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The Women of the Virus Research Laboratory: The Hidden History of the Salk Vaccine through the Women who worked with Dr. Jonas Salk in Pittsburgh, PA from 1947 to 1955

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Cover Page Footnote

I would like to acknowledge and thank Dr. Peter Salk and Ethel Bailey for their generous support and for providing me with unpublished material that was crucial for conducting my research.

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Abstract

Dr. Jonas Salk is known as an American hero who saved the nation when he developed the polio vaccine. His achievement was announced to the world on April 12, 1955. Dr. Salk was rightfully and universally praised, receiving the Presidential Medal of Freedom in 1977. But Dr. Salk did not work alone. Few of his coworkers were credited by Salk, at the time or in the wake of the announcement, and as a result the media and the public knew next to nothing about the eight-year-long collaborative efforts in Salk's Virus Research Laboratory (VRL). His coworkers and assistants were unknown then and have remained unknown for the last 65 years. This paper, "The Women of the Virus Research Laboratory," brings to lights the story of the unsung women who worked in the VRL and who were among the first major group of female scientists in American medicine. This prosoprographical study utilizes a range of unpublished and previously unknown material as a key source base to reconstruct the composition of the staff that worked in the VRL between 1947 and 1955. It identifies the women on the staff and their roles in the VRL and in the discovery of the so-called Salk Vaccine. The paper retrieves these women from

obscurity and shines an appropriate light on their work, arguing that the place of women in science in this country is, despite some popular perceptions, long, substantial, and worthy of discrete study.

Keywords: Women's History, History, United States History

Introduction

On April 12, 1955, Dr. Thomas Francis, as the director of the Poliomyelitis Vaccine Evaluation Center at the University of Michigan School of Public Health and Dr. Jonas Salk's previous mentor, announced on behalf of the National Foundation for Infantile Paralysis (NFIP), that "the vaccine works. It is safe, effective, and potent" (Kluger 295). Dr. Salk was then received on stage with a round of applause and tears from the thousands of attendees. This announcement came at the end of eight years of rigorous work and tedious replications of procedures to ensure the safety of the vaccine. When it was time for Dr. Salk to speak on behalf of his team's work, he personally thanked about a half dozen people that were not involved in the research but assisted in the development and progress. It was expected that Salk would thank his team at the Virus Research Laboratory (VRL) or at least mention them; however, he did not which led to upset amongst the staff members whom he had invited to attend the Symposium with him.

Staff in attendance included Dr. Julius Youngner, Dr. James Lewis, Dr. Percival Bazeley, Dr. Elsie Ward, Lorraine Friedman, Dr. Ulrich Krech, and Dr. Byron Bennett (Kluger 288). The mistake of not mentioning his staff was unexpected because Salk was

known for not wanting the vaccine to be named after himself when the development and work was a group effort. Salk wanted the vaccine to be called the "Pitt Vaccine" to commemorate the work of the VRL and the children and parents who volunteered to get the first trials of the vaccine. Salk's failure to credit his staff, specifically in April 1955, caused a great deal of conflict between him and his staff. Many members of Dr. Salk's staff were upset following the lack of recognition and most left the lab in the years following the announcement (Oshinsky, 2005). The women who were not recognized actually did not think much of this mistake because their interest was in fighting polio not getting credit for a medical milestone.

This study examines the individual roles in the laboratory from the start of the typing project to the announcement of the vaccine's success and zooms in on the female involvement. It utilizes unpublished material as a key source base in the process of reconstructing the list of staff who worked in the VRL with Dr. Salk from 1947 to 1955. This study aims to uncover the hidden history of the "Salk Vaccine" and the people, specifically women, who worked in the VRL. The goal of this research is to identify the women who worked for Dr. Salk and the roles they played in the development of the vaccine. The staff of the VRL has never been examined in depth by historians and the VRL is not mentioned in most works regarding Jonas Salk, polio, and the vaccine development. While the Ann Arbor Symposium has been mentioned, no work thus far has addressed the lab itself or the people that made the vaccine possible. Many historians have explored Dr. Salk's life, specifically his time as a virologist and his time at the Salk Institute; however, no one has taken the step to discover the staff of the VRL and give them the recognition that is deserved. Names of the staff members are seldom mentioned

in most monographs, unless they are names commonly known in the community as being associated with Dr. Salk – for example, Julius Youngner, Elsie Ward, Percival Bazeley, or Lorraine Friedman.

One source, John Troan's autobiography, mentioned that Salk did not recognize the contributions of his staff and that this was a peculiar slight (Troan 195). The extent of this call-out was only to say that Salk did not give credit where it was due and that many people were left out of history. The quote reads: "The ultimate disappointment was Salk's failure to cite them (the staff) individually at the University of Michigan conclave even though he singled out a half dozen persons outside the actual field of research for their assistance of development of the vaccine." The source sticks to the pattern of the rest and falls short of giving credit to unsung heroes. However, it must be noticed that this was the only source that got this far, even if it only called Salk out and did not take that final step of fixing the mistake. The intention of this paper is not to discredit Dr. Salk but to share the credit and acknowledge the people who were affronted by this mistake. Credit is due where credit was not given, and I hope to shine light on the unsung heroes of the VRL. The unsung heroes of this historical medical moment were the women. The women of the VRL knew they were being slighted but they did not care because the eradication of polio triumphed over recognition. Women are generally slighted when it comes time to recognize people for their contributions. In the case of the Salk vaccine, it is unique that Dr. Salk seemed to acknowledge everyone but his own team at the Ann Arbor Symposium. With this work, I plan to bridge the gap that none have before and give the credit that Salk did not. I have developed a complete staff list based on the unpublished

staff list that Dr. Peter Salk, Dr. Jonas Salk's son, put together in preparation for the 50th commemoration of the Ann Arbor Symposium.

Context/Background

Poliomyelitis, or polio, is a disease that ravaged the country every summer since the initial outbreak in 1916 (Rudacille 104). The summer "plague", as it was called by many, mainly affected children and was so terrifying to communities across the nation that people refrained from doing just about anything aside from necessities. Outside of school and church, parents didn't allow their children to go to public pools, movie theaters, or play outside with their friends because there was a large misunderstanding of what the disease was or how it was spread. Scientists quite honestly had no idea what polio was and that very much contributed to the longevity of the disease outbreaks, since 1916. There were two main misunderstandings surrounding polio; one being what the disease was and the other being how the disease spread. Without the correct information scientists were stuck at a stand-still even though they were trying a myriad of things to cure or prevent polio. This led to many false starts and confusion to the public; as well as mistrust when the vaccine was developed.

In 1935, virologists agreed that polio was caused by only one type of virus. They believed the virus grew in living nerve cells only and then traveled to the brain and into the spine by nerve tissue, which ultimately entered the body through the nose (Carter 14). All of this was wrong. It turned out that polio was caused by three types of virus, and it did not enter through the nose. Dr. Salk would later prove that the virus did not grow in just live nerve cells. In fact, the original belief that polio was a nervous system disease was also incorrect because it was an intestinal disease (Rudacille 112). The confusion on

whether polio was an intestinal or a nervous system disease sprang from the coining of the term poliomyelitis in the 1800s which describes the inflammation of the gray anterior matter of the spinal cord (Carter 8).

Another major complication in the adventure to curing and preventing polio was the way in which the disease spread. There was a great sanitation movement in the early 1900s that was intended to clean up the country and prevent disease; however, the 1916 epidemic was caused by this sanitation movement. The reason for this is because the open sewers and poor conditions exposed infants to a minute amount of the virus which allowed people's immune systems to become immune to the disease (Rudacille 113). In this case the increase on sanitation took away this initial introduction and children were no longer immune to polio. Increased sanitation had worked for other viruses so the public clung to the sanitation movement hoping that it would resolve the threat of polio when in reality it made the epidemics worse, all due to a lack of knowledge about what polio actually was (Smith 35-36).

The National Foundation for Infantile Paralysis (NFIP) was created by President Franklin Roosevelt and Basil O'Connor in 1937 from the Warm Springs Foundation to fund polio research (Rudacille 105). FDR originally asked his law partner, O'Connor, to take over the Warm Springs Foundation and then made him director of the NFIP when the organization became more serious. The way that the foundation raised money to fund laboratories was by hosting the famed President's Balls at the White House and by asking citizens to donate dimes. Dimes were chosen because in the 1930s it was not a burden but also a decent donation when everyone donated. This ask turned into a huge undertaking because Americans donated dimes in such a number that the White House halls were

"blocked by bags of coins." The mass of dime donations led to the foundation changing its name to the "March of Dimes" and becoming the most successful privately funded source for biomedical research in United States history (Rudacille 105).

Jonas Salk was a young scientist out of New York City who worked with Dr. Thomas Francis at the University of Michigan (Carter 51). While working with Dr. Francis, Salk was adamant about his name being first on publications because "In a profession where rank and status are often determined by the order of names on published papers" it was important for younger scientists to be able to establish themselves when working with seasoned researchers (Smith 24). When Dr. William McEllroy posed the question of moving to the University of Pittsburgh, Salk was intrigued but Francis was not. This was because the city was dirty with smog and the University of Pittsburgh was known for being of poor research quality. Salk's mentor disapproved so much that Salk made a promise to return to the University of Michigan in a year if Pittsburgh did not meet his expectations (Carter 52-53).

The University of Pittsburgh recruited Dr. Salk in 1947, as an associate professor of bacteriology and microbiology, to raise the status of Pitt Medical School and promised him his own lab space and control of his staff (Smith 101). This was in the height of the time that polio was ravaging the nation. In 1948, Salk received a grant from the NFIP to expand his lab and staff while he worked on the typing project (Troan 183). The typing project was essential to the understanding of polio, and it was necessary to determine whether there was a possibility of a vaccine. Contrary to popular belief, Dr. Salk never wanted to work on polio because his passion was in influenza. The reason he agreed to move to Pittsburgh and help the NFIP in the typing project was to get his own lab and his

own research staff while building his reputation. The idea was that the typing project would run itself while Salk continued his work on the influenza virus (Smith 110).

This phase of the VRL's work started in late summer of 1948 and ended in early fall of 1949. To achieve this humongous task Salk and his team clocked 12-hour days with six to seven days of work each week (Kluger 121). I call this task humongous because it required the testing of every sample of polio that the NFIP and other laboratories sent to the VRL to ensure that there were only two types of polio; however, in this process the third type of polio was discovered in Pittsburgh. That discovery led to the retesting of each sample to ensure that there were now only three types of virus to worry about. The results of the typing project were officially published in 1951 but at that point, Dr. Salk had unofficially, and without complete permission from the NFIP, began work on a vaccine.

In this race, there was a conflict between Dr. Salk and Dr. Albert Sabin on whether the vaccine would be made with a live or killed virus. Dr. Salk's lab was the only one to believe in the killed virus and worked hard against the disproval from the scientific community. Disapproval over the vaccine was due to the many polio vaccine failures that other scientists, who used a live virus vaccine, had caused. These failures also caused public mistrust. The Salk Vaccine is a series of three shots; this requires the child to return three times within a sequence of weeks to receive the shots (Rudacille 14). The Sabin Vaccine was released in the years following the Ann Arbor Symposium. This delay was mainly because Salk had already done human field trials to test his vaccine, and because it was successful, the disease was pretty much handled in the United States. This caused Sabin to do his field trails in a different country. The Sabin Vaccine is one

oral dose of a live virus vaccine, such as a sugar cube, which is obviously much more convenient. Therefore by 1965, most of the country was taking Sabin's vaccine over Salk's. However, the only reported cases of polio were associated with Sabin's flawed vaccine (Rudacille 117). The Sabin Vaccine is flawed due because of the rate in which the vaccine causes a patient to develop polio. Eventually the only reported cases of polio were vaccine-derived, from the Sabin Vaccine. This is the key point of the live versus killed virus vaccine argument. Salk knew that if he killed the virus before using it in a vaccine then it could not cause polio. Using a live virus vaccine always has the threat of a patient developing the virus that is being introduced. Due to the need to eradicate polio entirely the CDC decided to phase out use of the Sabin Vaccine and return to the Salk Vaccine in 1996. This fully eradicated polio in the United States and was official in 2000 (Kluger 319).

Understanding the mistake at the Ann Arbor Symposium, Dr. Salk attempted to fix it by naming five of his staff of fifty in an interview a few years later. The five staff members' names were Dr. Julius Youngner, Dr. Byron Bennet, Dr. Elsie Ward, Dr. Percival Bazeley, and Dr. James Lewis. Each of these staff members were head scientists who had their own rooms in the VRL and their own staff of technicians. Only one female was acknowledged by Dr. Salk; however, this is not unusual because women have been regularly left out of science even when they play important roles in discovering and inventing the focal points of research. The development of the Salk vaccine and polio itself has attracted attention by historians, authors, filmographers, and scientists.

In the beginning of the VRL's work Dr. Salk was seemingly adamant on sharing credit. This is reported in many monographs because he always mixed the names of the

authors on research articles. I found this to be true up to 1952, but in 1953 there is a switch, and Dr. Salk's name appears first on almost every article published out of the lab. In regard to this, Troan made a comment in *Passport to Adventure* that added to the rumor that Salk switched his stance on giving credit and began to put his name first: "In the introductory report on their vaccine work, [Salk] listed them (his staff) not as co-authors but only as collaborators." Labeling his staff as collaborators gives them less credibility and was a trend that appeared towards the end of the vaccine development. Another quote from Troan regarding this switch-up states that "Salk himself was guilty of denying members of his own team the full measure of recognition they deserved…. Most times only signed [research articles] 'Virus Research Laboratory, School of Medicine, University of Pittsburgh." While Troan acknowledged Salk's slight and made clear that it was unfair, he fell into the same pattern as everyone else by not taking the extra step to name the staff.

Virus Research Laboratory

The VRL was stationed in the basement of the Municipal Hospital for Contagious Disease. It contained four distinct rooms – one with Ward's lab, one with Youngner's lab, one with Bennett's lab, and one with Salk's lab. There were workstations throughout the entire lab where technicians worked. As the research developed, the VRL was given more grants to continue its expansion into practically all the Municipal Hospital. The first floor had a black and white checkered floor hallway and held Salk's office with Friedman's desk and work area outside his door. This level also contained the private offices for Dr. Bennett, Dr. Youngner, and other senior staffers, along with some workspace for junior members (Kluger 187). The VRL's monkey colony was housed on

the second floor of the hospital, and they made their own monkey feed in the basement where the main lab was (Greidanus). The third, fourth, and fifth floors of the Hospital were the wards of polio children, those in iron lungs were on the third floor (Kluger 117).

The VRL did tremendous work for the short amount of time that it took them to develop the vaccine. According to Dr. Youngner, no one could replicate the speed or what the VRL accomplished because their lab and the conditions they worked in would not pass inspection nowadays (Greidanus). The staff didn't wear gloves or masks and used mouth pipettes. The mouth pipettes were similar to normal pipettes except one used their fingers to squeeze the top and suck a solution into the pipette, one had to suck the solution up with their mouth. Pipettes are known for being used in scientific labs and variations of the pipette are used in more common settings, like a kitchen. This was dangerous considering they were pipetting live poliovirus and "one suck too hard you got a mouth full of polio" (Ethel Bailey). Accidents rarely happened but when they did staff would run to the wash station and rinse their mouths out with water and hope that they would not contract the virus. Ethel Bailey describes the time she accidently "sucked too hard" and rushed to rinse her mouth out, she later told her husband about the incident in case she became sick. Her husband was much more worried than she was, and everyone was holding their breathe in nervousness and fear. This scare happened occasionally and never happened to the same person twice. No one in Salk's lab contracted polio.

Salk's relationships with his staff members is a unique subtopic itself because depending on who was asked one would get a variety of responses. According to Dr. Julius Youngner, Jonas Salk was a distant figure who only gave directions to his staff and disappeared. A quote from Youngner saying, "communication was minimal" between

Salk and the VRL staff was contradicted by information gained through personal interviews I conducted. Youngner went further by saying that, each morning Salk would give out assignments and then disappear, leaving his staff to "find their own morale" (Carter 212). These morning to-do lists mentioned by Younger were confirmed in another source but not in the same attitude that Youngner had implied. Other staff members were quoted as saying that it seemed as though, "no one was above the cleaning/housekeeping work" and that these lists were not orders but were more of a way to keep everyone on track and ensure that each staff member knew what Dr. Salk wanted progress on (Kluger 166). Youngner remembered Salk as an almost crude man who was only in the lab during the important moments of discovery and all other times he was away dealing with the press and media. After April 12, 1955, Youngner was extremely disappointed in Salk for his neglectful credit to his staff and spoke out against Salk till the day he died. I have found that the main issue was that Salk took credit for the color dye solution that determined if the vaccine worked or not in test tubes. It is true that this was Youngner' s idea and that Salk did not clarify this in the research publications. Another issue surrounding the color dye solution was that Dr. Elsie Ward was the scientist who did that actual experiments that involved Youngner's idea. Ward was the first to discover the vaccine was a success and that the color dye solution was an effective method for testing the viability of the vaccine (Ethel Bailey). In the monographs published following the release of the Salk vaccine, Ward was given credit for using the technique in her section of the lab. Although Youngner was not the only upset VRL staff member, he was the most vocal. Other staffers had a high regard for Salk, the way he worked, and the way he communicated and utilized his staff.

According to Ethel Bailey, Salk was very kind and involved with his staff members and their work. She remembers Salk as a figure that guided them through the science and was hands-on in the lab hands-on and cared about the results and production of the vaccine just as much as anyone. Bailey had different stakes in this situation, and this could be why there is a difference between the recollections of Salk's relationship with his staff. When asked about details that Youngner mentioned, such as Salk only giving directions in the morning and disappearing for the rest of the workday, Ethel Bailey said the exact opposite. She told me that Salk was always around to make sure that things were running smoothly and that he had a large hand in the developments. She enjoyed working in the lab because there were very diverse and dynamic characters. For a lot of the staff this was a career and that is why they felt slighted by their colleague and boss.

This is a point of interest because Salk was adamant on sharing credit (at least in the beginning) and was careful to not mention himself first on research articles. He also came from working under Dr. Thomas Francis and is noted for saying that the lead scientist should not have their name first because they are already established, and the new scientist needs the assistance in getting his name and work recognized. It is clear though that towards the end of the project Dr. Salk was not as concerned with sharing the credit. I am not clear on the reason for this switch in attitude but the VRL staff started to notice and were concerned with how credit would be distributed at the end. This is even more odd because when it came time to patent the vaccine Dr. Salk did not want to patent it and make money off it because ,"you can't patent the sun" and he believed that the

polio vaccine should not be taken advantage of and that everyone should have an equal opportunity to receive the vaccine as soon as possible.

A key factor in the dynamic of the lab as the team was closing in on the vaccine was the staff referring to Salk as "Jonas E. Christ". There was concern going around the lab that Salk was getting "flaky" on sharing credit. This worry led to a very different relationship between Salk and his staff near the end. Julius Youngner and John Troan both have made comments regarding the thought of Salk not sharing credit when it mattered. When asked, Ethel Bailey had nothing but kind words towards Salk and his interactions with his staff. She did not mention this nickname which leads me to believe that it was used among the senior scientists who were seeking the credit rather than the assistants.

The Women of the VRL

Dr. Elsie Ward was the only female senior scientist on the Pitt Team and the only female named by Salk in the interviews following the announcement of the vaccine. She was a microbiologist and a zoologist who started working in the VRL in 1950 after answering a newspaper ad. She impressed Salk and her colleagues with her vast knowledge of tissue culturing (Kluger 115). She was described as being a gardener in the way that she tended to her cultures and "had a special touch" (Greidanus). To test the human samples from the Watson Home and the Polk School, Ward used the color-titration technique. On a morning in mid-September of 1953 she went into work early to check on her "babies." That morning when Ward walked into her lab, she saw a spectrum of red to yellow and although not all were yellow, some were and that meant the vaccine had worked. When Salk arrived that same morning, he broke his usual routine and headed

straight into Ward's lab. Upon seeing the yellow tubes, he said "Good for you, well done. Okay, now let's do it again" (Kluger 187-189). This not only was a turning point for the VRL and the vaccine development but a huge scientific moment for Ward. She did not seem to harbor hard feelings about that lack of credit at the Ann Arbor Symposium. She continued to work with Salk, and they published research together years after.

Ward had two assistants in her lab - Ethel Bailey and Louise Boccella. Ethel Bailey worked in Salk's lab from September 1952 and stayed until May of 1955. Bailey's story is a unique one as she was only in Pittsburgh because her husband was attending Seminary and when he graduated, she left the lab and the medical research field to travel abroad with her husband for the next 40 years. She was also an important figure in the VRL's work to develop the vaccine because she was the "unidentified research assistant" pictured with Salk in one of the most circulated pictures about polio and the vaccine. Bailey worked with Ward, along with Louise Boccella, handling the monkey testicle tissue. She described the process as having to cut the tissue with small knives, putting the samples in test tubes with a solution that would grow the cells out of the body. She was there on the morning that Ward discovered the yellow test tubes from the human trials, and she accompanied Salk to the Polk School to take samples from the handicapped children. In her interview she said that if anyone had hard feelings about the Ann Arbor Symposium, they didn't talk about it because they had "done their jobs" and were happy (Ethel Bailey). In the personal interview, Bailey talked about the use of mouth pipettes to inoculate the tubes. This technique was used with all solution, even live poliovirus. Also described during the interview was an incident where a drum of test tubes containing the virus was dropped and Bailey cleaned it up with "Lysol wipes" because she was not

worried about contracting the disease since everyone in the lab was basically vaccinated by that time. Although things like that happened, no one got sick from working in the lab.

Louise Boccella was hired in 1950 and worked under Dr. Ward as a technician. She was one of the few who were credited by Salk in his research articles. The credit was given at the end in the author's notes, but this was more credit than he gave the majority of his staff. She had a career after the VRL and continued work in the medical research field publishing research of her own (Salk, Youngner, and Ward).

Mary Bailey graduated from the University of Pittsburgh School of Medicine with a specialization in pathology and was hired in 1947, before Salk took on the typing project (Nordenberg and Byers 6). Bailey worked as a technician and was among the few who accompanied Salk to the D.T. Watson Home every Saturday where she was tasked with taking the blood samples, while Lorraine Friedman labeled these same samples, and Dr. Yurochko prepared the syringes (Carter 218). Salk administered each of the shots himself at the beginning of the human trials until they expanded to all of the city of Pittsburgh and he needed to get help to from his School Vaccine Program. Something interesting that Bailey did was going around from school to school asking children to talk to their parents about "offering up their arms for the new vaccine" (Kluger 212). Not everyone on the staff got to accompany Salk to the schools or got to go alone to advocate for the vaccine. M. Bailey's nephews were among the first healthy children to receive the polio vaccine, after Salk's children (Nordenberg and Byers 6). She stopped working with Salk upon the birth of her son, but agreed to come back to assist Salk in the School Vaccine Program and administered the vaccine to students of the University of Pittsburgh in 1957 in the Commons Room of the Cathedral of Learning (Nordenberg and Byers 6).

Lorraine Friedman was Salk's right hand "woman." She was with him from the beginning as one of the first staff member he hired. She held her position as an executive secretary for over 40 years even though she was only planning on staying around for about 3 years. She became his "alter-ego" and he trusted her more than anyone (Carter 71). Friedman knew the workings of the lab and was tasked with ordering supplies and redistributing notebooks at the end of each week after Salk would accidentally and habitually carry them around with him and stash them in a drawer (Kluger 122). Like Salk, she was known for being extremely organized and tedious, because that she kept records on five-by-eight file cards of every test that Salk conducted (Smith 142). Of course, being Salk's right-hand woman, she accompanied him to the Polk School and the D.T. Watson Home for the human trials. At the Polk School she gave out lollipops and kept records. She is noted for having said that she did not enjoy her trip to the Polk School and told Salk that if they made many more of these trips, she "doubted she would stick around", meaning she would find another job that made her less uncomfortable (Smith 139). Lorraine was also tasked with sending Salk's correspondence out of the lab and her initials are found at the bottom left of some letters. She signed the letters she typed with a lowercase "lf" and the abbreviated "Enc." This is comparable to Salk's other secretary, Anne Marbich, who signed "avm" and the full word "Enclosure."

Anne V. Marbich was a mother from Beaver County, Pennsylvania who rode the train from Aliquippa to Pittsburgh every day just to work in the VRL. She was a medical secretary to Salk and part of her duties included forwarding research information, which contained her initials, to other labs in London and Berlin (Suzanne Trbovich). While looking for her name or initials at the bottom of correspondence, I finally noticed a

lowercase “avm” under the left side of Salk’s name followed by “Enclosure.” I had overlooked this because I did not know what I was looking for or what I was looking at. I compared it to many letters and found the lowercase “lf” which I have concluded stands for Lorraine Friedman while the lowercase “avm” stands for Anne V. Marbich.

Mazrine Wells was a technician that worked under Dr. Youngner and contributed to the cell culturing work. She stayed to work with Youngner for a total of 30 years, staying with him at the University of Pittsburgh (Nordenberg 34). I chose to group her here with the secretaries because she acted as a medical secretary and assistant to Youngner.

Lenora Brown was an African American woman who played a large role in the development of the vaccine. She was sent to the VRL from the Rockefeller Institute in 1953 and focused much of her work on mice (Ethel Bailey). Other African American female scientists in the VRL were Ruth Hightower, Patrice Black, Fannie Jackson, Willa Hightower, and Doris Finney. There is hardly any information regarding their roles in the lab and their contribution to the development of the vaccine, but I do know that they partook in the science not the kitchen staff. Doris Finney joined the team in 1951 after graduating with top honor from the University of Pittsburgh School of Medicine (Ethel Bailey). She worked with Youngner and prepared the monkey tissue for the lab. She did not follow Salk to La Jolla and instead moved to Colorado to continue working in research. Having African American female scientists in the lab was an important and controversial thing in the 1950s. This was before the Civil Rights Movement and African Americans were viewed differently than today, and they were given less respect in the

academic spectrum. There is no evidence of Salk being "ahead of his time" or thinking of this aspect, he just hired based on skill, and experience.

The majority of the women from the Pitt Team did not continue their careers in the medical research field or scientific field. They went home. For personal and various reasons, the women chose to go home and resume their family lives. For approximately seven years, the members of the VRL had put their lives on hold to conduct this research and complete it at the pace that they did. Therefore, they spent little time with their families between the year they were hired and the year that they left. Ethel Bailey left the lab to travel with her husband as he did missionary work around the globe. She was asked to go to La Jolla with Salk but declined because she felt that she had accomplished her role when the vaccine was released. Anne Marbich was also asked to continue her work with Salk, but she chose to return to her farm life and take care of her children. To Anne, this adventure was temporary and ended upon the announcement of the vaccine. Although she may have had a desire to move to La Jolla, she was a mother first and had a commitment to her family. Most of the women chose to stay in Pennsylvania and not uproot their families to California. This was viewed as a temporary job for them, not a steppingstone to a career. Some women did follow Salk or went elsewhere to continue a scientific career, but they were the minority.

Conclusion

In conclusion, it is still unclear why Salk chose not to thank or mention his staff on April 12, 1955. However, I have determined that although he was adamant about sharing credit with his team in the beginning there was definitely a difference in attitude towards the end. I base this conclusion on the way that Salk signed research papers published out of

the VRL. In the early years of research Salk never put his name first on the authors list – he mixed his name in with the names of his senior staff members that worked on said research. Sometime between 1952 and 1953 Salk's approach changed. Starting in 1953 Salk's name was first on almost every article published out of the VRL. This change is even more clear when Salk began to put his name and then "in collaboration with" followed by the names of his staff members that did the work. The phrase "in collaboration with" is strong in the scientific field and it lessens the importance of those named after it – Salk had to know this.

I have also concluded that the men had more hard feelings towards Salk regarding the lack of credit than to the women. None of the women spoke poorly of Salk and were just happy to have had the chance to work on such a monumental project. The women did not seem to care about the slighting of credit because all that mattered was the vaccine and the fight against polio. The men that worked in the VRL, like Youngner, were extremely upset about not being thanked in Ann Arbor, Michigan, and some made public statements bashing Salk.

In addition, the color-titration process that was implemented by Youngner in the VRL, was a point of continued research for numerous scientists when they left the lab, including women. I noticed that a bulk of the research articles that were published by staff members following the separation of the Pitt Team dealt with this same color-titration method even if they were not in the polio spectrum.

It is clear that women had a large part in the development of the Salk Vaccine. Whether it be as an assistant, a secretary, a scientist, or on the kitchen staff, women ruled the VRL. These unsung heroes deserve to be recognized for all that they sacrificed for

this scientific advancement. They risked their lives using mouth pipettes to transfer live polio virus to solutions, and as Ethel Bailey said, “One suck too hard and you got a mouth full of polio,” and it happened! They risked their family lives by devoting a tremendous and tiring amount of time to the discovery of the vaccine. From Elsie Ward and her discovery of the success of the vaccine, to Anne V. Marbich and Lorraine Friedman for their secretarial work, to the African American women who put an overlooked milestone in history: your efforts are no longer unnoticed. These women made the polio vaccine possible.

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