



# Is cancer just an incurable infectious disease?

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**Summary** The word 'cancer' is of Latin derivation and means crab. By the turn of the 20th Century organized medicine had come to the conclusion that it was not a matter of whether infectious disease caused cancer, but which one. For over two hundred years a cancer germ had been discovered and rediscovered, named and renamed, each scientist adding to the knowledge, but to no avail. Then, in 1910, certain American medical powers did a 180-degree rotation, deciding that cancer was not caused by a microbe, and that anyone who thought otherwise was a heretic, a charlatan or a quack. But Dr. Virginia Livingston and her network were none of the above, their meticulous peer-reviewed research and publications, done at the height of US post World War II technology. And Dean Burk, Head of Cell Chemistry at the NCI went so far as to say that Livingston's cancer germ was as real and certain as anything known about cancer. Researcher, MD Alan Cantwell Jr. grew up thinking that all germs responsible for the important diseases were supposed to have already been discovered. But much to his dismay, he found one that was left out: the cancer germ. Cantwell already knew that for finding this, Livingston had already been branded by traditional medicine, leaving what he thought to be perhaps the major discovery of the 20th century largely discredited. The striking analogy between cancer and tuberculosis was noticed long before the tubercle bacillus was discovered. In 1877, Sir John Simon clearly pointed out the similarity and in fact argued very strongly in favor of a microbial origin for cancer. But Simon's vindication would have to wait for Livingston's germ, which although tuberculosis-like, was not tuberculosis but an atypical form of this mycobacterium, melded from the mycobacterium and other related *Actinomycetales*. Had medical science and the powers that be spent as much time in investigating and destroying Livingston's germ as they did in attacking her and those around her, cancer might be curable today.

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## Hodgkin's cancer under attack

When Virginia Livingston was a student at Bellevue Medical College her pathology teacher mentioned, rather disparagingly, that there was a woman pathologist at Cornell who thought Hodgkin's disease (a form of glandular cancer) was caused by avian tuberculosis [1]. This lady had published, but no one had confirmed her findings. Afterwards, Liv-

ingston compared slides of both. In Hodgkin's, the large multinucleated giant cells were called Reed–Sternberg cells. They were similar to the giant cells of tuberculosis, which formed to engulf the tubercle bacilli. Livingston stored away in her memory that the lady pathologist was probably right but she would have a difficult time in gaining acceptance.

By 1931, Pathologist Elsie L'Esperance was seeing 'acid fast' tuberculosis-like bacteria riddling her Hodgkin's tissue samples. And that germ, once injected into guinea pigs, caused them to come

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down with Hodgkin's too, fulfilling Koch's postulates. L'Esperance brought her stained slides to former teacher and prominent Cornell cancer pathologist James Ewing. Ewing initially confirmed that her tissue slides were indeed Hodgkin's. But when he found out that her slides came through guinea pig inoculation of the human avian tuberculosis she had found in Hodgkin's, Ewing, visibly upset, said that the slides then could not be cancer. It betrayed his checkered history.

In 1907, you could have approached Dr. James Ewing about a cancer germ, and he would have embraced you over it. At that time, both for he and the rest of the nations medical authorities, it was not a question of whether cancer was caused by a germ, but which one. Was not it Ewing, at one time, who had proclaimed that tuberculosis followed Hodgkin's Disease "like a shadow"? Shortly after, James Ewing, "the Father of Oncology", sent a sword thru the heart of an infectious cause of cancer with "*Neoplastic Diseases*" [2], becoming an ambitious zealot for radiation therapy with the directorship of what would one day be called Sloan-Kettering squarely on his mind. His entry lay in prominent philanthropist James Douglas. A vote for Ewing, Douglas knew, was a vote for continued radiation and James Douglas began sizeable uranium extraction operations from Colorado mines thru his company, Phelps Dodge, Inc. [34].

Soon Sloan became known as a radium hospital and went from an institution with a census of less than 15% cancer patients, separated by partition, lest their disease spread to others, to a veritable cancer center. But the very history of radiation revealed its flaws, and by the early 1900s nearly 100 cases of leukemia were documented in radium recipients and not long thereafter it was determined that approximately 100 radiologists had contracted that cancer in the same way [3].

Still, Ewing, by now an Honorary Member of the American Radium Society, persisted.

Elise L'Esperance was anything but alone in linking Hodgkin's to a tuberculosis-like germ called Avium. Historically Sternberg himself, namesake of Hodgkin's trade-mark Reed-Sternberg cell, believed Hodgkin's was caused by tuberculosis. Both Fraenkel and Much [35] held, as L'Esperance, that it was caused by a peculiar form of tuberculosis, such as Avium, and of all the cancers, debate over the infectious cause of Hodgkin's waxed the hottest. Into this arena L'Esperance stepped in 1931, with few listening. She would publish *Studies in Hodgkin's Diseases* [4] in an issue of *Annals of Surgery*. It proved to be the one legacy that no one, not even Ewing, who would soon die from a self-diagnosed cancer, could take away.

## Dr. Virginia Livingston

Our (cancer) cultures were scrutinized over and over again. Strains were sent to many laboratories for identification. None could really classify them. They were something unknown. They had many forms but they always grew up again to be the same thing no matter how they were cultured. They resembled the mycobacteria more than anything else. The tubercle bacillus is a mycobacterium or fungoid bacillus. —Virginia Livingston, 1972

Virginia Wuerthele-Caspe Livingston was born in Meadville, Pennsylvania and went on to obtain impeccable credentials. Graduating from Vassar, she received her M.D. from N.Y.U. The first female medical resident ever in New York City, with time Livingston became a Newark school physician where one day a staff nurse asked medical assistance. Already diagnosed with Raynaud's syndrome, the tips of this nurses fingers were ulcerated and bled intermittently. Livingston also diagnosed Scleroderma. But upon further examination there was a hole in the nasal septa, something that Livingston had previous seen in the mycobacterial diseases TB and Leprosy. Livingston approached dermatologist Eva Brodtkin and a pathologist for confirmation, all the while convinced that mycobacterial infection was causing the Scleroderma. She then preformed cultures from a sterile nasal swab — mycobacteria appeared, everywhere [1]. Injected into experimental chicks and guinea pigs, all but a couple died. Upon autopsy, the guinea pigs had indeed developed the hardened skin patches of Scleroderma... some of which were cancerous.

## Momentum builds

Livingston, now possessed, solicited fresh sterile specimens of cancer from any operating room that would give them to her. All cancer tissues yielded the same acid-fast mycobacteria. New Jersey Pathologist Roy Allen confirmed her findings. Livingston and Allen then found that they could actually differentiate malignant from benign tissue by their mycobacterial content [5]. But still the explanation for why the cancer germ showed so many different forms was elusive.

Try as she might, part of Virginia Livingston's problems in an American validation of her multi-shaped cancer germ lay firmly entrenched in the history of medicine, especially in the constantly

## Is cancer just an incurable infectious disease?

changing field of microbiology. Louis Pasteur could handle being quickly rushed off a *Paris Academy of Sciences* podium to escape harsh reaction to his suggestion that children's milk be boiled first, but he could not tolerate his rival Pierre Bechamp's statement that a single bacteria could assume many, many forms. On his deathbed, Pasteur was said to have changed his mind when he said: "The terrain is everything", meaning the culture or milieu that bacteria grew on or in could change their shape or characteristics. But it was too late and even today, most conventional microbiologists deny the existence of such form changing (or pleomorphic) germs.

Robert Koch, Father of Bacteriology and discoverer of tuberculosis, could have helped. When he first worked with the bacteria anthrax, he noticed that anthrax's classical rod shape became thread-like inside the blood of laboratory mice. And then, after multiplying, they assumed spore-like forms.

Aware of what she faced, Livingston methodically went about proving cancers true cause. First in her line of attack were the long suspected and well-publicized tumor agents of Rous, Bittner and Shope. By photomicrographs, Livingston and her group demonstrated acid-fast mycobacterial forms in each of these so-called "viral" cancers. This included the famed Rous chicken sarcoma.

Early on, Virginia Livingston had decided that she needed help in validating her cancer germ and nobody knew the shapes and staining capacities of mycobacterial-related germs better than Dr. Eleanor Alexander-Jackson of Cornell. As far back as 1928, Eleanor Alexander-Jackson, bacteriologist, had discovered unusual and to that point unrecognized forms of the TB bacillus, including its filterable forms. By 1951, Alexander-Jackson was considered *the* expert TB microbiologist at Cornell.

In the same year, another American, H.C. Sweany proposed that both the granular and other forms of tuberculosis that passed thru a filter caused Hodgkin's Disease [6]. This was subsequently supported by studies by Mellon, Beinhauer and Fisher [7,8]. Mellon prophetically warned that tuberculosis could assume both classical red acid-fast forms as well as blue nonacid-fast forms indistinguishable from common germs such as *Staphylococci*, fungi and the *Corynebacteria* and that this would surely perplex microbiologists.

When organized medicine choose to ignore these studies, Jackson warned that a so-called cure for TB could be as short-lived as it took classical TB rods, for the moment gone underground as a non-acid-fast form, to resurface one day and spring back towards destruction. Although American

medicine had no serious time for Alexander-Jackson or her discoveries, it would not disturb her for as long as she focused on tuberculosis and its cousin leprosy. But when her focus shifted towards Livingston's cancer germ, it would move to destroy her. She simply posed too great a threat.

## Recognition

By December of 1950 Livingston, who had written over 17 peer reviewed articles by the end of her career, wrote together with Jackson and four other prominent researchers, what still stands as a milestone on the infectious nature of cancer [9]. At the AMA's 1953 New York exhibit, participants interest was particularly riveted towards an exhibit of Livingston's cancer germ, live. The press, muzzled by Sloan Kettering's head, Cornelius Rhodes, was not allowed to interview or report on this exhibit. Above, the cancer germs seemed indestructible, surviving a five-day experience of the intolerable heat from closed-circuit microscopy [1].

As Livingston and Jackson's work on the cancer germ became more and more convincing, her opponents surfaced and became more and more vocal. Also with recognition, came visitors. One a pathologist from Scranton, Dr. George Clark, told Livingston he had cultured Dr. Thomas Glover's famed cancer germ from human cancer and developed metastasizing tumors in animals from it. Clark assured her that Glover was on to the same bacterial pathogen as she was. For more than two hundred years, the same organism had been discovered and rediscovered, named and renamed, each discoverer adding to what was known about the cancer germ, but thus far to no avail.

## US studies take hold

Clark knew Glover as part of an investigative team of the US Public Health Service headed by George W. McCoy in 1929. Glover had just become too well known to be ignored. His cancer serum was working. Much was at stake. The Country was already committed to the idea that cancer could not possibly be an infectious disease, and Glover was saying that he had already isolated the cancer germ.

Actually, he had not, but few would believe that it was really his young, tobacco-chewing assistant, Thomas Deaken who had isolated it. Deaken worked his way up New York's health and hospital system from the most menial positions to labora-

tory assistant. With neither formal medical or scientific training he nevertheless learned laboratory protocol [10]. Incredibly Deaken engineered a geranium based culture medium, managing to grow out acid-fast bacteria. Then he inoculated mice and dogs, producing cancer with metastatic spread in every case [10]. Sometime between 1917 and 1918 Thomas Daeken, laboratory assistant, produced a specific anti-cancer sera by injecting horses with the human cancer germ. Moreover, the sera worked whether in prevention or cure of his cancerous laboratory animals. But he had come to the point where he needed someone to lend credibility to his work, and that someone, came in the form of Dr. Thomas J. Glover of Toronto.

It will always be to Glover's credit that he saw the importance and application of Deaken's work from day one. A contract was quickly drawn up and executed. Glover rushed back to open a Canadian cancer clinic in Toronto. The serum worked in many but not all cases; but as Glover's reputation grew, so to did the interest in him of Canada's organized medicine. A subpoena giving him 21 days to submit a full presentation of his treatment was issued. But Glover was not cooperating. Glover was in trouble and would soon be chased out of Canada [10].

By 1926, and now in the US, Glover published *Progress in Cancer Research*, presenting over 50 cases, most of which went into remission with Glover's Serum [11]. It sparked additional notoriety, both here and abroad. In 1929, Livingston's friend Dr. George Clark joined Dr. George McCoy, then head of the Hygienic Lab of the US Public Health Service. Their intended destination: Glover's laboratory, now at New York's Murdock Foundation. Glover was under investigation and McCoy wanted him to repeat his work, this time under Health Service surveillance and in Washington. Glover complied, and he and his team went to the nations capital to prove their case at what was to one day become the National Institute of Health. McCoy, the investigator, impressed by Glover's work, rather than come down on Glover, instead issued a 1937 letter to Surgeon General Parran, which spoke in glowing terms of the great importance and significance of Glover's cancer findings. Soon thereafter, McCoy was abruptly and mysteriously replaced by Dr. R.H. Thompson.

Parran, a product of organized medicine, had a definite agenda. The question before him was whether to publish Glover's now finished Washington report or not and Parran, despite continued committee approval, was not about to, sending Glover into a cold rage which ended with him walking away from Washington to publish independently. Meanwhile, Glover's serum, which had

helped and saved so many was subjected to cursory animal studies and a review without clinical trials before being condemned by Government agencies. Glover would eventually return to Canada, but he would never again answer questions as to just what had happened in America.

## Focus on breast cancer

Virginia Livingston went specifically after breast cancer. Thirty sterile cancerous breasts were transported from operating room to lab. Cancers were isolated from each breast and when axillary tissue from under the arm was supplied, the cancerous portion was cut from this too.

Livingston and Jackson found the cancer germ everywhere, and in the case of underarm glands, even when the pathology report was negative, the cancer microorganism surfaced [1].

Champion of toxic chemotherapy, Cornelius Rhoads replaced Ewing at Sloan. Rhoads, head of chemical warfare during the Korean war, was deeply committed to chemotherapy and the huge grants it brought from the pharmaceutical industry. It is poorly recognized that the chemotherapy or "chemo" used against cancer began as a weapon of mass destruction par excellence [12]. When the Axis folded, nitrogen mustard, declassified, first came under real medical scrutiny for cancer. Initially evaluated for lymphosarcoma in mice, human studies soon followed as more and more variants of nitrogen mustard were concocted and tried [12].

Other related classes of chemotherapeutic agents followed and so did their repercussions. Most had the potential to cause a second entirely different cancer [13]. Even tamoxifen for breast cancer was associated with a two to three-fold increased risk of cancers of the lining of the uterus (endometrial), some of which were high grade with a poor forecast [14].

Nevertheless, Cornelius Rhoads remained committed to the treatment, and at the same time prepared a series of major roadblocks to stop Livingston. In 1950, he barred her from presenting her paper on the cancer germ at the New York Academy of Sciences by discrediting Irene Diller, the symposiums sponsor, chief-editor of the respected journal *Growth*, and a prominent cancer researcher. Diller, like many, had accepted a gift from a pharmaceutical house at one point.

Livingston came across Diller in a *Life* article which talked about a Philadelphia cancer researcher who was observing strange fungus-like filaments protruding from cancer cells. Livingston

## Is cancer just an incurable infectious disease?

and Alexander-Jackson convinced her that her fungal forms (the prefix – myco in mycobacteria denotes a germ with fungal properties) were part and parcel of the cancer microbe, and that crucial to its identification was acid-fast staining.

Dr. Eleanor Alexander-Jackson's elation over the groups infectious breast cancer findings came to an abrupt halt when she was informed by her private physician Frank Adair that she too had it. A radical mastectomy was done at Sloan on Adair's advice. While anxiously waiting for the outcome, Dr. Virginia Livingston heard her name paged on Sloan's overhead. Rhoads wanted to speak to her regarding Jackson's ongoing surgery. It was urgent.

Alexander-Jackson was still in the operating room and the radical had been done. In Rhoads office, the two adversaries faced off. Rhoads was after permission to go after a cancerous lymph node deep in the middle of Eleanor's chest. Livingston bristled.

"We have been looking for a tumor such as she has." said Rhoads.

Apparently a radical was not enough. He was seeking permission to try a new surgical technique which went after the deep chest node. Livingston had had enough. Just the thought of the cruel, disfiguring procedure made her sick.

"Not on your life." She shot back, as she left [1].

### The single most convincing study of how bacteria causes cancer

By 1965, Edith Mankiewicz, Director of labs at Montreal's Royal Edward Chest Hospital and assistant professor of bacteriology at McGill, by examining human cancer tissue, established mycobacterial-like germs inside cancer [15]. In the bibliography of her landmark paper is reference to a personal communication with Dr. Eleanor Alexander-Jackson. One of the cancers under Mankiewicz's trained eye was lung cancer. Lung cancer, or bronchogenic cancer, was first reported in the nineteenth century at a time when it was practically unknown-while mycobacterial disease of the lung, primarily tuberculosis, was so rampant as to be called 'white plague' or in certain circles: 'captain of the men of death.' By the middle of the seventeenth century, one in five deaths was due to tuberculosis and at the end of the nineteenth century, there was fear that it would destroy the very civilization of Europe. So difficult was it to differentiate tuberculosis from the newly discovered bronchogenic cancer that it was only after cases first mistakenly diagnosed as lung cancer

were operated on that the benefits of surgical resection of tuberculosis were recognized [16].

Mankiewicz not only showed the cancer germ in malignant tissue but significantly demonstrated how it probably evolved from tuberculosis and related microorganisms when some of the viral phages that lived in them jumped germs, bringing genetic materials which altered the target germs virulence. In fact beneath her microscope lay a pictorial of how the cancer germ emerged from TB-like bacilli to create pre-malignant change in mammalian tissue [15].

By 1970, Sakai Inoue, a PhD from Maebashi, Japan and Marcus Singer, a doctor at Case Western's Developmental biology, completed the single most convincing study of how bacteria cause cancer altogether, with mycobacteria. Supported by grants from the American Cancer Society and the National Institute of Health, their study used cold-blooded animals, namely the newt or salamander and the frog. But similar studies showed its applicability to mice [17] and humans [18,19]. Inoue:

An organism similar to the mycobacterium described here has been isolated and cultured from tumors and blood of tumorous mammals, including man, and when injected into mice and guinea pigs, has been reported to yield a chronic granulomatous disease, neoplasm (cancer), or some intergrade. —Inoue and Singer, 1970

Back in the spring of 1953, Sakai Inoue noticed an adult salamander with a hard mass on its stomach. He removed the mass, which turned out to be malignant. Then he injected tissue from the mass into healthy animals. Again, cancer developed. In the work that followed, Inoue and Singer, from electron micrographs, knew that bacteria were involved, bacteria which stained acid-fast...mycobacteria [20].

Inoue inoculated three other types of mycobacteria, into healthy animals. All came down with cancer, something that did *not* happen when other germs such as *staphylococcus* or *streptococcus* were used. Amazingly Inoue and Singer even noted regressions in some of the cancers, especially if very dilute solutions of the germs were used to initiate them. Furthermore, since cancers stemming from 'carcinogens' were structurally identical to mycobacterial induced cancers, the investigators results suggested that such 'carcinogens' might merely be factors that activate preexisting infection. The phages inside mycobacteria are viruses known to be activated by carcinogens such as UV light and chemicals [21]. Mankiewicz, five years

previously, had shown that these phages, once activated, could cause pre-malignant changes in mammalian tissue [15].

Sakai Inoue and Marcus Singer's study should have once and for all convinced Virginia Livingston's opponents of the veracity of her results, and that she was not mistaking common contaminants such as *staph.* or *strept.* for the cancer germ. . .but it did not.

## The politics of cancer

It was public knowledge in early 1951 that the Black-Stevenson Cancer Foundation intended to award two huge Black grants of \$750,000 towards cancer research and that the first would go to Livingston's group at Newark's Presbyterian; with an equivalent amount to go to The Memorial Center for Cancer (now Sloan-Kettering), which Rhoads headed. The trustees having already decided this, the actual allocation was left in the hands of Newark lawyer Charles R. Hardin, but fate intervened. Livingston:

Hardin, the lawyer in charge of allocation, soon would lie dying of cancer at Memorial and while still alive was prevailed upon by design of Rhoads to sign a paper giving Rhoads power over how Presbyterian's grant was to be spent. And that wasn't going to include further research towards an infectious cause for cancer. Livingston, 1972

Still Rhoads was not finished. Livingston, already world-recognized, took her cancer microbe and a guest named George Clark to Rome's Sixth International Congress for Microbiology, a trip paid for by her husband's firm as a consultant to British industry. In Rome, Livingston met Emy Klieneberger-Nobel at the Lister institute. Klieneberger-Nobel was a pioneer uncovering bacteria without cell walls which led them to assume many forms [32]. She called them 'L-forms' in deference to the Institute at which she worked. Her exploration also covered bacteria with cell-wall breaches. In either case, the resulting germs, called 'cell-wall-deficient' assumed many forms. Livingston immediately saw Klieneberger's work as clearing a large part of the confusion over her many-formed cancer germ.

Livingston's trip to Rome's Congress of Microbiology was punctuated by a stop to visit von Brehmer in Frankfurt. Von Brehmer's vaccination techniques, long respected throughout Europe, were now licensed by the German government.

During the war, Wilhelm von Brehmer's scrimmage with the Nazi medical establishment went right to the top. Severely criticized for saying that cancer was an infectious disease, the struggle eventually found its way to Hitler himself, who, puzzled, yet interested, ordered an inquiry on the matter at the 1936 Nuremberg Party Conference. Subsequently, the committee formed came down hard on von Brehmer's views. Nevertheless, unperturbed, he somehow persisted into the legendary status he now maintained.

Big names began to join the conference, including Nobel Laureates Fleming and Waksman.

By the time Virginia Livingston returned to the States, the Rome conference had been highlighted by several news services. Beginning with the *New York Times* and *The Washington Post*, other papers quickly followed suite: the cancer germ had been found. Reaction quickly followed. At *The New York Academy of Medicine*, spokesman Iago Gladston, fresh from executive session, held his own sort of news conference:

This is an old story and it has not stood up under investigation. Microorganisms found in malignant tumors have been found to be secondary invaders and not the primary cause of malignancy. Livingston, 1972

Livingston returned to Newark. Her Chief, James Allison, contacted her with the bad news. Since they had lost Black-Stevenson funding, he wanted her to close up Presbyterian's research and move back to Rutgers's home campus in distant New Brunswick. And in still another cost-cutting gesture, she was informed that her close friend and associate Eleanor Alexander-Jackson would have to go. Shocked, Livingston made arrangements to leave Rutgers altogether.

Barely unpacked from Europe, Livingston's husband would now be hounded by the IRS regarding where they got the funds for the European trip. Someone had implied the money came from his wife's grants. This did not bear out and the couple demanded to know who had instigated the inquiry. "Someone high up in New York in cancer." The IRS agent replied [1].

## Parallels with plant cancer

By 1925 Mayo's Charles Mayo became interested in Erwin Smith's discovery of cancer in plants, called crown gall. Livingston and Jackson, sensing a possible link between Smith's work and their own, went to the Bronx Botanical Garden to request

## Is cancer just an incurable infectious disease?

cultures of *Bacterium tumefaciens*, the plant cancer germ he had discovered. No mere accident led Virginia Livingston towards Smith's work. Smith stained his plant cancer germ with Fuchsin, long used to spot tuberculosis. And Smith's bacteria, like Livingston's, had many shapes. He had stumbled across *B. tumefaciens* in 1904, when he received some New Jersey daisies with overgrowths superficially resembling olive tuberculosis, a known disease of plants, but which proved to be plant cancer.

Smith had long suspected a bacterial cause for human cancer and criticized pathologists for drawing:

Too sharp a demarcation between malignant tumors, on the one hand, where the cells of the animal or human host, acting under some unknown stimulus are responsible for the tumorous growth and granulomata (benign tumors) on the other hand, such as tuberculosis and actinomycosis, where a visible microbe is responsible for the primary tumor, and the direct migration of this microbe for any secondary tumors that may appear. Rogers, 1952

Smith's conclusion:

At the bottom, I think the distinction between such a disease, for example as tuberculosis or leprosy and malignant tumors is not as sharp as some histologists have been inclined to believe. Rogers, 1952

It could be said that at one time the entire medical and scientific community was set on fire by Erwin Frink Smith's discovery of the bacteria that caused plant cancer. Twice honorably mentioned in *The Journal of the American Medical Association*, their Editorial "Is Cancer of Infectious Nature?" mentions how Smith's work made "a very strong case in favor of his view of the infectious cause of cancer in general." (JAMA, 1912)

By 1921, Margaret Lewis, of the Livingston Network, approached Frink Smith regarding her planned chicken inoculations with *B. tumefaciens*. Lewis would go on to elicit the cancer sarcoma from chick embryos using *B. tumefaciens*.

On January 31, 1925, an English abstract in the authoritative German *Kinische Wochenschrift*, written by Ferdinand Blumenthal, trapped Smith's attention. Blumenthal, with assistants Meyer and Auler had shown that human cancer bore a microorganism closely resembling *tumefaciens* which in turn caused malignant tumors in plants as well as animals, complete with spread or metastasis.

Paula Meyer had worked with Friedlander on the human cancer germ since 1923. Her particular

discovery was of a bacteria inside breast cancer which she called PM for Paula Meyers. She had also discovered closely related strains from 15 other human cancers. Smith examined stained slides of Meyer's cancer germ from human breasts. It looked much like *B. tumefaciens*. Meyer's germs were short rods, single or paired, and they stained with the same Fuchsin that he had used [22].

Moreover, when Blumenthal and Meyer inoculated their human cancer germ PM into plants, the tumors looked exactly like crown gall. That PM could produce plant cancer was now for Erwin Frink Smith beyond a shadow of a doubt. But it could not be *B. tumefaciens* itself, because no strains that he had tested grew at body temperature in warm-blooded animals. His conclusion: that human cancer was probably due to some other microbe, possibly a mycobacteria, that had similar chemical activities to *B. tumefaciens*.

### Seibert rules out contaminants in the cancer germ

The only time that Dr. Florence Siebert, long part of established medicine, ran into resistance and suppression, was when she decided to have a closer look at Livingston's cancer germ. One of America's finest Ph.D. — Biochemist's, while still at Yale she resolved the mystery of the many fevers coming from distilled water for injection and thought to be caused by fever-producing 'pyrogens', quickly proving that these were in fact bacterial contaminants.

Having solved the mystery of pyrogens, Siebert was asked by Dr. Esmond Long to stay on at the University of Chicago to develop the Tuberculin skin test. Long suggested a European trip to learn techniques practiced on the continent [23]. At the Pasteur Institute of Paris, she exchanged ideas with Boquet, Calmete and Guerin: the three investigators who presented to the world the only recognized vaccine for tuberculosis, called BCG [23]. Siebert returned to the US and when Long left Chicago to head laboratory operations at the Henry Phipps Institute in Philadelphia, she accompanied him.

By 1903, Henry Phipps, wealthy partner of Andrew Carnegie, sought a charitable outlet for his wealth. He then joined Lawrence F. Flick, a doctor with a vision to open a center solely dedicated to the study, treatment and prevention of Tuberculosis. Still working off grants from the National

Tuberculosis Association, Seibert was asked at Phipps to continue her work for a skin test using Koch's original Old Tuberculin (OT).

Seibert refined and purified the protein in her TB skin test. She named it PPD-S, both because it was a purified protein derivative and was intended to serve as a standard (S) for the US Government, which it eventually became. Then, after 30 years in tuberculosis research, Seibert turned towards cancer. In 1948, Margaret Lewis of Philadelphia's Wistar Institute asked Seibert to do a nucleic acid analysis on Wistar rat tumor extracts, which Seibert agreed.

Next, Irene Diller, who networked extensively with Livingston, asked Seibert to look at her slides of the cancer microbe. Seibert relates what she saw:

I saw tiny, round, coccoid organisms, many of which were magenta in color. The slides had been stained with Ziehl-Neelsen reagent, which we regularly used to stain our tubercle bacilli red. When I learned that she had isolated them from a rat tumor and could do so regularly from tumors in general, as well as from blood of leukemic patients, I asked, "Could you find them in the rat sarcoma tumor I am studying?" Seibert, 1968

Diller agreed to try. Lewis allowed Seibert to forward the tissue sections. The results came back. The same cancer germ appeared. Seibert immediately saw the implications:

This looked terribly important to me, and I was thenceforth willing to do whatever I could to help in this promising field. We did help by studying the immunological relationship to our tubercle bacilli, as well as to the "atypical" bacteria closely related to our tubercle bacilli. Seibert, 1968

Seibert was even more impressed with how Diller, following the footsteps of Livingston and Jackson, proved, thru Koch's postulates, that her germ was the cancer germ.

It is based on her (Diller's) work that I am willing to say I believe she has found the cause of cancer, which I think no one can refute, and this work should be welcomed and confirmed by other cancer researchers, and not be ignored, even in view of the great stir at present about viruses. Seibert, 1968

Florence Seibert joined Livingston's crusade in earnest in the 1960s, turning her cancer organism over to Frank Dunbar, chief of laboratories at the Southwest Tuberculosis Hospital in Tampa. Dun-

bar's conclusion: the multi-formed germ did not belong to his groups of known "atypical" mycobacteria, even though they did have some of the properties of the mycobacteria [23].

## Experimental medicine for the masses

Eventually Virginia Livingston gained university affiliations in San Diego working out of the University of San Diego with Dr. Gerhard Wolter of nearby San Diego State. In 1970, Wolter and Livingston discovered actinomycin-like compounds produced by the cancer germ, one of which, Actinomycin D or Dactinomycin, despite its toxicity, was being used in cancer. Livingston cautioned that not only did these actinomycins arrest the maturation of cells and inhibit the immune response but that they also inhibited enzymes and decreased hormone levels, stimulating the body to increase its hormone production [1].

She was puzzled as to why anyone would want to use a devastating substance like Actinomycin D for the subsequent treatment of cancer. But it was being done. Even more disturbing was the way in which organized medicine was responding to the hormonal disruption in the body caused by her cancer germ.

In 1966, Charles Huggins of the University of Chicago went to Stockholm and received a Nobel Prize for determining the effects of sex hormones on cancer that had spread. Following this, the practice of castrating cancer victims came into vogue. Consequently, someone came to the conclusion that if castration helped initially, any recurrence would better be treated by cutting out the adrenal glands, housed on top of each kidney. And since this never produced earth-shaking results, a new procedure was devised to cut through the nose and remove the pituitary-the master gland of the body, lodged near the brain. Virginia Livingston had established that abnormal hormonal stimulation was coming from the toxic materials and hormonal derangers manufactured by her germ. In response America was chopping out the glands of its cancer patients.

## Livingston confirmed

In *The Cancer Microbe*, Alan Cantwell acknowledged the invaluable help of four women who pioneered the early microbiology of cancer: Virginia Livingston, M.D.; Eleanor Alexander-Jackson, PhD;

## Is cancer just an incurable infectious disease?

Florence Siebert PhD and Dr. Irene Diller [24]. Cantwell grew up reading that all germs responsible for the important diseases were supposed to have been already discovered. But much to his dismay, once a physician-researcher, he encountered the one left out: the cancer germ. And although he knew that the many-shaped germ had long been considered a mere contaminant or secondary invader or even non-existent, Cantwell, like Seibert, knew better.

Cantwell first contacted Virginia Livingston thru the suggestion of a colleague who had heard her on radio and immediately sensed their common ground, which was, by then, the acid-fast bacteria found in Scleroderma and cancer. Despite her meticulous research, Cantwell knew that Livingstone had already been branded by traditional medicine as a charlatan, leaving what he thought to be perhaps the major discovery of the 20th century largely discredited [24].

By 1971, Cantwell had published on Scleroderma in the highly respected *Archives of Dermatology* and had no further intention of pursuing Livingston's germ. Livingston, Jackson, Diller and Seibert had each drawn fire from the medical establishment and despite Livingston's persistent overtures towards him, there was no way he wanted in. By 1974, Lida Mattman's *Cell Wall Deficient Forms* [25], reconfirmed for Cantwell as well as others that many bacteria, but especially tuberculosis and the mycobacteria existed naturally in many forms – a cycle of growth which involved "cell-wall-deficient forms" ranging from viral look-a-likes to bacterial forms to granules and then on to larger globoid shapes. But most physicians and laboratory scientists were being taught little about cell-wall deficient bacteria.

Cantwell's silence threshold was exceeded forever when he again saw the cancer germ in the skin of the chest wall of a young woman who had lost both her breasts to metastatic cancer. Removing this patient's skin lumps, Cantwell and colleague Dan Kelso at first cultured *Staph. epidermiditis*, a common contaminant. But as their cultures aged, the seeming staph cocci became large globoids, rods and yeast-like forms – *with acid-fast granules everywhere* [25].

Tracking down specimens of the woman's original cancer, removed a year earlier, Cantwell not only isolated the variable acid-fast cancer germ in the tumor itself, but in surrounding specimens taken from the woman and thought by pathologists to be normal. This in effect established that the germ existed in the victims tissues before it became cancerous.

In a series of peer-reviewed, penetrating articles, Cantwell found the cancer microbe in three other cancers: Hodgkin's, Kaposi's cancer of the skin and a rarer skin cancer called mycosis fungoides. It became obvious to Dr. Alan Cantwell after twenty years of microbe hunting that the old tenets of microbiology were not much use when it came to showing an infectious cause of cancer. In man as well as in nature, bacteria were constantly changing forms and evolving in their lifetime. The cancer microbe, unstable by nature, was no exception [25]. But 25 years after removing the metastatic breast nodules from the skin of a young mother and finding them variably acid-fast, there remained no cure for a germ which though tuberculosis-like, seemed indestructible. And a germ without a cure, as shown by the mixed reception to Koch's discovery of tuberculosis, even decades later, fostered its own resentment and disbelief, a resentment and disbelief which Virginia Livingston never stopped facing.

## BCG

It seems to me that it is entirely rational to state that the reason the BCG vaccine is effective not only against tuberculosis, but leprosy as well as cancer is because of the fact that the cancer germ is closely related to the BCG since it is in the same family, the *Actinomyce-tales*. Livingston, 1972

When Florence Seibert met Boquet, Calmete and Guerin in Paris to discuss their BCG, the only recognized vaccine for tuberculosis in the world, made from cow or bovine tuberculosis, none of them had any idea that it would one day be used against cancer. But in fact, currently, this diluted vaccination of *Mycobacterium bovis* or cow tuberculosis is the most effective treatment for transitional cell carcinoma, a cancer of the urinary bladder. Moreover, BCG is the most successful therapy of its kind, called 'immunotherapy' [26]. Within 'immunotherapy', it soon became fashionable to suppose that BCG or cow tuberculosis somehow 'bolstered' the immune system, but noted immunologist Steven Rosenberg held that the immune system was highly specific. One immune stimulant such as BCG should not stimulate a response from another immune stimulant, cancer [27].

The precise mechanism as seen by a 1993 University of Illinois study was that initially cancer cells seemed to eat (or phagocytize) and kill the

*Mycobacteria bovis* in BCG. But then, suddenly, the cancer cells too died. Although investigators in the study admitted the relationship wasn't clear, a strong 'tumoricidal agent', inside the *Mycobacteria* was pointed to [28]. Livingston felt that investigators were probably unwittingly looking at was a common phenomena in nature known as 'lysogeny'. Lysogeny is what happens when one colony of a similar bacteria kills another by hurling viral phage weaponry towards it, without itself being harmed.

By the late 1970s Virginia Livingston could no longer ignore Chisato Maruyama of Japan and sent John Majnarich of Seattle's BioMed Laboratories to Japan to have a closer look.

In 1935, Maruyama, of the Nippon Medical School began to develop a vaccination against tuberculosis which turned out to be good against cancer. The Maruyama vaccine was similar to BCG, but instead of using cow tuberculosis as its base, the Japanese version used human tuberculosis. Chisato Maruyama had long noted that patients with either the *Mycobacteria tuberculosis* or leprosy seldom had cancer [33]. By the 1970s Maruyama's vaccine was proving quite successful in that he claimed that half of the 8000 cancer patients he had treated had benefited [29].

## Livingston's legacy

By the early 1970s Virginia Livingston, badly beaten by the medical establishment, was ready to launch a counterattack in the form of a study which showed that her cancer microbe secreted human chorionadotropic hormone (HCG) — a growth hormone long associated with cancer. Initially, despite laboratory evidence to the contrary, her contention that a bacteria could produce a human hormone was not believed. But then reports from traditional bastions such as Allegheny General, Princeton and Rockefeller University confirmed her findings.

Livingston believed that this growth hormone, secreted by her cancer germ built up uncontrollably to stimulate tumor growth, turning normal cells into malignant ones when either the body's immune system was weak or essential nutrients were deficient. Dr. Hernan Acevedo of Allegheny, in fact, showed that all cancer cells had the hormone [30]. Livingston's discovery, a medical milestone, gave further impetus to a microbial theory of cancer with well over a century of research behind it. Yet despite this, the premise behind an infectious cause was stubbornly refused by orthodox medicine.

Virginia Livingston was past 80 when she died on June 30th, 1990. Just months before, a subpoena was issued to her prohibiting her vaccinations, made from the patient's own cancer germ (autogenous), with which she had had great success. Following this, her vaccine was stigmatized as an "unproven method" in the March–April 1990 issue of CA — The Journal of the American Cancer Society [31] with references to her mistaking several different type of bacteria, rare and common for a unique microbe. This despite droves of research papers establishing *mycobacteria* as either coming before or coexisting with cancer. Ironically, Acevedo, who had lauded her discovery that the cancer germ could manufacture human growth hormone was instrumental and key to the society's conclusion. Yet when questioned by this author approximately a decade later, Acevedo admitted that he had ignored acid-fast forms which were indeed present in the cancer preparations Livingston sent to him. He felt these irrelevant, and mentioned that besides, the technology was not available at the time to pursue these acid-fast forms further. On such fuzzy logic, it seemed that perhaps the most important scientific cancer lead in this or any other century was buried.

## Conclusion

The striking analogy between cancer and tuberculosis was noticed long before the tubercle bacillus was discovered. In 1877, Sir John Simon clearly pointed out this analogy and in fact argued very strongly in favor of a microbial origin of cancer. But by 1910, certain American medical powers did an 180° rotation, deciding that cancer was not caused by a microbe and that anyone who thought otherwise was a heretic, a charlatan or a quack. But Virginia Livingston was none of these. Rather she was a symbol of painstaking research and dedication at the height of post World War II American medical technology.

Opponents of Livingston said she saw contaminants of a group of commonly encountered germs. But Florence Siebert, an expert on contaminants who standardized the present day tuberculin skin test for the US government saw no contaminants present and Dean Burk, Head of Cell Chemistry at the NCI went so far to say that Livingston's cancer germ was as real and certain as anything known about cancer [29]. Yet in the subsequent suppression of Livingston and her many colleagues by the medical establishment a picture emerges, and it is not a very pleasant one.

## Is cancer just an incurable infectious disease?

Virginia Livingston gained international status when she discovered that her cancer germ produced human growth hormone, long associated with malignancy. However, at first even this was not believed. Had she gained the same stature regarding identifying the cancer germ itself, by today there probably would be no cancer. At this time there is admittedly no cure for Livingston's cancer germ. Suppression led to its own disinterest in cure and each year a multitude must suffer and die as a result.

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