200 pound sledges to and from the South Pole.



FIGURE 1: Photograph of So. Polar Expedition – Capt. Scott and his exploration ship: TERRA NOVA. Courtesy of the George Grantham Bain Collection (Library of Congress)

This author spent 13 months of his military service time as the Officer in Charge of the Amundsen-Scott South Pole Station, 1964-65, where he met an NBC correspondent who provided the author copies of taped interviews he conducted while on assignment in the Antarctic. [12] Included was an interview with Sir Charles Wright, a young physicist who had been part of the 1910-12 Scott expedition. During a one hour interview Wright revealed numerous interesting details of his experience on the "Ice."

Scott departed for the South Pole on November 2, 1911 having laid out food and fuel depots along the intended Ross Ice Shelf and Beardmore Glacier route towards the Polar Plateau during previous summer (Nov. to Feb. of 1910-11). Wright said "we lacked physical conditioning. Went down hill from the day we started. We knew about scurvy but lacked antiscorbutics". Reaching the top of the Beardmore Glacier (10,280 feet) and onto the Polar Plateau with only 169 miles remaining to the Pole, Scott decided, at the last minute, to add Captain Titus Oates to his four man "Pole" party. According to plan, the remaining three supply team members without Oates turned back to the McMurdo winter camp. Scott's decision

compromised the previously allocated amounts (planned for four men) of staged food and fuel available for his five-man team on their return trek back from the Pole. Lt. Edward Evans, one of the three men returning to McMurdo base, became severely scorbutic while descending the Beardmore Glacier and had to be dragged to McMurdo by sledge. Sir Charles Wright recalled that Evans improved dramatically within seven days of eating 3 or 4 onions.

Scott's team arrived at the Pole on January 17, 1912 – 77 days en route, and one month and two days after the Amundsen's Norwegian team planted their flag at the Pole. Scott and his four mates turned northward and began dragging their sledges the 800 miles back to their McMurdo Sound base. Along the way, Chief Petty Officer Evans sustained a hand laceration that was not healing. Evan's strength slowly deteriorated and while descending the Beardmore Glacier both he and Scott had to be rescued following a fall into a crevasse. Scott recorded that Evans became increasingly "stupid and confused" and within two weeks lapsed into a coma, dying in his sleep on February 18th. Scorbutic wounds do not heal, even old well healed wounds can break down and small blood vessels become brittle. The party felt he might have had a brain bleed resulting from his fall into the crevasse. Army Captain Titus Oates' old Boer War femur fracture became increasingly painful. He developed severe frostbite and gangrene of his feet and could no longer pull his sledge. Realizing that his end was near and perhaps not wanting to be a burden, on March 17 Oates walked off at the start of a ten day storm which would ultimately kill his three mates.

The rest is history, not enough food or fuel and finally not enough time. Searching in the Spring, Wright said he spotted the tip of Scott's green colored tent sticking just above then snow surface. Digging the tent out they found the bodies of Scott, Bowers and Wilson, 130 miles from the McMurdo base and only 11 miles from "One Ton Cache" which could have possibly saved their lives. Scurvy was not mentioned in the final report or in Scott's last diary entry of March 29, 1912.

The Pole party had been without ascorbic acid for four and one half months and at the very least had been suffering the early stages of scurvy, struggling with all the disabling early "symptoms" succinctly described by Dr. Jonathan Letterman in his Union soldiers. Additionally, Scott's party had been on starvation rations for weeks, while man hauling sleds some 1566 miles, and with temperatures of minus 50 to 70 degrees Fahrenheit towards the end. Wright said that Scott insisted each man's daily ration be precisely packed so they knew that by the end of March, the Pole Party had would have exhausted all their allocated food and fuel supplies.

Infantile Scurvy

Toward the end of the 19th Century, the scurvy story becomes even more difficult to understand. Added to

the confusion was an observation made in London by Dr. Cheadle, of a ten month old infant fed on condensed milk originally thought to have rickets in whom he made a diagnosis of scurvy. Cheadle soon saw two additional patients whom he reported in the Lancet. Barlow reported several more cases in 1883, confirmed Cheadle's observations and diagnosis while adding post mortem findings that were exactly those Lind had seen in his sailors in 1772. Soon additional cases were reported from the US and the Continent and the Germans began to refer to the disease as "Barlow's Disease." [13]

In 1897 the American Pediatric Society reviewed 379 cases of infantile scurvy and found most had received condensed milk, pasteurized milk, sterilized milk, or propriety foods in water. They concluded that "the further the infant's diet was in character from natural food of an infant the more likely its use is to be followed by the development of scurvy." [14]

Condensed and pasteurized milk had been quickly adopted by affluent parents.... whose infants became candidates for scurvy since ascorbic acid deteriorates at high temperatures. The disease was not seen among the lower economic classes who could not afford condensed milk and relied on breast-feeding. Perhaps Barlow's disease could be classified as "scurvy due to technological advance"? Cases of Barlow's disease continued to occur until after World War 1.

Scott departed for the South Pole on November 2, 1911 having laid out food and fuel depots...Wright said "we lacked physical conditioning. Went down hill from the day we started. We knew about scurvy but lacked antiscorbutics"



FIGURE 2: Axel Holst (1860-1931) Professor Hygiene and Bacteriology, University of Oslo. Discovered that guinea pigs could not synthesize ascorbic acid. Developer of "guinea pig assay." Courtesy Univ. Oslo

Scurvy, Science and Serendipity

About a century after the British Navy began supplying citrus to its ships, essentially eliminating scurvy at sea, another happening occurred which ultimately paved the path to the final understanding of scurvy at its most basic level. In 1907 two Norwegians, Axel Holst and Theodor Frølich, published what some believe is the single most important paper in the field of scurvy. They began their research studying the problem of “ship beri-beri” which appeared in Norwegian seamen after the government instituted the use of white wheat flour for bread in place of the traditional hard rye flour bread. (beri-beri is caused by a dietary deficiency of Vitamin B-1, thiamine and maybe associated with diets consisting polished white rice. Thiamine is found in the rice husk as well as the husk of other grains and is lost during the milling or polishing process)

The researchers were dissatisfied with their pigeon model of beri-beri and theorized that a mammalian model might more closely resemble the human disease. Dogs were too expensive and they did not want to work with rats so the guinea pig was chosen. Guinea pigs were exclusively fed a diet of bread made from milled grain which resulted in death occurring in most animals by thirty days. Examination of the carcasses showed hemorrhage in the muscles of the hind limbs and the ribs. Microscopic changes in the bone and cartilage resembled those associated with infantile scurvy and were classically consistent with scurvy. With this model they showed that milk heated to 100 degrees C lost its antiscorbutic activity and that germinating peas and grain showed significant antiscorbutic activity. Their studies received relatively little notice and after 1913 funding restrictions prevented continuation of their studies. [15] Wilson, writing in 1975 summed up their contributions: “They had shown that scurvy could be produced by diet and cured by diet. Of the three theories then existing: infection, toxication and faulty diet, only the last was supported by their findings “. [16] Serendipitously, Holst and Frølich had chosen one of the very few mammals unable to synthesize ascorbic acid.... A (THE) model for human scurvy!

With the out break of WW1, work on scurvy intensified at the Lister Institute of Preventive Medicine in London, utilizing the guinea pig assay, to understand and minimize the loss of antiscorbutic activity that accompanied cooking and preservation of vegetables. Surprisingly, studies of various citrus juices revealed that fresh lime juice possessed approximately one quarter the antiscorbutic activity of fresh lemon juice. [17] Harriette Chick and her group of female researchers (all the men were away at the War) carried out very basic research using the guinea pig model. This and other data gathered by the Lister Institute group was extremely useful to the WW I war effort during which scurvy once again raised its ugly head, particularly among troops fighting in the Middle East. The next step was to characterize and isolate the active antiscorbutic agent. A Hungarian scientist, Albert Szent-Györgyi began work in 1928 on reducing substances in plants, eventually isolating crystals of hexuronic acid.

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In 1932, Svirbely and Szent-Györgyi utilizing the guinea pig assay, documented that hexuronic acid was indeed the antiscorbutic factor. [18]



FIGURE 3: Dame Harriette Chick (1875-1939)
Prominent British female protein biochemist with an international reputation. Courtesy of Wellcome Trust

The Nobel Prize in Physiology or Medicine, 1937, was awarded to Dr. Albert Szent-Györgyi “for his discoveries in connection with the biological combustion process, with special reference to Vitamin C and the catalysis of fumaric acid.” That same year, Sir Walter Norman Haworth received the Nobel Prize in Chemistry “for his investigations on carbohydrates and Vitamin C. Shortly thereafter Tadeus Reichstein developed a method of synthesizing and commercially producing Vitamin C.



FIGURE 4: Albert Szent-Györgyi (1893-1986) Hungarian biochemist who isolated hexuronic acid. Later immigrated to US and worked at NIH and Woods Hole doing muscle research; and later, cancer research. 1937 Nobel Laureate

The Boston City Hospital Epilogue

Interestingly in October 1939, Dr. John Crandon, a 2nd Harvard surgical resident at Boston City Hospital performed an experiment to induce scurvy in himself. [19] He followed a diet entirely devoid of Vitamin C consisting of bread, crackers, cheese, beer, eggs, chocolate, and sugar. Within three weeks his blood ascorbic acid level dropped to 1.0mgm/100ml. and

became undetectable after 6 weeks. He remained asymptomatic and working. "From the beginning of the third month of the diet there developed a feeling of fatigue which became progressively more marked" At 134 days hyperkeratotic papules surrounding the hair follicles were noted on his back, thighs and on his lower extremities. Petechiae appeared over the lower legs at 161 days into the experiment. At three months a skin biopsy healed normally but a second skin biopsy performed at 182 days failed to heal by ten days. A wound biopsy showed a "lack of intracellular substance and capillary formation." At this point Crandon was started on 1000 mgm. of ascorbic acid IV each day while continuing on his experimental diet. A repeat wound biopsy, after 10 days of ascorbic acid showed "ample intracellular substance and capillary formation."

Crandon lost 27 pounds over the six months and his fatigue continued to increase after the 3rd month. By the sixth month his performance "placed him in the same category as the Group X of Robinson (Control population), consisting of men in the eight decade of life, for whom the five minute walk was maximal work." [20] During a period of maximal work, running on tread mill at 7 miles per hour, he could sustain his effort for only sixteen seconds reaching a maximal heart rate of 190. With 2 weeks of therapy he did 66 seconds and after roughly 7 weeks he lasted for 84 seconds, still less than controls. (Range 3-5 minutes). [19]

A British study done during WWII employing conscientious objectors as well as a third study performed in the United States essentially confirmed Crandon's observations. [21]

Looking at these findings it is easy to appreciate scurvy's effect on the crew of a sailing vessel or on an army with a large percentage of troops suffering from varying stages of this terrible disease. Scurvy lurks today chiefly among elderly widowers who do not eat properly but is most frequently seen in conflict zones across the globe among large populations. The author has never personally seen a patient with scurvy and he is confident most of today's American physicians would say the same thing. He fears he would be challenged by a patient with early scurvy symptoms but without signs.

In reading the long history of scurvy, one is discouraged how many people had the right idea about prevention and treatment and that correct lessons learned were repeatedly forgotten and replaced by fallacious theories which served to confuse physicians and injuring and killing patients. There are many lessons to be gained by medicine from close study of the history of scurvy.

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Disease

Fungi and Witches:

How Convulsive Ergotism may have Influenced the Salem Witchcraft Affair

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Ergot is a fungus with incredible medical and historical significance. It has been the source of a number of important pharmacologic discoveries as well as the cause of many disastrous epidemics and plagues.

The most common type of ergot (*Claviceps purpurea*) is seen in rye and related cereal plants, and contains a high concentration of ergot alkaloids. These alkaloids have a wide range of biological activities involving circulation and neurotransmission.[1] Symptoms of ergot poisoning, or ergotism, include but are not limited to abdominal malaise, pares-thesias, psychoses, loss of sensation, gangrene, and hallucinations.[2] Even though the ergot alkaloids consist of a number of chemical compounds, lysergic acid, a precursor of the hallucinogenic drug lysergic acid diethylamide (LSD), is found in high quantities and often cited as the reason why ergot should be avoided. Other ergot alkaloids have been purified and used to manufacture Methylergonovine, a vasoconstrictive drug used to stop postnatal bleeding, Cabergoline, a dopamine receptor

agonist used to treat Parkinson's Disease[3], and Ergotamine, a pure alkaloid extract used to treat severe migraine headaches.

Ergot poisoning can affect people in different ways, but the symptoms can be classified into two main categories, convulsive and gangrenous –perhaps due to the varying concentration of different alkaloids found in the fungus.[4] Convulsive ergotism is due to alterations in the nervous system, and is characterized by diarrhea, nausea, vomiting, itching, paresthesias, spasms, seizures, hallucinations, and mania.[5] Gangrenous ergotism is due to vaso-constriction and affects the poorly perfused distal extremities, causing the fingers and toes to dry up and fall away. During the Middle Ages, epidemics of gangrenous ergotism were known as the “holy fire” because people with dry gangrene were thought to have been burned by a divine fire.[6] The association between ergotism and ergot consumption was first elucidated in France on 1676, but there was no reference to ergot in the United States until 1807 – more than a decade after the Salem Witch trials.[7] Until the



FIGURE 1: Trial of George Jacobs of Salem for witchcraft, Essex Institute, Salem, Mass. Courtesy of Detroit Photographic Co. (Library of Congress) <https://www.loc.gov/item/92515055/>

19th century, ergot was not known as a parasitic fungus, but rather, was thought to be “sunbaked kernels of grains.”[8]

In 1976, an article published in the distinguished Science journal by psychiatrist Linnda Caporael argued that the symptoms of those afflicted by witchcraft might have been due to convulsive ergotism.[9] However, a couple months later, historian Nicholas Spanos and psychologist Jack Gottlieb, contested her argument by publishing another Science article claiming that the witchcraft symptoms were not due to ergotism, and were instead better explained by fraudulent behavior and hysteria.[10] Since then, there have been many arguments for and against ergotism as an explanation of the witchcraft trails.

Background

Before examining the evidence pertaining to ergots, it is important to understand the context of colonial witchcraft and the events that led to the Salem trials.

The practice of “witchcraft”, or the conjuring of spells, is widespread across cultures all around the world and can be found during different time periods. However, the predominant concept of witchcraft in Western society had its origins in the Middle Ages. During the European 5th to 15th century, according to Old Testament laws, the practice of witchcraft was thought to be a combination of sorcery and heresy – in which witches performed rituals associated with the Devil.[11] This led to the widespread prosecution, torture, and execution of “witches”; a practice that eventually found its way to Colonial America.[12]

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Prior to the witchcraft trials that occurred in Salem, there were periodic accusations of witchcraft and ensuing court trials. However, such trials were civilized, nowhere as cruel as those held in the Middle Ages, and with outcomes usually favoring the accused. In one particular case, Godfrey, who was accused of witchcraft but had his case dismissed, was later able to sue his accusers for defamation and win the case.[13] In fact, executions due to witchcraft were so rare that before the Salem ordeals, there were only five “witchcraft executions” documented in Massachusetts.[14]

The events and outcomes of the Salem Witch trials are highly unusual and began in December of 1691, when eight girls from the village of Salem were affected with disorderly speech, odd postures, and convulsive fits.[15] The symptoms lasted for several months and the victims included the niece and daughters of minister Samuel Parris, a politically powerful figure in the town of Salem. After the eight girls were afflicted with their condition, they were seen by physicians, who dazzled by the constellation of symptoms, eventually proposed the possibility of bewitchment.[16] Parris’ neighbor then suggested Parris’ slave Tituba to bake a “witch cake” to determine whether the girls were really bewitched - the cake was made with rye and urine from the bewitched girls, baked in ashes, and fed to a dog that was then studied for signs of bewitchment.[17] If the dog showed signs of bewitchment, it meant that the girls were indeed bewitched. There is no account of what happened to the dog, but the “witch cake test” was positive; and the girls soon made accusations of witchcraft against Tituba and two other elderly women

of ill repute, Sarah Good and Sarah Osborn. The three accused women were brought to custody on the 29th of February of 1662.

Tituba first denied knowledge of the bewitchment, but eventually was pressured to confess her guilt, thus setting the pattern that would run the course of the trials – accused witches confessed and then became accusers themselves, therefore validating previous accusations and instigating further investigations and trials.[18] Those that confessed would end up being labeled as “detestable Witch” and sent to prison, while those that did not confess, would end up executed. Over the following several months, hundreds of people were accused of witchcraft, including at least eight children under the age of twelve, and resulting in 20 executions and 5 deaths in prison.[19] During many of those trials, the afflicted girls were called in as witnesses.

The witchcraft trials ordeal ended on September 17, 1662 when the Court of Oyer and Terminer adjourned the trials. Governor Phips then released about 150 accused witches the following May.[20] Of those trialed, Tituba spent thirteen months in prison before being released; Sara Good never confessed and was executed; Sarah Osborne did confess and was imprisoned, but died after three months in prison.

Ergot

The thought that the entire witchcraft affair had a physiological explanation is not new. Before the accusations of witchcraft, reverend Parris was convinced that the girls were suffering from a physical illness and called in physicians on multiple occasions. However, those same physicians, unable to come up with a plausible explanation, eventually proposed the idea of bewitchment. Donald Willard a modern historian, hypothesized that the whole ordeal was due to Jimson weed, a poisonous plant introduced from the West Indies, and evolved the theory that Tituba, “acquainted with the weed’s properties in the Barbados, had been dosing the girls with concoctions made from it.”[21] However, even though Parris’ physician witnessed one of the afflicted girls handling a dry stalk of Jimson weed, there is no evidence to suggest that Tituba had been dosing any children.[22]

Linnda Caporael in 1976 was the first person to suggest Ergot as an explanation for the Salem Witchcraft trials.[23] She proposed that the symptoms of the girls afflicted by witchcraft were consistent with those of convulsive ergotism. These symptoms consist of “...crawling sensations of the skin, tingling in the fingers, vertigo, tinnitus aurium, headaches, disturbances in sensation, hallucination, painful muscular contractions leading to epileptiform convulsions, vomiting, and diarrhea... there are [also] mental disturbances such as mania, melancholia, psychosis, and delirium”.[24] To further support her hypothesis, she noted that all of the afflicted girls were in their teens

or early childhood, which is the age in which ergot has the most effect – having a lower body weight meant needing less ergot toxin to feel the symptoms.

Caporael then examined the growing conditions of ergot and the geographic distribution of those affected. Ergot is a fungi that thrives in warm, rainy springs and summers, it usually grows in rye, and can even continue to grow after the rye is harvested and stored. Typically, rye is harvested in late summer, stored, and then used when weather became cold. On examining the diary of Samuel Sewall, a Salem farmer, we find that the summer of 1691 was especially hot and stormy, the ideal conditions for ergot to grow.[25] The rye harvested that year was also threshed shortly after Thanksgiving and probably eaten during December, right around the time when the eight girls became afflicted with their symptoms.



FIGURE 2: Minister Samuel Parris (1653-1720).
Courtesy of the Massachusetts Historical Society

When examining the distribution of the eight afflicted girls, Caporael provides an explanation for how the rye contaminated with ergot might have been circulated. Three of the eight afflicted girls lived in the Putnam residence, a family with the largest landholding in the village and located in farmland that has the ideal conditions for growing rye – coincidentally, the mother of one of the girls was having neurological complaints at the time of the witchcraft affairs. During the 1690’s, the payment for the usage of land was done in provisions, and since the Putnam family had vast quantities of land, it is of no surprise that a large quantity of the ergot contaminated rye could have made its way to the minister Parris’ residency, where another two afflicted girls lived. The remaining three afflicted girls were from families that had some relationship to either the Parris or the Putnam household and could have received the ergotized rye either as a gift or payment.

Mary Matossian, a historian from the University of Maryland, further examined the geographic distribution of witchcraft prosecutions in New England. She found evidence of witch executions in Fairfield County,

Connecticut and eight other communities of Essex County, Massachusetts - aside from Salem village.[26] Those witchcraft executions all occurred between the winter of 1691 and spring of 1692.[27] As mentioned previously, executions on the charge of witchcraft were rare, and for there to be so many witch trials in such a short period of time and in such a widespread area is highly unusual. Matossian also mapped out the residences of all twenty-two of the Salem households whom in 1962 had symptoms consistent with ergotism. She found that their houses were all located near moist, acidic, sandy soil that is ideal for rye cultivation.[28]

No ergot

Just as there is evidence that ergot might have contributed to the symptoms of the girls afflicted by witchcraft, there is equally convincing evidence that ergot had nothing to do.

Spanos and Gottlieb thoroughly examined the symptoms of bewitchment in the context of ergot poisoning and found many inconsistencies. Most important was the fact that the afflicted girls were responsive to social cues. In the 16th and 17th century, it was well known that the sight of a witch could cause convulsions, while the touch of a witch could stop them.[29] This is exactly what happened in court. The afflicted girls "convulsed en masse [or screamed] when the accused entered the room [and] looked in their direction... and the convulsions would cease as soon as they were touched by the accused or when a certain Bible passage was read." [30] The precise timing of their convulsions and their dramatic behavior in court has led many to believe that the entire witchcraft trials were due to fraud - perhaps a plot to imprison and execute the political enemies of minister Parris.[31]

Other characteristic symptoms of convulsive ergotism were also not well represented during the Salem trials. Ergotism is characterized by intense abdominal complaints such as vomiting and diarrhea; however, when Spanos and Gottlieb examined all *the Records of Salem Witchcraft*, they were "unable to find any reference to the occurrence of vomiting or diarrhea among the afflicted girls." [32,33] Furthermore, they were also unable to find any evidence of livid skin color or permanent contracture of the extremities, which are also common symptoms of convulsive ergotism.

While Caporeal argued that the abrupt end to the Salem Witchcraft trials on the summer of 1692 was because the village was no longer exposed to ergotized rye, other authors have pointed out that abrupt endings to these scenarios are normal. Midelfort, a historian that has studied large scale panic in the 16th and 17th century, notes that such crises begin with accusations against "individuals of lower class or socially deviant" - Tituba was a slave and Sarah Good and Sarah Osborne were women of ill repute in the village.[34] The accusations then escalate to involve more prominent individuals, which then cause the authorities to question the validity of the prosecutions and quickly bring things to an end. In fact, the abrupt ending of the Salem trials was not due to the villagers withdrawing their prosecutions, as the ergot theory would suggest, but rather, the involvement of higher authorities.

Conclusion

Just like most historical events, the truth lies somewhere in between. Why did the eight girls have their symptoms? What happened to the dog that ate the "witch cake"? Why were the witchcraft accusations so geographically extensive? This author thinks that an



FIGURE 3: The Witch no. 2. 1892. Walker, Geo. H., & Co. (Library of Congress)
<https://www.loc.gov/item/2003677981/>

infectious organism or toxic substance –perhaps ergot or perhaps not – might have made the girls sick and triggered the whole incident; but somewhere along the way people became too illogical, too political, and too hysteric. We might never know what really happened.

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- [32] Records of Salem Witchcraft contains 117 depositions by the afflicted girls and 79 depositions in which witnesses describe the behavior of the girls
- [33] Spanos and Gottlieb, 191
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Treatment

The Wesselhoeft Water Cure

James S. Brust, MD

Associate Clinical Professor of Psychiatry at UCLA David Geffen School of Medicine
Boston University School of Medicine Class of 1968



James S. Brust, M.D., BUSM 1968, is a psychiatrist in private practice in San Pedro, California, where he serves as Chairman of the Department of Psychiatry and Medical Director of the Psychiatric Unit at Providence Little Company of Mary Medical Center in San Pedro, California. He is also Associate Clinical Professor of Psychiatry at the David Geffen School of Medicine at UCLA and teaches psychiatric residents at Harbor-UCLA Medical Center. In addition Dr. Brust is an independent historian with a wide range of interests. He serves as President of the George Dock Society for the History of Medicine at the Huntington Library in San Marino, California, and has been an active supporter of medical history at BUSM, lecturing on the school's history and donating historical artifacts to the library. He has contributed to every issue of ACESO.

Hydrotherapy, formerly called hydrotherapy, has been recorded in various forms back to the ancient civilizations, and even Hippocrates prescribed bathing in spring water for certain ailments. There was a renewed interest in the field in 18th century England; then a 19th century revival which began in the Austrian Empire with Vincenz Priessnitz (1799-1851), and spread to the United States by the 1840s. A number of physicians were involved including Drs. Joel Shew (1816-1855) who studied under Priessnitz in Europe, and R.T. Trall (1812-1877), a prolific author who advocated hydrotherapy and other noninvasive, non medication treat-

ments. Also prominent in the field was Dr. Robert Wesselhoeft (1795-1852).

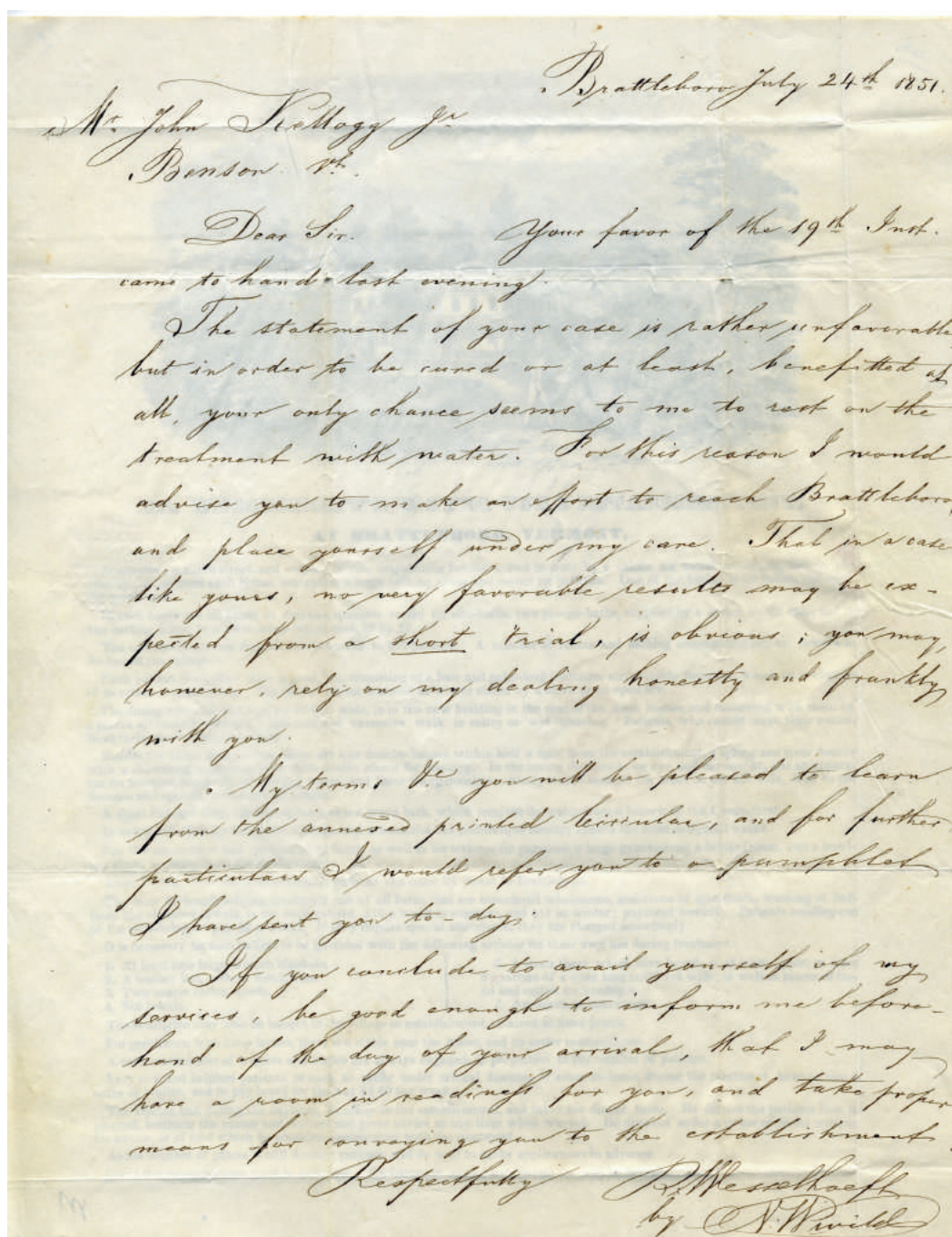
Robert Wesselhoeft came to the United States from Germany to join his brother William (1794-1858), and the two practiced homeopathic medicine in the Boston area. They became embroiled in the controversy developing over homeopathy, and Robert in particular became a target of criticism by Harvard professor Dr. Oliver Wendell Holmes, their conflict peaking in 1842 with the publication of *Holmes' Homeopathy and its Kindred Delusions*.^[1] Robert Wesselhoeft's response on behalf of the homeopathic community appeared in the publication *Some Remarks... on Dr. Holmes Lectures on*

Homeopathy...[2] Their conflict worked its way into the wider world of literature, as it is felt to be the basis for Nathaniel Hawthorne's 1844 short story "Rappaccini's Daughter." [3] Sometime shortly after, Robert Wesselhoeft, who had a hydrotherapy practice in West Roxbury, left the Boston area for Brattleboro, Vermont, where he established the "Wesselhoeft Water Cure."

While there was no formal connection between homeopathy and hydrotherapy/ hydropathy, homeopathic physicians in that era seem to have had an affinity for this therapeutic use of water, which, like their own approach, avoided the harsh and toxic methods used in main stream medicine at that time. Generally, though, they viewed hydrotherapy as an auxiliary branch of medicine and hygiene,

complementary to homeopathy but not a formal part of it. [4] "Dr. Wesselhoeft's water-cure establishment" became a thriving enterprise in Brattleboro.

Wesselhoeft prepared an advertising information sheet that was part of a four page foldout, to which a handwritten letter could be added, the whole then folded and sent through the mail. This article presents an example, mailed in July 1851 to a Mr. John Kellogg, Jr., in Benson, Vermont. In the letter portion (fig. 1), written for him by an assistant with very legible handwriting, Dr. Wesselhoeft advised Mr. Kellogg to come to Brattleboro: "The statement of your case is rather unfavorable, but in order to be cured or at least benefitted at all, your only chance seems to me to rest on the treatment with water." "

A handwritten letter on aged, slightly yellowed paper. The letter is written in a cursive script. At the top right, the date "Brattleboro July 24th 1851." is written. On the left, the recipient's address "Mr. John Kellogg Jr. Benson Vt." is written. The letter begins with "Dear Sir." followed by "Your favor of the 19th Inst. came to hand last evening." The main body of the letter discusses the recipient's case, stating it is "rather unfavorable" but that "in order to be cured or at least, benefitted at all, your only chance seems to me to rest on the treatment with water." The writer advises the recipient to "make an effort to reach Brattleboro, and place yourself under my care." It is noted that "in a case like yours, no very favorable results may be expected from a short trial, is obvious; you may, however, rely on my dealing honestly and frankly with you." The writer then refers to "My terms" which can be found in an "annexed printed circular" and a "pamphlet" sent to the recipient. The letter concludes with a request for the recipient to inform the writer of their arrival so that a room can be prepared and conveyance arranged. The letter is signed "Respectfully" followed by the signature "Dr. Wesselhoeft" and "by C. W. Wild".

Brattleboro July 24th 1851.

Mr. John Kellogg Jr.
Benson Vt.

Dear Sir. Your favor of the 19th Inst. came to hand last evening.

The statement of your case is rather unfavorable, but in order to be cured or at least, benefitted at all, your only chance seems to me to rest on the treatment with water. For this reason I would advise you to make an effort to reach Brattleboro, and place yourself under my care. That in a case like yours, no very favorable results may be expected from a short trial, is obvious; you may, however, rely on my dealing honestly and frankly with you.

My terms. &c. you will be pleased to learn from the annexed printed circular, and for further particulars I would refer you to a pamphlet I have sent you to-day.

If you conclude to avail yourself of my services, be good enough to inform me beforehand of the day of your arrival, that I may have a room in readiness for you, and take proper means for conveying you to the establishment.

Respectfully
Dr. Wesselhoeft
by C. W. Wild

FIGURE 1: Handwritten letter from Dr. Wesselhoeft advising Mr. Kellogg to come to Brattleboro for treatment. Courtesy of the Boston University Alumni Medical Library, gift of Dr. James Brust.

In looking over the printed circular describing the facilities, services and prices (fig. 2), it is important to remember that the term “douche” had a different and wider meaning in the 19th century than it does today. “Douche” simply referred to the application of water to the body surface. The way in which the streams of water were generated, their number, strength and temperature could vary. The term generally did not apply to internal application (though the circular

While there was no formal connection between homeopathy and hydrotherapy/hydropathy, homeopathic physicians in that era seem to have had an affinity for this therapeutic use of water, which, like their own approach, avoided the harsh and toxic methods used in main stream medicine at that time.

advised patients to bring “an injection instrument” so there may have been some introduction of water into body orifices).

One cannot help but be impressed by the size and scope of Dr. Wesselhoeft’s operation. Judging from the prices, the mention of boarding horses and hiring extra nursing personnel, and the well dressed appearance of the women in the photograph (fig. 3), he seems to have attracted the well to do. It is said that Harriet Beecher Stowe stayed at the water cure for eleven months.[5] Robert

Wesselhoeft was serious minded about his method and its results, publishing series of cases treated at his establishment in Brattleboro.[6]

Though neither Robert nor William Wesselhoeft lived to see the founding of the Boston University School of Medicine, the Wesselhoeft name became legendary there. Robert’s two sons Conrad (1834-1904) and Walter (1838-1920) were founding faculty members of BUSM in 1873. Conrad in particular became one of the leading homeopathic physicians of his era, attracting many high profile patients, including Louisa May Alcott, who dedicated her last novel, *Jo’s Boys*, to him.[7] There have been subsequent generations of Wesselhoeft physicians continuing to recent times, and an endowed chair in the Department of Medicine at BUSM still carries the Wesselhoeft name. While hydrotherapy is still very much with us in the form of whirlpool baths and the like, Wesselhoeft’s mid 19th century advertising letter sheet is a fascinating window into a grander era of the therapeutic use of water.

Notes:

[1] Oliver Wendell Holmes, M.D., *Homeopathy and its Kindred Delusions; Two Lectures Delivered Before the Boston Society for the Diffusion of Useful Knowledge* (Boston: William D. Ticknor, 1842).

[2] Dr. Robert Wesselhoeft, *Some Remarks on Dr. O.W. Holmes Lectures on Homeopathy and its Kindred Delusions; Communicated to a Friend* (Boston: Otis Clapp, 1842). This pamphlet was a compilation of seventeen letters written by Wesselhoeft in response to Holmes’s criticism of homeopathic medicine.

[3] “Rappaccini’s Daughter” originally appeared in *The United States Magazine and Democratic Review*, December 1844, and was later reprinted in a collection of Hawthorne’s stories titled *Mosses from an Old Manse* (London: Wiley & Putnam, 1846). For an analysis of the relationship of “Rappaccini’s Daughter” to the Holmes-Wesselhoeft dispute, see <http://hawthornessevendables.com/chapters/dr-wesselhoeft-in-rappaccinis-daughter.html> (accessed October 9, 2016).

[4] On the relationship between hydropathy and homeopathy, see John S. Haller, *The History of American Homeopathy, the Academic Years, 1820-1935* (Binghampton, N.Y.: Pharmaceutical Products Press/Haworth Press, 2005) 249-251.

[5] Harriet Beecher Stowe (1811-1896), author of the acclaimed and influential novel *Uncle Tom’s Cabin* (1852), had a number of connections to the New England Female Medical College and Boston University School of Medicine community. She served on the Board of Lady Managers of the NEFMC, and her nephew, Edward Beecher Hooker, M.D. (1855-1927) graduated from BUSM in 1877.

[6] In three separate publications issued in 1848, 1849, and 1853, Wesselhoeft reported on cases treated. The first two were printed in Brattleboro by J.B. Miner and covered 563 and 392 cases respectively. The last, published by E.O. Jenkins in New York, contained over two hundred more.

[7] Louisa May Alcott, *Jo’s Boys* (Boston: Roberts Brothers, 1886). The dedication, which appears on an unnumbered page near the front of the book, reads: “To Dr. Conrad Wesselhoeft, this very inadequate tribute of affection and respect is gratefully inscribed by his friend and patient, the Author.”

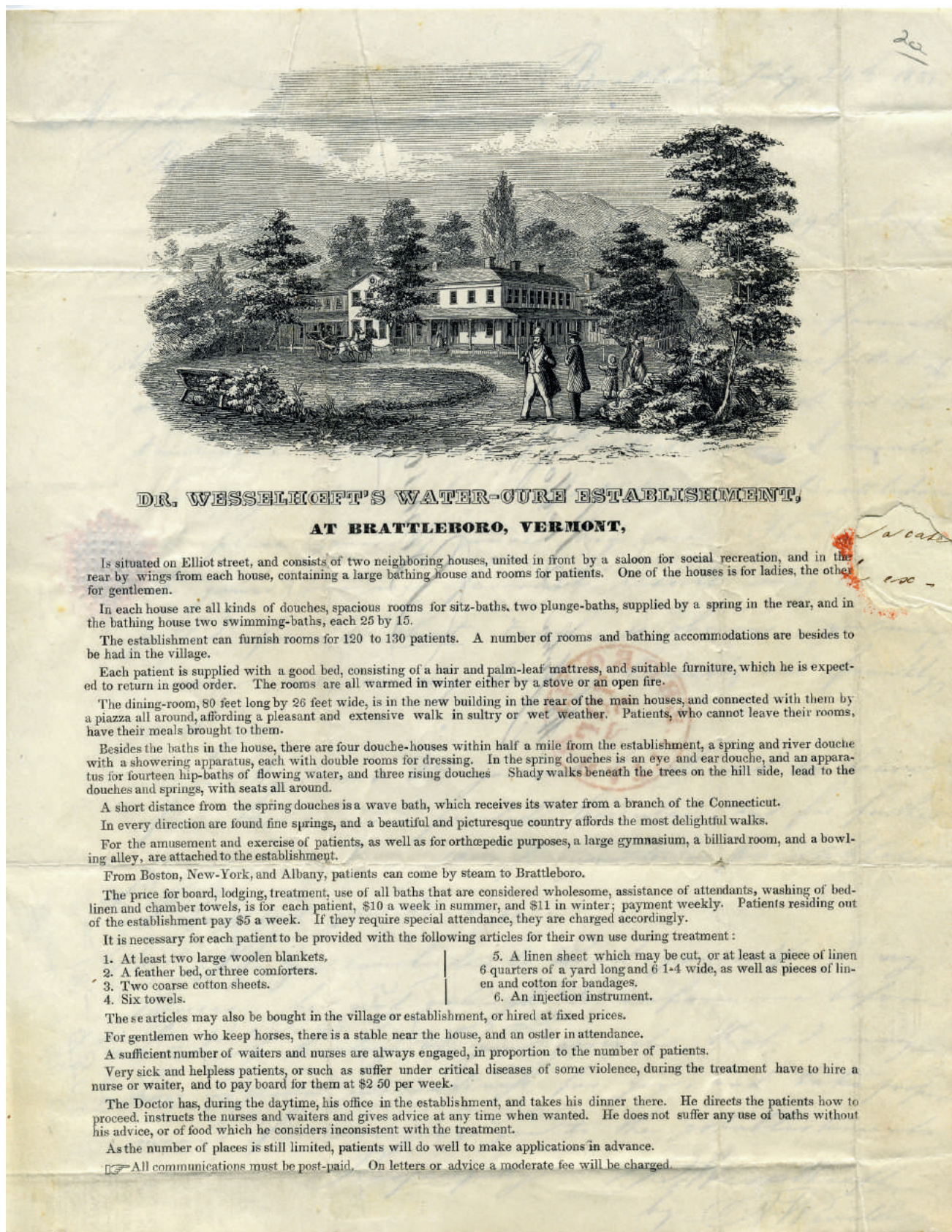


FIGURE 2: Printed circular describing the facilities, services and prices of Dr. Wesselhoeft's water-cure establishment. Courtesy of the Boston University Alumni Medical Library, gift of Dr. James Brust.



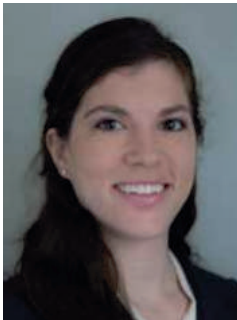
FIGURE 3: Photograph of Wesselhoeft Water Cure Establishment. Courtesy of the Boston University Alumni Medical Library, gift of Dr. James Brust.

Feature

History of Present Illness

Reprinted from The Pharos, Autumn 2016. Copyright 2016 by Liat Bird. By permission of Alpha Omega Alpha Honor Medical Society
Her essay won Second Place in the 2016 Helen H. Glaser Student Essay Competition.

Liat Bird, MD
Pediatric Resident UCSF
Boston University School of Medicine Class of 2016



***Liat Bird:** I moved around as a kid, but ended up near Sacramento, California. I went to the University of Chicago, where I completed my bachelor's degree in international studies, and my prerequisites for medical school at the same time. I then spent two years working at the Dana Farber Cancer Institute in Dr. David Weinstock's lab before starting at Boston University School of Medicine in 2012.*

Ms. B is a 65-year-old woman with a 35-pack-per-year smoking history, and stage IV small cell lung cancer (SCLC), s/p six cycles cisplatin/paclitaxel without improvement. She presents from clinic with vegetative depression, and failure to thrive.

Three weeks prior to admission, Ms. B finished her first round of chemotherapy to treat metastatic SCLC. She reports having many side effects, including skin rash, nausea/vomiting, and headaches. A post-treatment CT scan shows progression of her disease, with lesions in the long bones and liver, as well as the lung. CT head does not show any brain lesions.

She was scheduled to begin cisplatin/irinotecan chemotherapy at clinic today, but upon presentation appeared dehydrated and thin. She reports that she has not eaten for one week. Her daughter, who came with

her to clinic, also reports that Ms. B has been taking in very little fluids. Ms. B reports that she is "not hungry," and that she "knows she should eat" but does not want to.

She does not report nausea/vomiting/abdominal pain. She does not report any suicidal ideation.

Of note, she has lost 10 pounds over the past two weeks, and per clinic notes, her affect was very flat. She was admitted to the hospital for vegetative depression, and failure to thrive.

Mrs. B

I don't want to eat.

I know that sounds crazy, and maybe I am, but I just don't want to. Nothing sounds good. Not even strawberry ice cream mixed with strawberry Boost, my

go-to meal since chemo.

I'm losing weight.

My family is worried.

My family. I know they want me to eat. I think they know that I'm trying. I would eat for them, if I could. I just can't.

And now, I'm sitting in the oncology clinic, again, having the conversation about chemotherapy, again. I'll listen.

My daughter mentions that I haven't eaten in four days, that I just say I'm not hungry and move on with my day. This is true. I'm not hungry, and the days go on, don't they?

The oncologist's face scrunches into a worried frown. He asks me why I'm not eating. Why do they keep asking? I just don't want to. Nothing sounds good.

He asks me if I feel depressed. The small part of me that is still alive laughs at that. Depressed? Me? With stage IV lung cancer and the most miserable three months of my life behind me? With more miserable months ahead hooked up to an IV pumping in chemicals that make my skin feel like it's melting off my body, make me nauseous, make me tired? Wouldn't that make anyone welcome death, like an old friend?

I can't think like that. My family. They need me. My children. My husband. I can't fail them.

I just don't want to eat.

My daughter explains that I would force down food maybe once a day, but that stopped four days ago. I couldn't force it anymore. Not even when my husband looked at me with those hurting eyes. Not even when my daughter was crying in the kitchen when she thought I couldn't hear. I can't force it anymore. I tell the doctor that I don't want to eat. Nothing sounds good.

His face stays frozen in that concerned pose. I know he wants to talk about chemotherapy again. I was supposed to start today. But now I can't. Because of the dehydration. And the weight loss. I'm ruining his plan. He sighs. He says something about going to the hospital. I don't see why. My daughter's face brightens, so I say I'll go.

In the hospital, I get changed into a gown. They put a needle in my arm. They set me up in bed. The nurse is very nice. It's a cancer floor. They know how to deal with people like me.

The doctors come in. They ask all the same questions. I tell them, again, I just don't want to eat. I can't force it anymore. Everyone leaves. My daughter says goodbye.

A girl in a short white coat comes in. She looks nervous. She sits down. She asks what is going on.

I thought she was going to ask me about the food again. I answer that I just don't want to eat. She says she heard that from the others. She repeats her question: What's going on? She just looks at me. Cocks her head like a dog does when it's listening. Says nothing.

She told me later it was because she was so nervous. She's a student, and she didn't know what to do or say. She was scared, so she did the only thing she could think of, which was to wait and listen. Now that I think of it, I could hear her heart beating from across the room.

She sits, looks at me expectantly, and lets the silence fill us up. We let my death be with us. It feels gentle, and the part of me that is still alive stirs. It says, I can't force it anymore. It says it's not about the food, it's about the fight.

She nods, and my living part grows, exploding upward, rushing to the surface and bursting out of my face as I say aloud the things I'm scared to feel.

I say that I never wanted to fight this, to spend my last months in misery. I have had such a wonderful life, with my husband of 40 years, and my two beautiful daughters. I have done all I ever wanted right at home, in Waltham. I have made Halloween costumes, and baked cookies, and fought with my rebellious teens and my exasperating husband, and made up with them, and lived my simple beautiful fulfilled life.

Suddenly, I am saying out loud that I do not want more chemotherapy; that I am ready to die. My living part, rooted within me and now blooming across my cheeks, demands to be sustained until my heart stops beating. This is not living I say. It is worse than dying. It is something else, and I do not want it.

She still says nothing. I come back to myself and remember why I started chemotherapy in the first place.

I remember sitting in my doctor's office after having pneumonia for months and months. It would get better with antibiotics, but then it would come back once the pills ran out. My daughter, the preschool teacher, felt bad because she thought she gave it to me from her kids at school. She was sick before me, then I was sick. She got better but I didn't.

The X-rays kept coming back with things on them. I was still smoking cigarettes then; a decades-long habit doesn't disappear just because you're having trouble breathing. Then I started sweating heavily at night, and losing weight. With the recurrent lung infections, my doctor said something about "post-obstructive pneumonia." Then there was a scan of my lungs, and then another one of my whole body, and then, all of a sudden, there I was with my doctor and she was saying cancer. Then I couldn't hear anything at all.

Of course, my two daughters and my husband came with me to the first oncology appointment. I wasn't feeling too bad, just drenching sweats at night, and that annoying cough that wouldn't go away. The oncologist starting talking about chemotherapy, and I thought why, it's everywhere: in my lungs, and my bones, and my liver, and I don't want to suffer. Before the words could get out, my daughters and husband were nodding along, comforted by the you-never-knows, and the she-could-have-five-more-years, and the we've-come-a-long-ways. When they looked eyes and into their laps in a shower of golden groundless optimism—I couldn't say no.

I started chemotherapy, and went from night sweats and coughing to nausea, vomiting, skin rashes, pain in my arms and legs, hair loss that hurt, and fatigue so bone-deep and wearying that getting out of bed became a Sisyphean task—just one more struggle in the wasteland of my life.

The scans came back with still more cancer, and I wanted to scream, but the shimmering insubstantial

hope kept pouring out of my oncologist, and out of my desperate, eager, wounded family—so much that I felt like it was choking me in a beautiful boundless flood.

So, when the oncologist said we should try again, I said “yes,” rather than stem that tide of belief.

I have lived my life for my family, and I would live my death for them too, if that was what they wanted.

But now...I just don't want to eat anymore. I can't force it.

I'm crying. The girl strokes my hand, says that I am so strong, she cannot imagine how a person can be that strong. She tentatively asks me if I know about a thing called hospice. I do not. She says she worked in one for a summer and it was the patients there, like me, who inspired her to go to medical school.

She tells me about it. About comfort, and acceptance, and symptom control.

My living piece—pausing in its task of implanting roots within me—tells me that this is what we need, or we'll go back to the not-living-not-dying place where not even strawberry ice cream with strawberry Boost tastes good.

I ask her to call the hospice doctors.

It all happens so fast. My living part busily curling up past my ears in green growing tendrils as things move forward. A doctor comes and talks to me, and then we all meet— my oncologist, my family, and this doctor who runs the meeting.

I say all the things I wanted to say months ago when the chemo started. I cry, and my family cries. Then, the most wonderful thing happens. They tell me that it's hard to let go, but they don't want me to hurt. I know

they all can see my living piece, the part that came at me, brimming with hope, it was spilling out of their from them, and our years together. The realest thing. Budding above my eyes and around my forehead, waiting.

The ethereal flood of boundless optimism stops flowing out of them, stops crushing me. Instead, small searching vines of warmth, love, acceptance, support, everything, grow from them, down their legs, up my arms, right into my beating heart. My living part bursts into full bloom.

My husband's hurt is still there in his eyes, but then he takes my hand gently and says he will stand with me now, just like he did 40 years ago at the altar when we promised each other in sickness and health, til death do us part.

He says I have always taken care of him, and he asks me to let him take care of me, just this one time. I say of course. Of course.

We're all so sad, but it's peaceful too. Somehow comforting, real, honest, right.

I'm finally happy, now that I'm out of the not-living-not-dying place. The flowers of my life are around me, sustaining me. I'm happy now that I can be alive, right up until I die.

When the girl comes to say goodbye (because I can go home now, now that I'm alive again) we hug. I think for a moment, and then ask her to share a strawberry ice cream mixed with strawberry Boost with me.

It tastes wonderful again

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