DAVID J. HESS
Science and Technology Studies Department
Rensselaer Polytechnic Institute

Technology and Alternative Cancer Therapies: An Analysis of Heterodoxy and Constructivism

Theories of the construction of technology are reviewed from the wider interdisciplinary conversation known as science and technology studies (STS) and from the growing field of the anthropology of science and technology. These theories are used to contribute to research situated at the intersection of the anthropology of alternative medicine and of medical technologies. Cases drawn from the research tradition on microbial theories of cancer are considered to show how unorthodox medical theories become embedded in technologies through choices in microscope design and treatment technologies. In turn, the technologies contribute to the heterodox standing of the researchers, their research, and their therapies. [cancer, alternative medicine, constructivism, medical technology]

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Social scientists and other researchers have demonstrated that alternative medicine plays a substantial role in the complex medical systems of advanced capitalist countries (e.g., Eisenberg et al. 1993). Anthropologists such as Anderson (1981, 1990), Baer (1987, 1996), Davis-Floyd (1992), and McGuire (1988) have complemented survey approaches of other fields by developing analyses rooted in the perspectives and histories of alternative medicine practitioners and patients (see also Hess and Davis-Floyd 1996). Likewise, anthropologists have contributed to the general science and technology studies (STS) literature on medical technologies by studying topics left out by sociologically and historically oriented studies, such as the complexities of patients' and users' perspectives (e.g., Forsythe 1992; Layne 1992; Rapp 1991). However, the intersection of these two fields—the anthropology of alternative medicine and the anthropology of medical

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technologies—remains relatively under studied and under theorized. This article contributes not only to the subdisciplinary nexus, but also to medical anthropology in general, by importing concepts from the wider interdisciplinary conversation known as STS and from the growing field of the anthropology of science and technology.[1] Specifically, by examining case studies of alternative cancer therapies, the concepts of scientific heterodoxy and technology construction are developed.

Theoretical and Methodological Background

The idea that science and technology are somehow "constructed" is now commonplace in STS and in a number of other social science fields, including anthropology (e.g., Gaines 1992). As a first approximation, the basic idea behind any analysis of the constructed nature of science is that the content of science (e.g., methods, theories, accepted findings) is not a transparent representation of material reality but instead a map of (or way of mapping) reality that is in turn inflected. The inflected nature of these mappings (that is, the construction of knowledge) varies across subject matter and discipline, and its dimensions include cultural values, historical contingencies, social interests, and gender bias, among others. Likewise, when applied to technology, the idea of "construction" implies that similar social and cultural factors play a substantial role in what has come to be accepted as stabilized, standard technology. In other words, technology is not merely a product of practical reason, standards of efficacy, or utilitarian considerations; instead, these "rational" considerations are inflected through sociocultural and historical contingencies.

The term *constructivism* (or *constructionism*) remains somewhat controversial because extreme formulations are subject to the charges of epistemological relativism and antirealism. However, as many social scientists and philosophers now realize, it is possible and, if one is to do critical work, necessary to develop versions of constructivism that are nonrelativist or that embrace cultural relativism as a method without falling prey to epistemological and other relativisms (e.g., Giere 1988:ch. 4; Hess 1995:ch. 2, in press a:ch. 1). Thus, instead of debating epistemological relativism and realism, it is more productive to shift theorizing over constructivism to the issue of what type of sociocultural insight one gains from any particular version of the conceptual framework. It is therefore useful to start with the question of how constructivism varies across disciplines and research groups.

Sociologists working in the tradition of the sociology of scientific knowledge have developed a number of frameworks for studying technology. One example is the SCOT (social construction of technology) approach. This type of analysis begins with interpretive flexibility, that is, a state of multiple options (such as a variety of design choices) that form the conditions of possibility for a controversy or conflict. The analysis then shows how technological closure (success or failure of an innovation) depends on a process of social negotiation in addition to technical or efficiency considerations (Pinch and Bijker 1987). Another, more influential approach is the actor-network theory, which analyzes how technologies succeed by becoming essential to growing, heterogeneous, sociotechnical networks that gain power by making others "interested" in their own products and therefore by enrolling others as allies (e.g., Callon 1994). Because the latter approach claims to show how actors build or rebuild social structures alongside technologies and

knowledge claims, some theorists have advocated dropping the word "social" from "social constructivism." From this perspective the term "social constructivism" coincides with a view of the social as an exogenous variable rather than something that is co-constructed through the rise and fall of networks.

Two alternatives to these versions might be termed "cultural" and "political" constructivism. Classical anthropology adds to the interdisciplinary discussion a comparative perspective that I prefer to think of as "cultural construction." This version refers to the ways in which technologies operate as meaningful material culture through which values, politics, and social structures are reproduced and altered at a given point in a culture's history. A second approach, political constructivism, is found more among feminist, radical, and other critical scholars inside and outside anthropology. This approach shows how technological choices are simultaneously political ones that benefit some social categories at the expense of others (e.g., Wajcman 1991; Winner 1986). Related to this perspective is the work of some critical sociologists who see knowledge and artifacts as congealed outcomes of social conflict (e.g., Restivo 1994). Yet another tendency is recent work in anthropology, cultural studies, and culturally oriented social studies in general that focuses on "cultural reconstruction": that is, how patients (often women in the context of reproductive technologies), users, consumers, nonexperts, and experts from other fields reinterpret technologies in ways that the experts did not intend (e.g., Clarke and Montini 1983; Martin 1994; Rapp 1991).[2]

The SCOT and actor-network accounts tend to focus on the success stories and are good for revealing strategies and practical reason, whereas comparative, cultural accounts are good for revealing the assumptions left unquestioned by all sides. Feminist/antiracist/critical/reconstructive accounts often point to alternatives that have been forgotten in the wake of technological successes engendered by selection processes within a capitalist patriarchy. In all versions the best analyses show how the technical is the social/cultural/political, that is, how practical decisions of design and/or usage are simultaneously power-permeated and sociocultural.

This article extends anthropological and related analyses of the construction of science and technology by showing another way in which culture and power are important to the construction processes: through technological heterodoxy. It is commonplace to think of religions as having orthodoxy and heterodoxy, and many scientists even think of science as having a heterodox "fringe" of unaccepted fields of inquiry (Hess 1993). Likewise, in medical anthropology Baer has developed this field of study through his analyses of chiropractic as a professionalized, heterodox medical system (e.g., Baer 1996). Studies such as his have shown that it is more accurate to think of complex medical systems as constituted around orthodoxies and heterodoxies than to think of them as merely a pluralistic gathering of units; thus factors of power and hegemony rather than merely cultural logic shape the sociocultural systems around orthodoxies and heterodoxies.

Although the concept of heterodoxy has received attention in the study of complex religious, scientific, and medical systems, the concept may be counterintuitive for technologies because it is so easy to fall into instrumentalist, common sense ways of thinking about them: either they work or they do not. Yet because technologies are both positioned symbols in conflicted societies and congealed

outcomes of social conflict, in effect they operate as totems—or "techno-totems"—of identifiable individuals, networks, communities, and social categories.[3] In some cases technologies become props (if not agents) in power struggles between those sanctioned by official institutions (orthodoxies) and those who are marginalized if not suppressed (heterodoxies).

Another way in which constructivist studies can and should be extended is to move beyond ostensibly value-neutral or apolitical forms of constructivism as evidenced in some of the sociological versions such as SCOT and actor-network theory. Like several other anthropologists, I have emphasized the importance of questions of intervention, evaluation, politics, and policy in the study of science, technology, and medicine (see Downey et al. 1996). My proposed alternative to older, value-neutral forms of constructivism involves the following phases of analysis: (1) describe a history of suppression of a research area and therapeutic practice (following Martin et al. 1986), (2) develop an analysis of interests that is combined with a cultural account that foregrounds gender and social difference (employing "cultural" in the anthropological sense of the term), (3) evaluate the scientific claims, and (4) recommend future research and policy.

This article focuses on the first phase (suppression) in two case studies drawn from a larger research project about theories that bacteria may play an overlooked etiological role in cancer (Hess, in press a). The larger project considers other case studies and develops a complete analysis that involves all four phases described above. The two case studies presented here are based largely on documentary sources, but they are supplemented by interviews with representatives of the therapies.[4] The research is also rooted in previous, long-term fieldwork on alternative science, medicine, and religion in Latin America and the United States, including fieldwork among Spiritist mediums and doctors in Brazil (of about two years' duration over four visits). Research in the United States includes attendance at conferences, lectures, and gatherings of parapsychologists, New Age groups, and alternative cancer groups, as well as immersion in the literatures of these groups. A second research project on alternative cancer therapies, which began in 1996 and was supported by an National Science Foundation (NSF) grant, involves interviews of 60 opinion leaders in the alternative cancer field about the criteria they use to evaluate alternative cancer therapies. Thus, although the form of the present article is historical and documentary, it is rooted in "ethnographic authority" (Clifford 1988).

Microbial Theories of Cancer

The topic of a possible bacterial or general microbial etiology for cancer was chosen because even though it is a largely forgotten area of biomedical research, it has at least a minimal claim to scientific credibility. Researchers in this tradition have produced several dozen peer-reviewed publications and probably the equivalent number of nonpeer-reviewed publications. Although the study of heterodox medical research traditions, technologies, and therapies can be interesting from an anthropological/sociological perspective for the light it sheds on the social dynamics of science and medicine, this field of research may also be of increasing biomedical interest in coming years. Recent studies on choriogonadotropin as a tumor marker, together with studies of bacterial expression of homologous mole-

cules, suggest that the field may be reevaluated in the future (Acevedo et al. 1987, 1995a, 1995b). Furthermore, studies of cell-wall deficient bacteria also suggest that there may be increasing recognition of their role in chronic diseases (e.g., Domingue 1995, in press; Mattman 1993).

The major researchers covered in the case studies of the forthcoming book are, in addition to those discussed in this essay, Coley, Diller, Glover, Livingston (or Livingston-Wheeler), Scott, and Seibert for North America, and Enderlein, Issels, von Brehmer, and Villequez for Europe (Hess, in press a: ch. 5). These researchers held advanced degrees in medicine or science, but with the exception of Coley they were largely marginalized from mainstream medical communities due to the nature of their research interests and medical therapies. The researchers discussed here—Rife and Naessens—are in some ways the most controversial because they lacked formal credentials, did not publish in peer-reviewed publications, and faced severe legal prosecution.

In general these researchers defended the theory that microbes play an important role in the diagnosis and/or the etiology of cancer. Most versions of their theories held that bacteria are pleomorphic (form-changing) and capable of extended existence within the host body. Furthermore, bacteria are capable of modifying into virus-sized phases and existing in forms that are today known as cell-wall deficient bacteria, surviving in a latent state as hidden intracellular or extracellular parasites, and developing through a full cycle that includes fungus-like and virus-like phases. Although "bacterial" approaches to cancer were popular in the 19th century, they had fallen out of favor by the beginning of the 20th century, when theories of heredity and trauma became more popular. By the midcentury mutagenic theories of cancer had achieved widespread acceptance among cancer researchers. The reasons for the failure of the bacterial or microbial theories included the following: (1) bacterial samples cultured from cancer tissue often revealed a variety of microbes, which led to the suspicion that the microbes were merely artifacts; (2) substantial skills were required to make regular and consistent cultures of pleomorphic and cell-wall deficient microbes; (3) the emergence of early 20th century research on cancers induced by heredity, radiation, and chemical carcinogens showed that noninfectious sources played at least some role in cancer etiology; and (4) factors of political economy helped spur medical opinion away from the infectious theory.

Whereas the infectious theories of cancer implied that treatment would focus on vaccines and sera, the noninfectious theories of cancer were interwoven in a therapeutic practice that became increasingly cytotoxic, that is, oriented toward destroying the renegade cancer cells by surgery and radiotherapy. After World War II chemotherapy and hormone therapy became increasingly important, but the cytotoxic strategy continued (Bud 1978; Moss 1991). The emphasis on standardization and machine-based or pharmaceutically based technologies was consistent with the industrial organization of the modernist culture (Bud 1978; see also Martin 1994).

Among microbiologists wide-ranging microbial cycles of the type advocated by some of the bacteria-and-cancer theorists fell out of favor. Based on emerging understandings in systematic bacteriology, genetics, and (later) molecular biology, sharp distinctions were drawn among standardized categories of viruses, bacteria,

and fungi. As studies of bacterial pleomorphism (or cell-wall deficient bacteria) fell out of favor, they also became associated with women researchers in microbiology, one of whom suggested the term "cell-wall divergent" as a more appropriate descriptor of the so-called funny bugs (Mattman 1993). Women researchers also played a crucial role in the continuation of microbial theories of cancer in the United States. Virginia Livingston and her predominantly women colleagues developed bacterial vaccine treatments that became interwoven with nutritional, immune-bolstering, and more holistic approaches to the treatment of cancer. The gendered cultural logic at work in the construction of the orthodoxy/heterodoxy relationship in cancer therapies is illustrated by a confrontation between Virginia Livingston and John Lawrence of Lawrence Radiation Laboratories (later Lawrence Livermore Laboratories) during the 1966 seminar for science writers. Lawrence wanted to have "a cobalt machine in every town and village in the United States" (Livingston and Addeo 1984:94). Livingston recalls, "At that statement I became excited and began to wave a petri dish (used for making cultures) over my head and said that it could be mightier than all the high-powered radiation machines in the world" (1984:94). To Livingston and her network of largely women allies, the petri dish symbolized an alternative approach to cancer etiology and therapy that focused on building up the immune system through diet and vaccines rather than attempting to eradicate the cancer through scalpels and cobalt machines. The gendered associations of holistic, metabolic therapies in contrast with conventional therapies, and of the largely women's network of research on bacterial variation in contrast with more conventional bacterial research, are explored elsewhere (Hess, in press a: ch. 5).

The construction of an orthodoxy of surgery, radiotherapy, and chemotherapy (known in alternative circles as slash, burn, and poison) was by no means merely the product of an autonomous medical profession that made choices based on purely rational, cognitive, or financially disinterested motives. Outside financial interests also shaped the development of the culture of orthodox or mainstream cancer research. These interests included investments by doctors and industrialists in the use of radium therapy in the United States during the early parts of the century, and investments by the pharmaceutical industry in chemotherapy after World War II.[5] However, orthodox or mainstream cancer research also developed a momentum and (gendered) cultural logic of its own and therefore should be seen as somewhat autonomous from shaping industrial interests. Following Sahlins's theory of cultural change (1976), an appropriate metaphor might be that of a somewhat autonomous research culture that responded in terms of its own developing cultural logic to an ecology of shaping interests.

Rife

Reports on Royal Raymond Rife's life and research contain few biographical details about his early life.[6] According to journalist Barry Lynes (1987), who worked with Rife's former partner John Crane to research the biography, Rife was born in Nebraska in 1888 and served in the Navy during World War I. During the war the U.S. government assigned him the task of investigating foreign laboratories, and it is possible that Rife came across work on electromedicine by Georges Lakhovsky or that he met directly with Nikola Tesla.[7] After the war Rife worked

as a handyman and chauffeur for the roller-bearing magnate Henry Timken, and he spent his productive adult years in San Diego.

Rife claimed that after 1920 he built several high-powered microscopes that worked at magnifications of 17,000X or higher, that is, at much more than the 2,000X to 3,000X associated with standard light microscopes. He claimed to have achieved this higher level of magnification without sacrificing a great deal of resolution because the design of his microscope passed light through rotating quartz prisms that polarized the light. Rather than staining samples, he used a variable monochromatic beam of light, which he "tuned to coordinate with the chemical constituents of the particle, virus, or microorganism" (Rife and Crane 1953:2).

Rife's microscope and his research on filterable viruses attracted the interest of several medical researchers, among them Arthur Kendall, the director of Medical Research at Northwestern Medical School. By the end of 1931 Kendall and Rife had published papers on the bacillus typhus in the filterable state, which Kendall claimed they had been able to see with the Rife microscope (Kendall and Rife 1931; Kendall 1931). They also announced their findings before a meeting of prominent doctors and researchers in Los Angeles, and Rife was soon demonstrating the microscope to the local medical and research community (Lynes 1987:43–45). In 1932 Kendall presented his research before the meeting of the Association of American Physicians, and in that year he also published articles in *Science* and the *Journal of the American Medical Association* (Kendall 1932; Kendall et al. 1932). Kendall was an active participant in the "filtrationist" controversy; in the 1920s and 1930s bacteriologists debated claims that at least some species of bacteria could pass through a filter and therefore included a "filterable" phase (see Amsterdamska 1991). Although Rife failed to interest many of the leading bacteriologists in his research, one important exception was Edward Rosenow of the Mayo Clinic. In 1932 Rosenow met with Rife and Kendall at Northwestern, and he subsequently confirmed in print their observations of filter-passing organisms (Rosenow 1932; Lynes 1987:46).

Rife used his microscope to follow microorganisms through their pleomorphic cycles, and by 1932 he claimed to have identified viruses for cancer, typhoid, polio, and herpes. In that year he also claimed to have cultured bacteria from a breast mass that contained a 1-centimeter block of tumor for which the malignancy had been independently confirmed from another laboratory. In accordance with Koch's postulates, Rife reinjected his viruses into albino rats and later found at the point of injection a mass that microscopic analysis revealed to be malignant. However, he did not think that other laboratories would be able to replicate his procedure because conventional microscopes lacked the combination of high magnification and appropriate light frequency that were required to see the viruses. In effect, the very construction of technology that had enabled his (claimed) discoveries now blocked him from recognition.

Rather than attempt to sell and market the microscope, which was extremely complicated and expensive, he attempted another solution. Rife found that by altering the medium in a slightly acidic direction, the virus transformed into something larger that would no longer pass through his filters. At the next stage, the organism reached a monococcoid form that could be seen through a standard microscope when stained with silver nitrate and gentian violet. He found this form

in the monocytes of the blood of over 90 percent of patients diagnosed with cancer. When cancer researcher and medical doctor O. Cameron Gruner from McGill University came to visit, they found that they could take the fungus that Gruner had isolated from his cancer samples, put it through the K-medium (Kendall medium) and filter, and arrive at Rife's virus. Likewise, when they put Rife's virus on Gruner's pH-basic asparagus medium, it transformed into Gruner's pleomorphic "fungus" (Gruner 1942; Lynes 1987:71). However, by taking his research in this direction, Rife was further aligning himself with the outgroups in the controversy over bacterial variation.

Rather than continue basic medical research and attempt to present that research to the medical and bacteriological communities, Rife began to focus on medical applications. He developed an electronic frequency instrument that, he believed, created a frequency "in the correct coordination or resonance of the chemical constituents of a given organism or virus, and to devitalize with said frequency, the organism or virus in question" (Rife and Crane 1953:1). After successfully destroying the virus in over 400 experimental animals by using the "mortal oscillatory rate" of his electronic frequency machine, Rife began to experiment with human cancers. He claimed that when he used the machine on patients, the machine destroyed or rendered harmless the organisms without causing any damage to the patients. It is not clear from Rife's description exactly how the machine was used, but from interviews I learned that contemporary use of the Rife machine in the Rubio-Fry Clinic in Tijuana involves attaching it to the patient's body through electrocardiograph plugs (interview, September 1995).

Although the electronic frequency machine was predicated on a theory of nonstandardized microbes that was associated with the filtrationist school, it made possible a standardized clinical application. The standardization of the therapy via a machine was consistent with the preference for standardized therapies in the dominant medical culture (such as its use of radiotherapy), and one might therefore expect that Rife's machine-standardized theory would move relatively smoothly through the medical community. Indeed, this is what began to happen. Under the supervision of Milbank Johnson, M.D., a special medical research team was set up at the University of Southern California to test the machine on humans. Johnson obtained funds from the Hooper Foundation for Medical Research at the University of California at San Francisco to carry out clinical trials (Lynes 1987:55). They used the machine for three minutes duration at three-day intervals, a protocol that was designed to give the patient's lymphatic system time to absorb and cast off the devitalized dead particles of the cancer virus. Rife writes, "Sixteen cases were treated at the clinic for many types of malignancy. After three months, fourteen of these so-called hopeless cases were signed off as clinically cured by the staff of five medical doctors and Dr. Alvin G. Ford, M.D., pathologist for the group."[8]

By 1937 Johnson had opened his third clinic, and there was widespread interest in the Rife "frequency instrument," especially in California (Lynes 1987:71). Johnson and colleagues were finding that they could successfully treat a number of degenerative diseases, including cataracts. Rife also formed the company "Beam Ray" to begin manufacturing the instrument. However, Johnson and his team decided not to make a public announcement regarding the efficacy of the frequency instrument. Given the controversial nature of their claims, they wished first to

document the microbial etiology of cancer (1987:83). Meanwhile, Gruner, whose dean had denied him a leave to study with Rife, wrote to Johnson that the Department of Public Health in Washington had undergone a change of management, and it appeared that they would shut down the research program on the microbial etiology of cancer. He also wrote that he doubted that the distribution of the machine would make much difference, because most cancer researchers did not examine living tissues and were not trained to culture microorganisms from cancer samples (Lynes 1987:93–94).

The shutdown of the clinics and of Rife's research program began when a patient they had treated returned to Chicago. Morris Fishbein, editor of the *Journal of the American Medical Association* from 1924 to 1949 and a legendary opponent of alternative medicine, then found out about the Rife machine. According to Lynes, Fishbein at first tried to buy into the company, and when that failed, he persuaded a disgruntled partner of Beam Ray to sue the company in 1939 (1987:89). Presumably Fishbein wanted to buy into the company in order to get access to information that he could use against the company, not because he wanted to become a backer of the Rife machine.

Beam Ray eventually won the lawsuit, and after the trial the judge offered to represent the defendants in a lawsuit against the American Medical Association (Lynes 1987:97). However, the trial served its purpose. Rife ended up an alcoholic, his partners were left nearly bankrupt, and any doctors who continued to use the frequency emitters were threatened with loss of license. Lynes writes that immediately prior to the trial the "only other quality 'electronic medicine research lab' was mysteriously destroyed by fire" (1987:99). The clinics were all closed down, and in 1942 Johnson sent his machine to Gruner, who decided not to use it out of fear of retribution. In 1944 Johnson died under mysterious conditions; Lynes claims that federal inspectors later ruled he was poisoned (1987:97). Allies of Rife claimed that it was impossible to publish anything on the microscope or therapy in medical journals. However, in 1944 Raymond Seidel and Elizabeth Winter published on the Rife microscope in the *Journal of the Franklin Institute*, a scientific rather than a medical journal. The clever essay, titled "The New Microscopes," took advantage of the relative lack of closure in microscopic technology and covered the Rife microscope along with the new electron microscopes. Seidel also described in an annual Smithsonian report how the frequency emitter killed the purported cancer virus. Lynes writes, "Following the publication, Seidel soon became aware that he was being followed. Then a bullet crashed through his car windshield while he was driving" (1987:98). Kendall, Lynes writes, was said to have been paid $200,000 to remain silent about the Rife technology and therapy (1987:102). Finally, a new technician stole the quartz prisms from Rife's microscope, rendering it inoperable. Rife closed the lab in 1947. Unfortunately, Lynes does not document these final events surrounding the demise of the Rife machines; such documentation would be an important contribution to the historical record, and until they are fully documented they cannot be considered confirmed.

When Rife became a recovering alcoholic, he entered into partnership with engineer John Crane to manufacture again the frequency emitters. According to Lynes, by 1960 they had leased out 90 machines to doctors across the United States for testing. In that year Crane's office was raided, and equipment and records were

confiscated. Crane was prosecuted for violating a California Department of Public Health ruling that banned the machine from the market (1987:129–130). The foreman of the jury was a doctor with close ties to the American Medical Association, and Crane was denied access to his own confiscated records for use in his defense. He was found guilty and sentenced to ten years in jail; he served a term of three years. Other doctors were told to stop using the electronic frequency machine, and Rife went into hiding in Mexico.

Rife died in 1971. The FDA continues to ban the Rife machine for medical use on the grounds that the machines are unsafe. Rife generators and copycats are apparently available for those who are plugged into the appropriate networks. However, even within the alternative cancer therapy movement, some have cautioned against the use of Rife machines because they are untested and they may be poorly calibrated. It is possible that the improper use of some bioelectric therapies may lead to cancer cell proliferation rather than remission. It is also difficult to get additional information on the Rife machines. When I wrote to some of the addresses listed in one alternative cancer therapy guidebook and asked for information on Rife generators, my mail was returned unanswered. Like many alternative cancer therapies, the Rife therapy has survived outside the borders of the United States, in this case in Tijuana.

Naessens

Gaston Naessens is probably the best-known living French researcher to support the theory that a pleomorphic microorganism plays a role in the etiology of cancer. Naessens grew up near Lille, a northern city that is known in the history of microbiology as the place where Antoine Béchamp taught. An advocate of an extreme form of bacteria pleomorphism, Béchamp was also a contemporary of Pasteur who claimed that Pasteur plagiarized some of his best work from Béchamp. Although Naessens did not become aware of Béchamp's work until later in life, he probably was exposed to a Béchampian line of thinking in his college studies in science at the University of Lille. During the Nazi occupation, Naessens continued his college education in southern France among displaced professors from Lille. Born into a family of bankers, he had the luxury to pursue his inventions. Having worked in a laboratory for blood analysis, he became interested in blood parasitology, and he invented a dark-field microscope that used prisms and laser beams. Although the technology is different from that of the Rife microscope, Naessens also achieved high levels of magnification and resolution. The higher levels of magnification and the dark-field technology allowed him to observe the smaller, virus-like phase of what he claimed was a 16-stage, pleomorphic microbial blood cycle.

Like a prior generation of researchers in Germany such as Günther Enderlein and Wilhelm von Brehmer, Naessens believes that there is a native blood microbe (the "somatid") that ranges from the size of a virus to that of a fungus. He views the microbe as part of the natural flora of the blood that play an essential role in growth and reproduction (such as the production of necessary growth hormones). He believes that in some cases the microbe can develop into extended, fungal phases of the cycle when the immune system is compromised and "blood inhibitors" are not present. When I interviewed him at his home in Quebec, he explained that the

somatid cycle is primarily diagnostic of chronic or advanced diseases, but that the advanced or fungal stages of the somatid cycle release excess growth hormones, which may contribute to cancer. In general, this version of the microbial theory, which rests on the theory of a native blood flora like native intestinal flora, is part of the continental tradition of this heterodox school of microbiology. In contrast, in the North American tradition (such as Rife) there is less interest in an indigenous blood flora, and research focuses instead on culturing microbes from cancer tissue.

As for Rife, Naessens also became interested in therapeutics. He developed anablast, an anticancer serum that was derived from horse's blood after injecting the animal with bacteria cultured from the blood of cancer patients (Villequez 1969:53). There is a history of similar anticancer sera in both France and North America, and researchers claimed that the sera were responsible for many successful cases of cancer remission. Naessens was not a doctor or a pharmacist, however, and he did not report his results in a medical journal. He therefore occupied an extreme position as an outsider to the medical establishment. Unlike Rife, he also appears not to have found many allies among established medical researchers. In the 1960s Naessens was tried for the illegal exercise of medicine and pharmacy (1969:55). The result of the trial was that he was fined, his laboratory was closed, and much of his equipment (but not his microscope) was confiscated.

To pursue his work without interference, Naessens moved to Corsica. When word spread of his whereabouts, however, he was invaded by hundreds of patients. The French medical authorities began an investigation that led to another trial. Meanwhile, he had relocated to Quebec where he developed another anticancer drug, 714-X, the one that is now best known in the alternative cancer therapies movement today and to some extent among AIDS patients. As Naessens explained to me, the drug affixes nitrogen atoms to molecules of camphor. He reasons that because cancer cells are nitrogen traps and because camphor is attracted to cancer cells, the drug provides the cancer cells with the necessary nitrogen that would be robbed from healthy cells. As a result, the immune system is able to recover to the point where it can then destroy the cancer cells.[9] The toxicity of camphor may also contribute cytotoxic effects.

In 1985, the Quebec Medical Corporation prodded the government into indicting Naessens, and he went on trial in 1989. Because the charges included murder, the potential sentence was life imprisonment. He had treated a terminally ill patient who had asked him to treat her, but according to Naessens her cancer was too advanced and there was not enough time for his treatment to work. The trial is described in detail in *The Persecution and Trial of Gaston Naessens,* by journalist/writer Christopher Bird (1990). In a surprise event for alternative cancer therapies, Naessens won the trial. The prosecution brought in male scientific experts who questioned Naessens's theory of a pleomorphic microbial cycle in the human blood. The defense focused on the therapy rather than the theory, and it called as witnesses men and women from all walks of life, including "ordinary" people and some leaders of Quebec society. Many of the witnesses for the defense stated that they owed their life to Naessens; the jury swung in their favor and returned a not guilty verdict. Although Naessens is now very careful not to prescribe or administer 714-X, the Canadian government allows the drug to be administered under special

permission. Requests for the drug have been high during the 1990s, and Naessens's laboratory is apparently busy with its ongoing work of blood analysis.

Technology and Medical Heterodoxy

Rife and Naessens developed two types of technologies—unusual microscopes and alternative cancer therapies—that were constructed along with versions of the theory that pleomorphic microbes play a substantial role in health and disease. Consider first the microscopes. Because the researchers were interested in following virus-sized phases of what they believed was a larger microbial cycle, they found it valuable to invest their time in developing unusual microscopes. Both claimed to study pleomorphic microbes live, without staining, and to follow them through form-changing cycles. Their technological innovations allowed them (from their perspective) literally to transform theories of filterable, pleomorphic microorganisms into observations.

However, the portability of the theories and research of Rife and Naessens—that is, their ability to diffuse across a wider research community—was also restricted by the very technologies that allowed them to study their microbes. Dark-field microscopy is itself a relatively uncommon technology, and claims that a new light microscope could allow magnifications equivalent to electron microscopy created skepticism. Aware of the problem, Naessens developed convertors that could be mounted on other, standard microscopes and that would enhance the resolution enough for researchers to be able to see what he claimed were the smaller phases of the microbial cycle. Through these technical innovations he hoped to remove one hurdle that blocked his technologies and theories from moving easily through the scientific and medical communities.

However, from a mainstream medical perspective, there are still two major criticisms of Rife's and Naessens's claims to have documented complex microbial cycles with their microscopes. The first argues that because electron microscopes are able to chart filterable particles, the microbial cycle could be confirmed or disconfirmed easily through electron microscopy. This argument is more applicable today than in the 1930s, when Rife was beginning his work and electron microscopes were emerging.[10] Today electron microscopy is one way to investigate the claims empirically, as are comparative DNA analyses of the different phases of the microbial cycle. Therefore, one might argue that modern technology would quickly show that Rife and Naessens were either right or wrong. For the present purposes it is sufficient to point out that electron microscopy and molecular technologies do not necessarily provide a technological solution to the controversy. Instead, they shift the terms of the debate toward the possible etiological role of buried bacterial genomes of common bacterial species in a variety of chronic diseases, with cancer remaining as one of the possibilities. For example, electron microscopy does reveal small, intracellular, electron-dense bodies. Since 1974 mainstream medical researcher Gerald Domingue of Tulane University Medical School has reported on these bodies and their role as a possible mechanism for bacterial persistence. He argues that reverting cell-wall deficient bacteria may cause infections systematically overlooked in clinical medicine (Domingue 1995, in press). It is also possible that cell-wall deficient bacteria may also play an etiological role in cancer, although

the existence of a single, pleomorphic cancer microbe no longer seems likely (literature reviewed in Mattman 1993).

The second argument, which is directed more at the technological design of the microscopes, is that such microscopes are theoretically impossible to build because the size of the wavelength of light does not allow sufficiently high resolution. However, some scientists were curious enough to examine the microscopes and courageous enough to back the claims of enhanced resolution and magnification. Today versions of light microscopes that have similar levels of resolution are being developed.[11] In short, the microscopes of Rife and Naessens were heterodox but probably not "pseudo" technologies.

Although the theories and microscopes of Rife and Naessens located them well beyond the mainstream, legal prosecution focused on the therapies that they developed. As for the microscopes, there is some anecdotal evidence that the Rife frequency instrument and the Naessens serum may have been successful, but there is no data even approaching current methodological standards in medical research. Yet, even if their therapies could be proven someday to be efficacious (by some consensus definition of clinical efficacy such as randomized clinical trials), their therapies were positioned in a field of cancer research that excluded the role of microbes as possible etiological agents in cancer.[12] In order for the therapies to be able to move into mainstream cancer research circles, they would have to be disengaged from their heterodox theories and reconstructed as cancer therapies that operate through accepted biological mechanisms. For example, the Rife electronic frequency machine would have had to be repackaged as a cytotoxic treatment similar to radiotherapy, not a machine that killed purported microorganisms based on tunings to resonant frequencies. Likewise, successful bacterial vaccines in cancer therapy would have to be distanced from the microbial etiology theory. This distancing has occurred somewhat, and with some success, with the bacterial therapy known as Coley's toxins. The American medical researcher William B. Coley endorsed one version of the microbial theory of cancer, and he believed that it might help explain the efficacy of his bacterial toxins therapy. However, his toxins have become moderately acceptable today through new understandings that view them as a nonspecific immunotherapy that releases a cascade of cytokines (Wiemann and Starnes 1994). It is likely also that Naessens's move from Anablast to 714-X was an attempt to develop a less controversial therapy because the latter was relatively separate from the microbial theory.

This brief article cannot do justice to the complexities of the two cases, but it helps illustrate the point that orthodoxies and heterodoxies in the scientific and medical world also play themselves out in the sociopolitical alignments, not to mention the design and construction, of technologies. The phenomenon of technological heterodoxy is only a subset of the general way in which technologies can serve as technical markers (technototems) of sociopolitical boundaries in scientific, technical, and medical controversies. Because this way of thinking about the material culture of medicine can be used to analyze technology as a marker of divisions among social categories, it is likely to be of general interest to medical anthropologists and other social scientists of medicine whose research involves areas other than the example here of controversy, heterodoxy, and alternative medicine. Furthermore, a better sense of how the technical is the political may be

of use to advocates of alternative medical therapies who wish to develop more sophisticated strategies for gaining the recognition that is a prerequisite for adequate testing and evaluation.

This article does not evaluate the claims regarding the efficacy of the Rife machine, Anablast, or 714-X. Elsewhere, I evaluate a substantial body of literature that suggests some efficacy for bacterial vaccines and sera (Hess, in press a). There is also some evidence to suggest that cell-wall deficient bacteria play an under recognized role in the etiology of cancer. However, DNA analyses (Domingue 1982) prove that there is no single, pleomorphic cancer organism, as the earlier researchers and Naessens believed. It is perhaps only possible in the age of flexible accumulation and flexible bodies (Martin 1994) that microbiologists and other researchers may reassess the extent to which bacterial variation may be the norm and cell-wall deficient (divergent) bacteria may play a role in chronic, degenerative diseases.

Given the rather dismal progress in improving five-year survival rates for the major cancers during the last 20 years (the period of the so-called war on cancer, which many in alternative cancer therapy circles call a "medical Vietnam"), it is time to reevaluate some of the cancer theories and therapies that have been rejected.[13] Recent clinical-outcomes studies in the field of alternative cancer therapies, such as the Gerson therapy melanoma study (Hildebrand et al. 1995), provide a hint of the possibilities that may someday be realized.[14] There is a long history of precipitous rejection of some alternative cancer theories and therapies that may may have opened the door to less costly and more effective treatments for cancer and other chronic, degenerative diseases. Although the field is full of unsubstantiated claims and has its share of charlatans, there are also a number of alternative cancer therapies that posit a credible biological mechanism, provide some evidence for efficacy, and warrant additional investigation. Consequently, additional research on selected alternative cancer therapies and changed regulatory procedures should be important features of a reformed national health care agenda.

NOTES

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Correspondence may be addressed to Science and Technology Studies Department, Rensselaer Polytechnic Institute, Troy, NY 12180-3590; hessd@rpi.edu.

1. The anthropology of science and technology is linked institutionally through CASTAC, the Committee of the Anthropology of Science, Technology, and Computing of the American Anthropological Association, and by an electronic list of over 200 names. For introductions to the field, see Downey et al. 1996 and Hess 1995, 1996.

2. See also Hess (1995:chs. 5, 6) for a review of studies of cultural reconstruction and of the comparative, cultural approach in science and technology studies.

3. By "totems" I refer to the co-constitution of natural and social categories (e.g., Sahlins 1976), a concept that is extended here to technical and social categories. The concept is only one specific instance of the more general theory of signification.

4. For the cases discussed below, I have interviewed Gaston Naessens and Jacinte Levesque as well as William Fry and Geronimo Rubio of the American Metabolic Institute

and Hospital Metabolico G. Rubio y Fry. (The latter, located in Tijuana, sometimes uses the Rife therapy as part of its general package of immunotherapies for cancer. The Rife therapy, like many other alternative cancer treatments, is legal in Mexico.) I was unable to get in touch with Rife's former partner Crane.

5. See Moss 1991 on the linkage between radium-therapy and the Dodge-Phelps mineral empire, New York's Memorial Hospital, and Johns Hopkins. For information on the pharmaceutical industry and cancer research, see Moss 1991 and Bud 1978. The role of interests as a shaping force is evaluated in Hess (in press a: ch. 6).

6. Other than published journal articles that are cited here, I have seen only one of his primary documents, a short manuscript in the National Library of Medicine (Rife and Crane 1953). To my knowledge nothing more survives him in publicly available archives, and I have relied on Lynes 1987.

7. Probably with the aid of Nikola Tesla, Lakhovsky developed a frequency machine similar to the one that Rife developed (see Lakhovsky 1988). Work on electronic frequency machines in France continued after Lakhovsky with the controversial research of Antoine Priore.

8. Rife and Crane (1953:11). In Rife's short report there is no definition of what it means to be "clinically cured," nor of how long the claimed remissions lasted. No details are given of the ways in which they were defining a *cure*. Because the term *cure* was used more loosely at the time, *remission* is a better term to use today. However, in the literature on bacteria and cancer in general, there are claims that some of the therapies achieved long-term remissions (more than 10 years), which could be defined today as "cures."

9. I have not yet seen a detailed, written biochemical rationale for 714-X, and although the drug is popular in alternative medical circles, it is difficult to evaluate without a better understanding of its biochemical constitution and a rationale for its mode of operation. See Naessens n.d.[a], n.d.[b].

10. In France, electron microscopy was used to debunk the theory in the 1950s during a trial and investigation of a colleague of von Brehmer (Villequez 1969:47–48). Villequez, however, criticized the methodology and conclusions of the electron microscopy studies.

11. See, for example, Isaacson et al. 1992 or, for an account written for the nonspecialist, Fisher 1990.

12. Of course, I am well aware of viral oncology and research on protooncogenes, but in general oncoviruses are believed to play no role in major human cancers.

13. See also Clarke and Casper, this issue.

14. The study is not prospective, double-blind, or clinically controlled through matched pairs, but it suggests a possibility. Regarding bacteria and cancer approaches or nonspecific immunotherapies, see Livingston-Wheeler and Majnarich 1986. The Cassileth et al. study (1991) shows no difference between conventional and alternative treatment patients in the Livingston program. Quality of life was better among the conventional patient group, but it also was better at enrollment, so the results on this dimension are somewhat ambiguous. My point is that results may be negative, positive, or mixed, but the research should be done. Patients are citizens who have a right to know.

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