



A Series of Firsts
Women in Michigan Science and Engineering
1940-1985



PRODUCED BY WOMEN IN SCIENCE AND ENGINEERING (WISE)



Society of Women Engineers, 1946

A Series of Firsts

Women in Michigan Science and Engineering

PRODUCED BY WOMEN IN SCIENCE AND ENGINEERING (WISE)

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THE UNIVERSITY OF MICHIGAN

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Table of Contents

Foreword.....	6
Introduction.....	8
About WISE.....	9
Acknowledgements.....	9

Section 1: Trailblazers

An Overview of the Early Years for Women at the University of Michigan.....	11
The 1940s and 1950s: A Watershed Moment for Women in Engineering and Science....	13
Tenho Connable.....	15
Margaret Frank.....	19
Fay Aizenberg-Selove.....	24
Frances Holter.....	28
Sally Shumway.....	31
Marilee Kelly.....	33
Patricia Pilchard.....	39
Barbara Carter.....	44
Anne Natvig.....	48
Paulita Buckley.....	54
Dorothy Patterson.....	59

Section 2: Founders

History of WISE.....	65
Barbara Sloat.....	67
Image Citations.....	84

Foreword

At the Student Leaders and Honors Brunch each spring, the College of Engineering recognizes dozens of undergraduate and graduate students for their phenomenal achievements in the classroom, lab, and community. Women students are well represented. It is not uncommon for women to capture the event's top academic prizes, including the outstanding freshman and sophomore this year.

Of course, what is typical now was not always so. In the 1940s and 50s, women faced tremendous obstacles in their pursuit of careers in engineering. Professors and male students told women they didn't belong. Women were evaluated unfairly and isolated socially. They had to work harder than their male counterparts - without the same support - to combat the widespread belief that women possessed inferior math skills and lacked the ability to solve mechanical problems. Employment opportunities were restricted. The women profiled in the following pages overcame exceptional challenges, and they opened doors for generations of other women to enter the profession. Today's female students are the beneficiaries of these trailblazing alumnae.

Engineering has undergone dramatic changes in the past sixty years. The academic and professional possibilities open to women today would have been unthinkable to women students enrolled in the mid-1900s. Today, a diverse creative community is one of Michigan Engineering's points of pride. Beyond efforts to strengthen diversity among current students, the College supports Women In Science and Engineering (WISE) programs that reach out to K-12 girls to explain what engineers do - something that many people don't grasp. Our student organizations actively engage in mentoring and tutoring.

But reflecting on our progress should not make us complacent. Although women outnumber men in college enrollment nationwide and are leaders in science and industry, women do not choose engineering as often as other science-based fields, such as medicine. A third of all U.S. physicians and surgeons and half of all U.S. medical students are now female. But according to 2010 Bureau of Labor Statistics data, no U.S. engineering profession reports even a 20 percent female workforce, and some engineering categories are in the single digits.

The leaders of universities and corporations recognize that a diverse workforce produces better ideas, generates greater profits, and most important, ensures the vitality of our nation's technological and scientific future. It is my hope that this publication, a part of the "Women's History in Michigan Science and Engineering" project, will not only commemorate women's achievements in the past, but also help to inspire new students with the possibilities that await them in engineering and the sciences.

David C. Munson Jr.

David C. Munson, Jr.
Robert J. Vlasic Dean of Engineering
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August 10, 2011

Introduction

A Series of Firsts: Women in Michigan Science and Engineering celebrates the 25th Anniversary of the Women In Science and Engineering (WISE) Program at the University of Michigan. The first section, “Trailblazers”, includes eleven in-depth alumnae interviews that document the experiences of ten women who earned their Bachelor of Science degrees and one woman who earned a Master of Science degree at the University of Michigan between 1942-1957.¹ This section captures the voices of those who experienced firsthand the academic and social aspects of life at the University during a pivotal moment in American history. By entering fields that were traditionally dominated by men, these women achieved a series of “firsts” in the sciences and excelled academically in spite the challenges that they encountered both in and out of the classroom. Many of the women went on to pursue successful careers in the sciences working as professors at institutions, such as the University of Pennsylvania and the University of Toledo, or in the private sector for companies like Shell Chemical, North American Aviation, and the Ford Company.

The second section, “Founders”, features Barbara Sloat’s interview, which focuses on the founding and early years of the Women In Science program from 1980-85. With a unique viewpoint of academic life after second wave feminism, she discusses the challenges WISE faced in its early years - not the least of which was annual fundraising. She also highlights some of the most rewarding programs and resources they developed in those first five years including the Warner-Lambert Lecture Series, the Women Faculty in the Sciences Resource Directory, and an annual conference for women in science. Finally, she touches on the personal choices she had to make to bring WISE to fruition and to continue pursuing her own dreams.

WISE has chosen to publish these twelve interviews in order to recognize those individuals who have traditionally been marginalized by the dominant cultures in science and engineering and to make their stories accessible to the general public. To facilitate that goal, we are also publishing excerpts from the original audio interviews on an accompanying website at: <http://www.umich.edu/~whimse>. Both the book and the website offer unique primary sources for scholars and inspirational stories for young women pursuing careers in engineering and the sciences. They also provide general readers with firsthand accounts of what it was like for women to enter fields that were controlled almost entirely by men. Lastly, these interviews contain rich details about social, academic, and professional life during the 1940s, 1950s, and 1980s, thus

¹ Due to the quality and size of the published yearbook images, we regret that some of the portraits in this volume appear blurry after enlargement.

personalizing the impact of historical events like World War II, the Korean War, and the Cold War.

Perhaps most significantly, A Series of Firsts: Women in Michigan Science and Engineering reminds young women of the extraordinary changes that have occurred in engineering and the sciences that would have been unthinkable sixty years ago. Compared to today, when opportunities for women in the sciences have significantly expanded, these interviews testify to the tenacity and courage of women who were the "firsts" of their generation to enter the sciences at the highest academic and professional levels. They also link these historical accomplishments with present opportunities by providing role models for students who can learn from the ambition, innovation, and perseverance of alumnae. Finally, these publications serve as tools for important programs, such as Women In Science and Engineering, to continue promoting women in the sciences at the University of Michigan.

About WISE

The Women in Science and Engineering (WISE) office sponsors many outreach programs that encourage young girls, undergraduate, and graduate students to explore science and engineering. For more information, please visit our website at: www.wise.umich.edu/.

Individuals trained in the methods ascribed by the Oral History Association conducted the alumnae interviews in this text.

Acknowledgements

This project is funded by a generous contribution from the University of Michigan Alumnae Birthday Greeting Council. The Alumnae Council is the association of women graduates of the University of Michigan. The Birthday Greeting Campaign is an annual campaign that appeals exclusively to alumnae and women who support the University of Michigan.

Trailblazers



Civil Engineering Class of 1895 including Marian Sarah Parker³

An Overview of the Early Years for Women at the University

From the turn of the century to the 1940s, women's descriptions of college life seem remarkably similar. The first female students were admitted to the University of Michigan in 1870 - over fifty years after its founding in 1817. During the next few decades, women began to participate actively in athletic and social activities on campus. With the opening of the first women's residence halls in 1915, the University carved out living spaces for them on campus. The Michigan Union, however, was an exclusively



Mary Hegeler, 1888⁴

male organization and many of the women who were interviewed for this project remember having to use the side entrance to go into the building. However, male and female students did socialize together both informally and at organized events like proms, sorority formals, plays, and operas. Female students, as well as the wives of professors and others in Ann Arbor, formed the Michigan League to create a space for women. It served as a forum for women to socialize "irrespective of class, department, sect, or society in the spirit of loyalty to the University of Michigan." The first few generations of women who graduated described a range of academic experiences. Some believed that they had been treated fairly by faculty members, whereas others felt disrespected. Many also stated that the University did not make an effort to give faculty positions to female graduates whereas men were highly sought after.

Only eight years after women were admitted to the University, Mary Hegeler took classes in mining engineering and became the first woman to earn a Bachelor of Science in 1882. After graduating, Hegeler took over the management of her father's business, the Matthiessen-Hegeler Zinc Company. It was the largest zinc company in the U.S., and Mary became the company president in 1908. It would be a decade after she graduated before another woman earned an engineering degree at the University. Marion Sarah Parker graduated with a Bachelor of Science in Civil Engineering in 1895. She moved from Michigan to New York to join the architectural firm of Purdy and Henderson. There, Parker worked as a structural engineer and participated in constructing some of the most notable buildings in early 20th century New York City such as the Waldorf-Astoria Hotel, the Broadway Exchange, and the Flat-Iron Building.

In the early twentieth century, Hegeler and Parker proved to be the exceptions, rather than the rule, for women studying engineering at the University. Few others followed in their footsteps. When male students left the campus to serve in WWI, opportunities opened up slightly for women who were interested in engineering. During this time, Mortimer Cooley, Dean of the College of Engineering, claimed that the work done by women in the mechanical fields equaled that of men, however, few of his colleagues would have agreed with his view. Women did not start to earn degrees in engineering and sciences until WWII, when a substantial number of male students enlisted. Most of the alumnae who were interviewed for this book entered engineering and science classes at this historical moment.



Marian Sarah Parker, 1895⁵

The 1940s and 1950s: A Watershed Moment for Women in Engineering and Science

During WWII, women entered traditionally male professions in significant numbers. The image of "Rosie the Riveter" is a testimony to the novel presence of women in manufacturing jobs at factories. The affect of WWII on women in academia, however, has received less attention. The University of Michigan in particular, created a unique opportunity for women during WWII because of its longstanding history as a co-educational institution. (Many of the elite universities on the East Coast did not admit women until the late 1960s). The WHIMSE alumnae testimonies offer a rare glimpse of gender dynamics between male and female classmates, professors, and other employees at the University during this pivotal moment in women's history.



University of Michigan World War II Army Units⁶

A significant portion of the male student population was absent from campus during WWII, leaving women to exert a greater presence at the University. Upon returning from the War, some men resented the presence of women in engineering, math, biology, and physics classes. The alumnae interviewed for this project also received mixed treatment from an all-male faculty. Some professors intentionally denigrated female students with public humiliation and unfair grading policies that drove female students from their classrooms, while others took them under their wings, mentored them, and inspired their intellectual development.

The stories they tell also describe the limitations - often self-imposed - on women in the 1950s and 60s. Most alumnae left successful careers upon marrying, in order to devote their time to homemaking and motherhood. After their children were grown, many returned to the workforce to teach or even to earn additional academic degrees. Their experiences at the University of Michigan seem to have inspired a lifelong desire to learn. Also of interest are the life trajectories of alumnae after graduating from the University. Although they were highly qualified to pursue careers in the sciences, many described ongoing discrimination in their professional lives. Others entered the workforce smoothly, rising to high-ranking positions in global corporations, becoming the first female faculty members in science departments at universities, and even working on high-level engineering projects for the federal government. Several of the women recall meeting the most famous scientists of the twentieth century.

Tenho (Sihvonen) Connable

Tenho graduated from the University of Michigan in 1942 with a Bachelor of Science in Chemical Engineering. She later earned a Master of Science in Computer Science from Western Michigan University, worked for Shell Chemical and Ethyl Corporation, and then taught computer science at Western Michigan University. She has four children.

Interview with Tenho Connable *February 5, 2007*

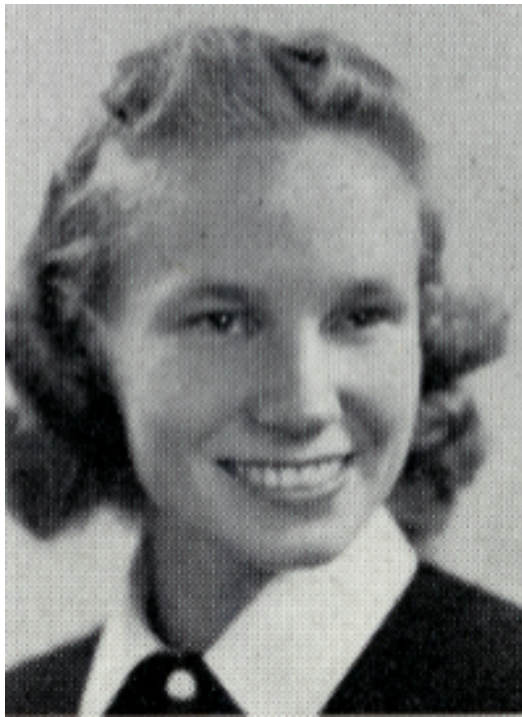
Growing Up

Both of my parents came to the United States from Finland before World War I. Like many immigrants, they were very hard working and relatively poor. My father was a tool and die maker, small dies. My mother did laundry for people. I did not know any engineers or scientists when I was growing up, but I became interested in science through my older brother. He is two years older than me, and he pioneered our family's involvement in engineering. My father, with his interest in technology, encouraged him, and I was usually with the two of them doing things. My brother started working with General Motors and eventually worked for Charles Kettering. That name might not mean much to you, but Charles Kettering is the reason there is a General Motors. At the time, he had a private lab with three engineers, and my brother was one of them. Looking back, my family did not necessarily encourage me to pursue engineering, but there was no discouragement either.

It was about 1924 when I started kindergarten at Goldberg Elementary School. All of my teachers seemed to refer to the fact that being Finnish was so wonderful, because Finland was the only country that was paying its World War I debt. It made me feel very humble - and it also made me very conscious of stereotyping. Then I went to Northwestern High School in Detroit where I was a good student, made good grades, and became the valedictorian. When I graduated from high school, President Franklin Roosevelt had just started the New Deal, and I was able to work for one of the teachers doing bookkeeping. I earned thirty-five cents an hour. I remember how wonderful I thought that was.

University of Michigan

I had my heart set on going to the University of Michigan for college. I visited the campus, and I remember walking through that beautiful Law Quad. But I had a tough decision to make, because I had been awarded a scholarship at Wayne State University and Michigan State. I knew I didn't want to live at home, so I gambled everything and decided to attend the University of Michigan. I arrived on campus in September 1937 with a Regents Scholarship. It paid tuition fees, which were \$60.00 per semester. With two semesters a year and books that ran about \$30.00 per semester, it added up to \$180.00 a year. (Those of you who help pay for your grandchildren's education know it is not uncommon for tuition to be \$35,000 a year with textbooks costing hundreds more.)



Tenho Connable, 1942⁷

I had decided in high school that I wanted to become an engineer, but my U of M councilor saw it as an unusual choice. He thought that engineering wasn't a field for women, so he assigned me to the College of Arts and Sciences. Never one to rebel against rules, I meekly entered the College of Arts and Sciences.

I learned two things my freshman year: The first, in the summer of 1937, all the nuclear scientists in the world met on the U of M campus. There were about 37 attendees, and Enrico Fermi was there. (Some people said he was the last man in the world who understood the complete field of nuclear energy.) The second lesson I learned was that women did not use the front door of the Men's Union - a side door was provided for us.

At the end of my freshman year, with grades good enough to keep my scholarship, I applied to the engineering college and was accepted as a sophomore in the chemical engineering department with full credit for my freshman class work. This same year another woman, Virginia Frey, entered engineering as a freshman in the electrical engineering department. Before I graduated, several other women were taking engineering classes too. I'm told that today, 17% of the students are women and that the chemical engineering department is now 50% women.

The University of Michigan has a Tau Beta Pi chapter. Tau Beta Pi is a national engineering society that recognizes academic achievement. Students are invited to join when their grade average is high enough. Then they go through both an informal and a formal ceremony where they are presented with the society key. My grades met Tau Beta Pi standards, but because I was a woman, there was no ceremony for me or the other woman who entered that year. Instead of the Tau Beta Pi key, we were given a small badge with the image of the key. Inscribed on the back of the badge was my name and that I was the fourth woman in the United States to receive such a badge. Many years later, I was invited back to take part in the formal ceremonies and receive the society's key.

Career and Family Life

In June 1941, still half a year short of a degree, I married a fellow engineer, Mike Hindert. He had enlisted in the United States Naval Submarine Service, and with the draft in force, he served mostly in the Pacific Arena until the end of the war. While I was in school finishing off my degree, I learned two things: First, as a woman, I was not going to be drafted, and second, as a married woman, I could no longer live in the University Cooperative House where I had lived the last three years. I find it interesting that today men and women live in the same dorms.

Do you remember that during the war years - 1941 to 1945 - it seemed that everyone was either in the service or moving somewhere? Well, I joined the crowd who moved frequently. During the war, we lost one out of four submarines. Letters home were rare. I would get a letter from my husband once every other month. Once, when they were on a particularly hazardous tour, there was no letter for four months. So, I was determined to have what time I could with my husband. Whenever my husband was stateside, I joined him, and when he left, I got another job. (Fortunately, I found them easy to get.)

In late 1942, I joined my husband in California for a few months. I discovered, that in spite of the fact that "Rosie" was allowed to do a man's work, there was still discrimination. In the shipyards, the squadrons that loaded ammunition into the ship's hold were made up entirely of Negroes who were supervised by officers from the Southern states. (Several years later, when my husband was in law school, we learned of the internment camps in the west that the Japanese-Americans were forced to live in.) Later in 1942, when my husband went off to sea, I was hired by Shell Chemical in San Francisco, where the company was headquartered. I asked to work in the oil fields, but I was told that women were not allowed in the field. Instead, I worked directly for the Vice President of the company. I had a secretary of my own, was served tea every afternoon, and worked with men who had been employed by the company in Indonesia, but who had escaped when the Japanese invaded the country. It was rather heady stuff for someone just out of college. I have no memory of the rationing of gasoline and certain foods that

civilians were forced to endure. Without a car, and never one to spend much time in the kitchen, my contribution to the war effort was buying war bonds and alternately working 54 and 44 hour weeks.

When the war ended in 1945, I worked for Ethyl Corporation in Detroit and shared an office with two other engineers. President Truman had ordered the release of two atomic bombs on Japan. (Some of you may know Warn, who lives in Woodside? He was a photographer for the Navy and he has pictures of Hiroshima taken right after the bomb was dropped. It is impossible to describe the extent and total devastation the picture shows. Some years later, I met one of the men who served as a navigator on the Enola Gay. He obviously suffered from serving on that trip.) Shortly after the bombs were dropped, we were reading a government report at work about how the atom bomb was made. (I later learned that when the war ended, the government removed all the technical literature on atomic bombs from all the libraries in the United States.) It reminded me of when I was a sophomore taking a physics course. Professor Randall had shown us slides of beta and gamma rays and said, "Take special note of this, they will have the greatest influence on your future life." Of course, Professor Randall was wrong, as it was not nuclear energy that has the most important influence on our lives; it was the computer. I often wonder if having a degree in engineering before the atomic bomb and a degree in computer science before the PC was the right road to travel.

Advice

In terms of the advice I have for women going into engineering, it would have be that being a woman isn't easy. My daughter does everything. She's a professional worker, has a marvelous, professional husband, and three children. I don't know how a woman does that. I would suggest that if a woman decides to get married, she discusses the child issue very carefully and discusses what the roles husband and wife will have during those very difficult years. I did everything serially, which also meant that I never even touched the glass ceiling. You really have to give it up to be a full-time, professional person. I think one of the most important things for achieving professional success is a mentor. And sometimes that's a matter of luck.

I very fortunate in that I never personally felt discrimination. I was always grateful for every door that opened for me, and I have no regrets. Granted, my ambitions were perhaps a bit different from others, because I was always married to a husband who was the primary income earner. I have been so lucky. I loved being in engineering school. I loved the studies. It was just a wonderful, wonderful experience for me.

Margaret (Barson) Frank

Margaret graduated in 1946 with a Bachelor of Science in Chemical Engineering and completed a Master of Education at Eastern Michigan University in 1973 in Secondary Education and Math. She worked as a chemical engineer in the pharmaceutical industry and as a high school algebra and geometry teacher. Margaret has four children.

Interview with Margaret Frank *February 16, 2007*

Growing Up

My parents were immigrants from Transylvania, and I grew up speaking Romanian as my first language. When I was four, I started kindergarten in Detroit and began to learn English very quickly. I can recall a blackboard easel with the alphabet and other items on it at home that we used to help us learn English. My parents felt that education was very important, even though my mother had not gone past the sixth grade, and my father had only reached the eighth grade. My dad worked at Kelsey-Hayes Wheel Corporation, but this was during the Depression Era, so he was out of work a lot. My mother worked outside the house doing cleaning and later doing maintenance work for Ford Motor Company. They were both committed to working to support my sister and my future education.

Growing up during the Great Depression - and in a mixed ethnic neighborhood in Dearborn - made me acutely aware of my family's financial position. I never really gave food a great deal of thought, however. We always had a large garden next to our house, and my mother received food supplements from the government. I had one dress to wear on Monday, Wednesday, and Friday and another to wear on Tuesday and Thursday, but I was aware of other children who wore clothes made only for welfare families. So, I had that kind of "Great Depression" frugality while growing up. It was difficult to ascertain whether my parents experienced outright discrimination or differential treatment as immigrants living in Michigan. Because they spoke with an accent, they weren't really that integrated into the neighborhood. My mother would attempt to get sewing jobs the City of Dearborn was running during the Depression. Although she had always had a sewing machine and could sew, she never got the jobs, and we never could figure out why, if it was an ethnic thing or what. It was always in the back of our minds, though.

I first became interested in science in junior high school. My science teacher, Mrs. Woods, seemed to pay a little more attention to me than the others. I did not quite understand why, as I never thought that I stood out in class. When I got to high school, my math teachers seemed to be quite supportive and helpful. By then, I was being coached to figure out what I wanted to do, because it was obvious that I was going to go to college. I know my geometry and physics teachers tried to discourage me, because they didn't really want any girls in their classes. I felt like I was supposed to just sink into the background and not get involved. Fortunately, my chemistry teacher was wonderful and very encouraging. Those were the days when you'd read Marie Curie articles and books, and it felt like, "Gee, that sounds like a good goal...to get involved."



Margaret Frank, 1946⁸

University of Michigan

I decided to attend the University of Michigan because of World War II. I got a scholarship when I graduated from high school to go to the junior college that they had established in Dearborn. At the end of my first year, all of the fellows were drafted, so there weren't enough students to continue the junior college. At that point, I decided to go to the University of Michigan. My sister was going to Michigan Normal, and I didn't want to go there or to Wayne State. I thought it would be quite an adventure to go to the University of Michigan because it was so prominent, and my mother and dad were very supportive. I had been working part-time since the age of thirteen trying to build up an educational fund, which, to tell you the truth, wasn't very large. I was, however, able to use that money for my education.

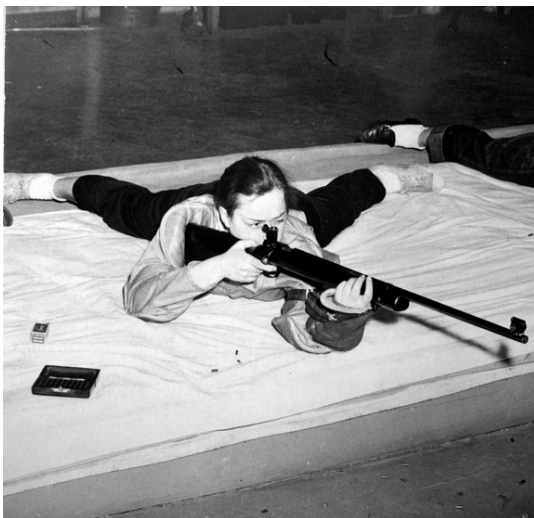
I was sixteen years old when I started college, so I was a little on the young side. In those days, there weren't many women in college, but I can remember one - Norah Altman Posner. Unfortunately, she is deceased. We had a few classes together. She graduated first in the chemical engineering class. It was very impressive. The University had the naval program at that time, so I always felt that the professors took roll by counting sailors and then counting civilians and women. It was the short-cut way of taking roll call.



"Something a bit unusual, a girl surveying." 1937⁹

The first year I lived in a League House on Washtenaw Avenue, which no longer exists; it's now a parking lot. I remember the number: 1333. After that, I spent a summer at Stockwell Hall when it was a women-only dorm. The thing I remember most about Stockwell is that the engineering students who were taking surveying courses would line the hill leading up to Stockwell while working on their measurements. That was always kind of a joke. After Stockwell, I stayed at Mosher-Jordan Hall. I think I had a single room on the fifth floor, so it was only a problem when the elevators didn't work, which happened frequently but wasn't

insurmountable. I remember they would lock the doors at 10:00 p.m., and I'd still be in the engineering building with my team doing some experiments, because the water pressure was only good enough in the evening for us to do it. The housemother would save my meal on a tray and open the door for me to come in. At Stockwell and Mosher-Jordan, I was the only engineer. I had friends in accounting, English, and other fields, but none of them were engineers.



Rifle practice ca. 1950¹⁰

The engineering school kept me quite busy, but I felt that I should take advantage of the other activities too. So, I worked part-time in the engineering department correcting papers and preparing specimens for the metallurgical department, picnicked occasionally with friends, and went to League dances and dances at the Union. There was also a rifle club in the lower level of the women's athletic building, which was downhill from Mosher-Jordan, and I really enjoyed my involvement with that. And then, there was the Society of Women Engineers. Of course, I can't quite recall what we did specifically, other than have meetings. We were all so

busy with our work. I think it was more of a camaraderie and support group. I can't remember if we met in the Michigan Union or the League, but I do remember that the Union had a side door for women, and I thought it was an anachronism.

I was doing my undergrad during the middle of World War II, so I remember seeing a sea of white uniforms because there were a lot of sailors. Sometimes, I felt that they had perks that the rest of us didn't, and in class, there didn't seem to be a lot of camaraderie between the male and female engineering students. The Navy fellows seemed to be quite cliquish, and there were only a couple of civilians. Yet, while there always seemed to be a separation of everybody in class, my professors treated me very kindly, especially when I worked for Dr. York and Dr. Bankero. Everybody in their offices was very polite and very helpful.

Career and Family Life

Before World War II was over, I was interviewed by the oil companies in my junior year - by Hubbell Oil Company in particular - and another one from Texas. They were looking for chemical engineers and wanted me to come to Texas when I graduated. Their engineering staff had been compromised, you know, with the draft and our professors were very active in that industry. I got a job at Parke-Davis in Detroit, Michigan. Dr. Harvey Mercker was the superintendent at the time and a University of Michigan graduate. I understood that he liked to hire University of Michigan people, so I interviewed there and started work a week later. Then, I was called to work at Ethel Corporation, where I worked for seven years in process development. I worked on the synthesis of the first antibiotic, Chloromycetin. It was quite exciting. What's interesting is that the friend I mentioned earlier had taken a tour of the East Coast to get a job and did not get hired. She was first in the class, and she did not get hired. Now that's discrimination. At work, I was still one of very few women. I had a friend in the lab who was a biochemist, and we had a very congenial, great staff of chemists and chemical engineers. There was no discrimination whatsoever (laughs).



Margaret Frank, 1946¹¹

Then I got married to a chemical engineer. I met my husband before I went to Michigan, and we got together afterwards. He was in the service, and then attended the University of Detroit engineering school on a co-op program. We ended up with four children, so I kept busy with them. I had a daughter who had asthma as an infant, so I had a hard time

deciding whether or not to go back to work. Then the department I was working for moved from Detroit to Holland, Michigan, so it made my decision to put my career on hold easy.

I got my master's in 1973 in secondary education and math. I was a stay-at-home mother, and the area we lived in was quite short of substitute teachers, so I was being urged to step in and help. My husband was traveling a great deal, so we needed to have someone stay at home. I thought that if I could match my children's schedule, it would be a good family choice to make. I taught for a little over 19 years, and I liked it, but it wasn't as exciting as working in the laboratory. I always felt that working in the pharmaceutical industry was the high point of my career.

My husband remained in the chemical engineering field, working on natural gas pipelines. He started out with Michigan Consolidated Gas in a co-op after the G.I. Bill, which provided veterans with the opportunity to go to college. He ultimately became Vice President of the Great Lakes Gas and Transmission Co., and testified before FERC in Washington, D.C.

Advice

The advice I have for women interested in being engineers - or entering any career, is that they need to be self-reliant, and really like what they're getting into. They've really got to have strong math and science background, but I think creativity is really important too. I don't think that gets stressed enough. I also recommend always asking questions, and questioning the status quo. Ideally, you have to do it because you want to do it - not because someone else is urging you to do it.

Fay Ajzenberg-Selove

Fay Ajzenberg-Selove graduated in 1946 with a Bachelor of Science in Engineering in Physics. She later earned a Master of Science in Physics in 1949 and a Doctor of Philosophy in Physics in 1952 - both from the University of Wisconsin. She did postdoctoral work at the California Institute of Technology, writing the first of a series of major review papers on the nuclear spectroscopy of the light nuclei. She continued to work and do experimental research for thirty-eight years while teaching at Boston University, Haverford College, and the University of Pennsylvania.

Interview with Fay Ajzenberg-Selove *January 29, 2007*

Growing Up

My family consisted of me, my father, whom I adored, my mother, whom I didn't much care for, and a sister who is fifteen years older than me. My parents left Russia in 1919 and stopped in Germany, where I was born in 1926, until 1930. Then I lived in France from 1930 to 1940, and then the war came. From then on, it was messy. We went along the Atlantic coast with a lot of other people and were lucky enough to be able to get into the so-called "unoccupied" France. From there, we went to Spain, Portugal, the States (briefly), and then to Cuba. We got immigration visas to the U.S. to become immigrants, but we had to go to Cuba to do so, because the consul for the United States in Canada was reputed to be an anti-Semite. Cuba gave us immigration visas almost immediately because I had been born in Germany. As far as the Americans were concerned, I was a German, and the German quota was open. So, they took me, and because of me, they took my family.

My father was a genius in his own way. He came from a very poor family in Warsaw, (which then belonged to Russia) and even though he was a Jew, he got a scholarship to go to the equivalent of MIT in Russia. It was called the Mining Academy. He finished with distinction, and as a condition of the scholarship, he became a coal miner and ultimately a mining engineer. In 1919, he disliked the regime so much, he took a locomotive at gunpoint and drove our family to Germany, where he became an investment banker. Because of the terrible Depression, he owed a lot of money, but he went to France and gradually repaid his debts. After some time, through my uncle (my mother's brother) he became a millionaire again. He owned part, about a tenth, of ten or eleven factories.

I can't imagine a time when I was not interested in science because I adored my father. My mother was a very good musician, but I didn't like her very much. So, because I adored Dad and he was an engineer, I wanted to be one too. He didn't push me, but he was a hero for me and gave me presents of money and erector sets - never dolls.

University of Michigan

My first choice for college was MIT. I was lucky enough to be interviewed by an alumnus who told me that there were numerus clausus. In case you don't know, that means they only took a certain number of people. There were numerus clausus for Jews and for women, and I didn't make it. So, I attended the University of Michigan because they admitted me.

I think I was the only woman. It's a little hard to remember 60 years later, but I can tell you that I felt like I was the only woman. There were about a hundred guys in the engineering class, and they were wonderful to me. They treated me like a rather naïve, (and I was) younger sister. They took me on their drinking expeditions and on their expeditions to find women, but they treated me like a wonderful younger sister. And I have to say that the most important thing I got out of Michigan is that I am very comfortable with men. I am clearly a feminist for other people. I want other people to have opportunities.



Martha Cook Residence, ca. 1940¹²

I lived in Martha Cook dormitory, and it was a terrific place to live. I was lucky in that I had a single room; it was lush. The food was excellent. I had really no interactions with the girls. They were all very pleasant, but I had very little to do with them. There were only three or four who planned to use the knowledge they were learning for something other than being a good wife. There was one very, very bright woman who

married a man who became a senator, but except for her, the others were just nice women who had nothing to do with me.

As far as I can remember, the professors they treated me well, but they were mainly very old. They were the people who did not go and work in war-related professions, and in my opinion, they were not very good. I finally switched from engineering to physics, because that was the only place where I met anyone who had seemed to enjoy himself.

When I went to graduate school at Columbia, I was taught by first-rate people who all had Nobel Prizes. They were just a different caliber of person.

Career and Family Life

I had no doubt that I wanted to teach. My first job was at a community college in Chicago, where I taught a hundred and fifty students who had just come back from the war and needed training in physics. After I got my Ph.D., I got a job doing research at Cal Tech. I was the first woman they had. While I wasn't treated any differently at Cal Tech because I was a woman, I do remember one time when I was discriminated against. I had just decided to leave a small college called Haverford because I just couldn't stand the president of the college. I couldn't leave the area because my husband was a professor at the University of Pennsylvania. So, my friend suggested that I become a research professor at Penn, because I could also teach as much as I wanted to. That was very important to me. Everything went well until I arrived at Penn, and the guy I was supposed to work with decided that he didn't want me. He had the backbone of a wet noodle, and he considered me too well-known. I made a complaint to the State Human Relations Commission saying that I was being discriminated against, and after a few unpleasant years, they found in my favor. Penn was given the alternative of either being sued by the federal and state governments (in which case they could have lost half a billion dollars) or taking me retroactively. As you can imagine, they took me retroactively, and I've been completely comfortable at Penn ever since. I found that if you win, the guys accept you. I was only the second woman at the University in the College of Liberal Arts, but now, I have worked on all the committees of the University, and today, there are, finally, women in the physics department.



Fay Ajzenberg-Selove, 1946¹³

My husband was a professor at the University of Wisconsin when I went there to get my Ph.D. Our meeting was not quite Romeo and Juliet, but it was almost like it. I'm sure you have heard of Nobel Prize Winner, Niels Bohr? His son, Aage Bohr, also won a Nobel Prize, and he and his first wife, Marietta, were very close friends of mine. One day, Marietta came to visit me when I was at Boston University and told me that I had to get married. I told her that I hadn't seen anyone I wanted to marry. I mentioned a guy we both knew, and she told me that I didn't understand myself. Then she said that she had met the guy for me the evening before at a cocktail party. He was an assistant professor at Harvard that I had seen around, but he didn't appeal to me. Marietta was a

very domineering woman, in a delightful way, and she said, “I’m not going back to Denmark unless you promise to meet him.” He was giving a talk quite soon after, so I went and sat in the first row. I fell in love with him, and for the next four or five months, I worked on him in every possible way. I got myself invited to places where he was going to be. I got fake tickets to the opera, in case he could make it, but it didn’t work. Then one day I came back from a trip, and he met me at the airport. We went to bed, and four months later, we were married. I’m still mad about him. We have been married for fifty-one years.

Advice

My advice for women interested in pursuing science is to be comfortable with men. That’s one of the most important things that I learned at the University of Michigan. All four of my heroes have been men. Also, don’t have regrets. When I was ten years old, I decided that I would live a life that I would not regret when I died. (At the time, it seemed that I might die pretty soon because of the War.) I have been extraordinarily lucky. I don’t regret anything.

Frances (Jenkins) Holter

Frances completed a Bachelor of Science in Engineering Math in 1947 and a Master of Science in Math in 1951. In addition to raising her two daughters, Frances worked as an aeronautical engineer, an engineering instructor at the University of Toledo, and a high school math teacher.

Interview with Frances Holter *February 2, 2007*

Growing Up

My father owned and operated a hotel in Big Rapids, so I was born and raised in a hotel with my sister. It was fun. After I graduated from high school, I went to Stephens College in Columbia, Missouri, which was then a two-year girls' school. Now it is a four-year girls' school. After my two years there, I came to Michigan and decided to go into engineering. When I told my family they just said, "That's very nice Frances, go ahead and try it."

University of Michigan

My sister was engaged to the son of the Assistant Dean of Engineering at the University of Michigan, and he encouraged me to enroll, so I did. There was no application process then. I lived in the Chi Psi lodge, and since this was during World War II, there weren't any boys there. My female roommates were studying mostly English and education. They weren't particularly excited that I was doing engineering, but I enjoyed it. I have to say, it was hard being in classes with all boys. They were indifferent to me. We didn't talk. Some of the boys didn't want to get sent to the Army or overseas, so they were very worried about getting good marks in school. It made competition a lot harder.

Some of my professors were good, and some were horrible. My chemical metallurgy professor, for example, said I should be "studying a cookbook, not chemical metallurgy." I had never taken physics in high school or during my first years of college, so I was scared to death. I had this neat professor, an older man, and after our first exam, he looked at my test and said, "Now Miss Jenkins, you didn't want to put this, did you? Did you want to change this?" I said, "Yes, I do." So, he sort of guided me through it, so that I just passed the test. It was my first test in physics. Everything was okay after that, but I

was still frightened. In fact, I never raised my hand, but he and some of my other professors called on me anyway. He was just like a grandfather.

In addition to attending classes, I kept really busy. I joined a sorority because most of my close friends were in it. There were also all sorts of war activities like knitting scarves, which I did, and I was also in the Society of Women Engineers. I was president, but truth-be-told, we didn't really do much. They do a lot now. I usually worked alone, but I was in one study group, and I was thrilled to be asked to be in it. They were all men, and truthfully, I think they just wanted to have the group meetings over on the front porch of the sorority house to meet more girls.



Frances Holter, 1947¹⁴

Career and Family Life



Frances Holter, 1946¹⁵

After Michigan, I went to work in Los Angeles, California for an aircraft company called North American Aviation. I did mostly trajectory calculations, and I lived on the beach, so it was a nice set-up and a lot of fun. There were a lot of men, but some of the department heads were women, so I didn't have to struggle. I worked there for two years, and then I decided that I didn't want to stay in California. I came home and got my master's in math at the University of Michigan.

I had a job while I was getting my master's doing aeronautical engineering for the U of M Aeronautical Research Center. At that time, we were mostly working on trajectories for guided missiles that either the Germans were going to launch at us or that we were going to launch at them. I worked with some women and we established camaraderie. Then I met my husband. We went to Texas for a couple of years where he worked on the space program in infrared technology.

After we came back, I did some teaching and that was fun. I taught engineering classes at the University of Toledo and high school math classes. You learn so much more

when you're teaching a class. Particularly math because you have to get in-depth, not just skim over the top of things. At Toledo, I taught all men. Some of them were really terrible. You learn so much about how a man's home background is reflected in what he does, whether he's unkind or cruel. If some of these kids didn't get a good grade, they'd let me know about it. I also encountered some resistance to my being a woman when I worked at Bendix. I'd be in charge of a project, and some of the men assigned to work on it with me were very male dominant. It was hard to work with them at first, because nothing you did was right. They would say, "This isn't the way we do it." Eventually, I stopped working, and we adopted two girls.

Advice

I don't have any particular advice, except to keep plugging along and enjoy it. Do the best you can do and don't get discouraged.

Sally (Farquhar) Shumway

Sally earned a Bachelor of Science in Engineering Math in 1947 and an M.B.A. in 1974. She worked at King-Seeley Corporation and Fram Corporation as an engineering consultant in Washington D.C., and as a supervisor in the Emissions Test Laboratory at Ford Motor Company. While working full-time, Sally raised her four children as a single parent.

Interview with Sally Shumway *February 19, 2007*

Growing Up

We lived in Birmingham, and my dad was treasurer of the Burroughs Adding Machine Company, which is now part of Excel. My mother was an artist and probably one of the world's first feminists. She established herself in New York City as a designer, so according to her, women could do anything. In fact, she said to me many times, "You know, you can do anything you please. Just because you're a woman, it doesn't mean you can't." She marched for women's right to vote down 5th Avenue. I believe it was in 1917. She was quite a gal.

I became interested in science and math because my Dad always liked numbers. Somewhere along the line, junior high or early high school, I took an aptitude test, and I did really well in both math and science. I did terribly in social studies and okay in English. So, there was no point in considering a lot of different professions. In addition, it was wartime, and we were supposed to do something that really mattered. Engineering fit the bill. At one time, my godmother's father had been Dean at the engineering school at Michigan, so there was that connection.

Generally, women were expected to get married, stay home, and have babies. We all wanted to do that until the war came along, and there were no men left because of the draft, so women ran the world. I remember my mother, in her enormous blue jeans, driving tanks to Fort Wayne from the Dodge Plant. You know, they did everything, so I think at that point women found they could do things.



IN SPRING A YOUNG MAN'S FANCY . . .

Sally Shumway is third from left, *Michigan Technic*, 1945¹⁶

University of Michigan

I decided to go to the University of Michigan because it was just the only place to go. At one point, I wanted to go to California because I'd never been there. I thought U.C.L.A. would be great. But I wanted to stay near the family during the war, and it was just too far from home. Transportation was also terrible because all the trains were troop trains. You rode with the troops, and guys weren't any better behaved then than they are now.

I got a scholarship to UM through the alumni association. My father was totally aghast at the idea. He was a Southerner, and having a daughter who was an engineer was a little difficult for him. So, Mom suggested, "Why not apply for a scholarship and then he can't say anything." I did, and they gave me a tuition scholarship.

Later that summer, my mother and I went up to visit the school, and we went to see Assistant Dean Lovell. He took one look at me and said, "I don't want any girls in my engineering school." To which my mother replied, "My daughter has a scholarship to your engineering school." And that was that. There were actually sixteen girls that started when I did, but by the end of the first year, they'd all transferred to other schools. Dr. Schneiderwind advised me through the first two years of engineering school, and he told me to go to Katherine Gibbs, which was a secretarial school. He said, "You're doing well. You'd make a great secretary for some engineer." I said, "No, you don't get it. I'm going to be the engineer."



Stockwell Hall, ca. 1940-1950¹⁷

The first couple of years I lived in Stockwell, known as the Stockyard at the time. Then one summer they closed Stockwell, and I moved to a League House. These were private houses. We had no food, but it was a nice arrangement because you had a lot more freedom. We still had to be in at 10:30 p.m. at night though. The only guys that had a curfew were the Navy V-12 and a group of Army guys that were totally grounded.

On weekends I did normal things. I'd go down to the Pretzel Bell, a student tavern, and lie about my age to get in. I also played a lot of bridge in the dorm with my girlfriends. The experience wasn't that different from anyone else's, except we were called the "Vassar of the West" because there were more women than they were used to having. I think that's why we had the Society of Women Engineers, because I don't think any of us

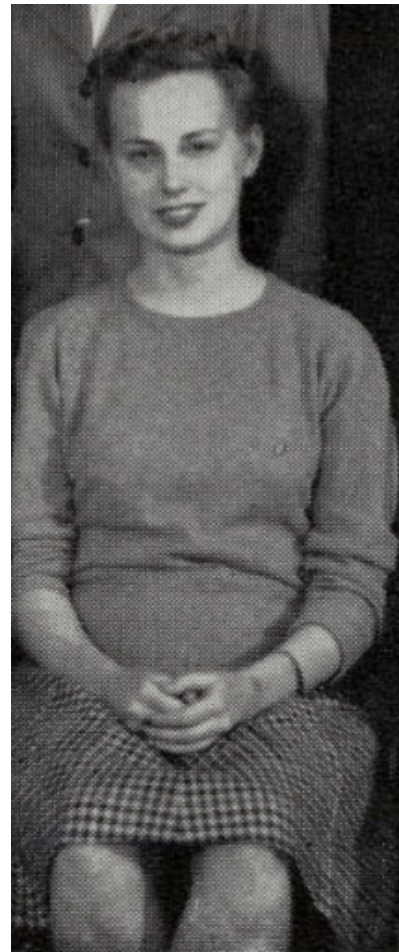
really had a lot of friends. There were about sixteen women in it, and I was the president for a while. We always joked about the fact that we wouldn't have any friends if we didn't have each other because nobody understood us. I remember one time we put on a program of the Bikini Atoll atomic explosion tests. I think we sold out Hill Auditorium.

My professors were either very supportive or very unsupportive. When I took a class in materials engineering, I got to turn the crank on the Brinell machine, and I got the heaviest hammer. There was also a guy who put the tail of my shirt in the vice once, and I half ripped it off. It was real subtle stuff like that. But then there was one professor from the Philippines who made me his student assistant. He wanted me to go to the Philippines to teach, so I met every kind of reaction. It was tough on the guys, because they'd always had the school to themselves.

Career and Family Life

After graduation, I wanted to stay in Ann Arbor, so I went to every place that had an advertisement. I ended up working for the University doing a statistical study, and then I went to work for King-Seeley. They built automotive gauges for Ford Motor Company. After that, I went to work for Fram Corporation in Dexter. They had a big lab there, and I worked in their dust tunnel. That's where I met my husband. He had an engineering degree, but he was a salesman. When he was transferred to Washington, D.C., I went and worked for two years for a consulting engineering firm there. We had one of the world's first computers - a big, old analog thing. It was more fun than a barrel of monkeys, because my job was to take these performance curves from aircraft engines and convert them into mathematical formulas. After two years, my husband was transferred again to New England. I said, "I'm not going. I like what I'm doing here." So, for six months he commuted back and forth to Washington. Finally, we moved to Rhode Island.

In Rhode Island, I stayed home and had four kids until my husband became mentally ill and died. I can't tell you how grateful I am that I had an engineering degree and some experience working at that point. I looked for jobs in Rhode Island and got nowhere, until one day, I got a call from one of the men who worked for Fram,



Sally Shumway, 1946¹⁸

and he offered me a job. I stayed there for three and a half years. Then my sister sent me an ad from Ford Motor Company stating they were looking for someone to help set up a test facility. (Emissions was becoming a big thing at that point.) I got that job and stayed with Ford for the next twenty years. I had a policy at Ford of never accepting a move to a new job that had not been filled by a man, because they were satisfying the requirements for women in management, and I never wanted to be a statistic. I wanted a real job.

So, I worked while raising my children. The oldest was seven and the youngest two when I went to work. It was crazy, but I had a wonderful woman that watched my children all day long. I'd get a student to live-in and give them free room and board in exchange for helping me out. It worked out. I also remarried a man who helped me raise my kids. He was a wonderful father to them until he died of a heart attack. After I retired in 1986, I moved to Tucson. One of my daughters and I had been here on a camping trip, and I looked at that blue sky and I said, "You know, after years of Michigan's gray skies, I'm moving down here." I remarried in 1989 and became a manager of an H&R Block office doing tax preparation.

Advice

My advice for future women engineers is to go for it. If that's what you want to do and you have the skills for it, there's no reason in the world not to do it. Engineering is a wonderful field. It has all sorts of latitude and many different areas that you can go into. I'm very glad I spent all those years working in engineering.

Marilee (Diamond) Kelly

Marilee earned a Bachelor of Science in Aeronautical Engineering in 1949. After working at the University of Michigan Aeronautical Research Laboratories at Willow Run for several years, she devoted herself to raising her four children and to volunteer work.

Interview with Marilee Kelly *March 30, 2007*

Growing Up

When I grew up it was the Depression, so it was a hard time for people, but a good time too. My family was very loving. I was the oldest child, and my sister was born four years later when the banks failed. But I remember thinking, “Boy, we are the luckiest family in the world because we got a new sister and a radio!” Radios were new then. My father was a machine tool designer, and my mother was a stay-at-home mom. My father actually had two jobs, so I think we were better off than a lot of my friends whose fathers didn’t have any job.

My parents exposed us to all kinds of experiences like sailing on our sailboat, swimming, bike riding, and digging up wildflowers in the woods. I also loved reading and collecting caterpillars. We used to raise them to watch them spin, hatch, and lay eggs. It was just for fun, so I never thought of it as being science or engineering or anything.

In elementary school, I liked nature study. Then, when I got into high school, I wanted to take all of the math, biology, chemistry, and physics classes. They were interesting to me, because they were problems and not memorizing.

University of Michigan

I remember wondering what Ann Arbor would be like. I don’t think I had to apply to go to the University of Michigan. I just knew that it was the next thing in line for me. My first impression of the campus was that it looked very different from what I was used to. The big fraternity house that’s on the corner of Hill and Washtenaw looked rather foreboding with its tall gates.

During World War II, the University took over a bunch of fraternity houses and used them for dorms. That's where I lived my freshman year. There were just girls, no boys, as there weren't many men on campus. We had a house mother, so maybe it was a little like a sorority, except none of us knew each other ahead of time. We were supposed to sleep upstairs in an unheated dormitory room. I guess maybe that's the way fraternities do it. We also had a study room that four of us used. When I came back as a sophomore, I lived in the same type of dorm out on Geddes, overlooking the Arboretum.



Marilee Kelly, 1946¹⁹

While I spent most of my time studying, I found time to do other things too. In fact, I was one of the first women to join the sailing club. I was just so shocked to hear, "Well, actually, we don't allow women in this club," at the first meeting I attended that I must've sounded off. After some consideration, they let me and another girl in that year. I also went to dances in the ballroom of the Union every Friday and Saturday night. Dancing was the big thing at the time, so the Senior and the Junior Proms were a big deal too. In addition to the dances, I went to the football games and hockey games. UM had good teams then, and one year we won the Big Ten title in football, hockey, and basketball. Boy, that was a great year!

Overall, my experience in the engineering school was good, but I did experience some challenges because I was a woman. I transferred to the engineering school as a sophomore, and there were only four women in the entire college. In fact, during my time there, I never had a class with another woman in it. At one point, my aeronautical engineering professor, who was head of the department, actually told me that girls shouldn't be in engineering. He held me after class and told me to drop his class because he wouldn't pass me. I did, but I transferred to different professor's section. I also had a professor whose final project was to design an airplane. All of the guys in that class had been in the air force and had been flying, so they knew what to do to make them better. I'd never been in a plane in my life, so it was very hard for me. I tried to talk to the professor, but he just said, "Well, you should have thought about that. You don't know enough to be taking this course." Fortunately, he didn't say it was impossible, and he did pass me.

Career and Family Life

I met my husband at the University of Michigan Aeronautical Research Laboratories at Willow Run. I was running out of money, my parents were running out of money, and then I saw an ad for a job out there. The labs had decided that they needed some women around, so they hired me. I suppose that was the opposite of being ostracized. My husband and I got married in December of 1949 and continued to work at the Aero Labs at Willow Run. Then we started a family and had four children. I never intended to keep



Willow Run Village, 1949²⁰

on working after having a family. I wanted to be a stay-at-home mother. That's what mothers were in those days. In fact, I knew very few people that kept on working after having kids. My husband told me that he always felt very privileged to have a wife who was also an engineer. He could come home with a question from work, and I could not only understand it, but look at it from a woman's point of view.

Advice

My advice for women entering the engineering field is to do your thing. Don't worry about the fact that you're a woman. Just do it. It seems to me that gender shouldn't matter when engineering companies are deciding whether to hire someone.

Patricia (Lewis) Pilchard

Patricia completed a Bachelor of Science in Aeronautical Engineering in 1950. She then went to work at North American Aviation as an aerodynamics engineer, raised four children, and later resumed her career as an aerospace engineer for the Navy at Point Mugu.

Interview with Patricia Pilchard May 8, 2007

Growing Up



Patricia Pilchard ca. 1940-50²¹

I was born on August 17th, 1927. The Depression followed soon after, so my parents were not only young, but they were also pretty poor. I was born three months after Lindbergh crossed the Atlantic solo. I don't know if it was a pre-natal influence, but I have been fascinated with airplanes for as long as I can remember. I remember being about five years old and getting the bright idea to put wings on my tricycle, so I could fly. My granddad had been putting shingles on the roof at the time, so there were some boards and nails. I picked up a rock, and I tried to put wings on my tricycle. Then, all of a sudden, it struck me that it would not work. I remember that was the moment when I crossed the line between being a child and being an adult. I realized that there was a lot more that I needed to know before I could fly.

I started working when I was about twelve to save money for flying lessons. When I was sixteen, I went out to a little airport out on the edge of town and signed up for flying lessons. Because it was still World War II, I had to join the Civil Air Patrol to take them, which was fine with me. The more I learned, the more I wanted to know. I started pouring over college catalogs, but the only thing I saw that had anything to do with aircraft was aeronautical engineering. I had absolutely no clue what that was. I'd never

known an engineer, and the only ones I'd ever heard about were locomotive engineers. However, I decided that that's what I wanted to study.

My parents were very, very protective. They wouldn't even let me go skiing, so I knew they certainly would not give the okay to flying. However, once they found out I was already doing it, they were supportive. (I think they might even have been proud.) When I announced that I had decided to study aero engineering, my Dad just kind of exploded. My mother was supportive because she wanted me to go to college. She tried to talk me into doing something practical, like being a flying secretary, and of course, everybody suggested that I be a stewardess, but that was not what I had in mind at all. I wanted to know all about planes.

University of Michigan

I chose the University of Michigan because it was close to home and affordable, which helped, as I didn't have any financial help. The best I could do was work all summer long and then make a deal with my dad to cover the rest. I worked all the way through school. My first job was working in the dormitory where I lived. It was work, but also my social time, as it was really the only time I got to see my friends. I was very busy studying the rest of the time, and I didn't have the advantage of having other engineering students in the dorm to study with. (Back then, dorms were strictly separated.) I did have one roommate, Audrey Muller, who was also an engineer. I think she became the country's first female naval architect marine engineer. She was a very interesting person and as into boats as I was into airplanes.

When I went to school, there were about 3,500 or so in the engineering school, and maybe twenty of them were women. There weren't any women in my classes, so I got a lot of attention - and a lot of requests for dates. I remember having to walk down a long hall to get to the end of the line to sign up for classes. (They did it differently then because we didn't have computers.) I remember getting whistled at and being embarrassed, but realizing that I was just going to have to take it. I also remember an English class where the whole back row was Marines from the South Pacific. It was a speech class, and as usual, I was the only girl in the class. I was very shy and embarrassed easily. It was just their delight when I had to get up and give a speech, because they would sit in that back row and heckle me. I remember thinking that if I can get through this, I can get through anything. I also joined the Society of Women Engineers for a while. I thought it would be a good idea, but I didn't really get very involved in it. They were still trying to get organized, so they weren't doing very much. Then I met my husband and didn't have a lot of time to socialize.

Some of my professors took the attitude of, "What are you doing here?" And some were merely surprised to see me. Occasionally, however, I would get a professor that would be

particularly helpful, especially when I was not as well-prepared as the guys were. (When I went to high school, all the girls had to take home education. No girls were allowed in the shop or even the mechanical drawing classes, which I thought was a terrible handicap.) For instance, there was this little old Scottish professor who taught metal processing. The class involved getting metal really hot and banging it with a hammer to shape it into something, like a blacksmith does. I didn't have the strength to do that, and it was just ridiculous. The professor would walk over, scowl at me, and mutter under his breath. Then he would take my hammer, give the piece I was working a few good licks, and hand it back to me. I ended up getting an "A" because he had done all the work. I always laughed about that. He was very grumpy to me, very gruff, but he reminded me of a grandfather I'd had that played tricks on me.



Registration in Waterman Gym, September 1951²²

Career and Family Life

Before getting married in January of 1949, I got a job in the research center at Willow Run. I worked for a very interesting graduate student named Kip Seigal, and he had me working on things like computing rocket trajectories. I was very good at math, and I would figure out how to solve the problems he presented me. After I graduated, I got a job at North American as an aerodynamics engineer. They had a woman from the World War II Women's Air Service Patrol who did the filing and computing, and when she left to go back into the service, I took over. Back then, they made excuses for not hiring women such as, "You will get married and quit or you will have a baby and not have time to work." But the woman who was working there helped me get the job. In the beginning, I did mostly filing, but gradually more responsibilities were given to me. Eventually, they decided I was fully qualified as an engineer, and everybody could do their own filing. I worked there for four years until I finally did have a baby and quit. I didn't intend to quit. I was just going to take a leave of absence, get a housekeeper, and go back to work, but it didn't work out that way. In truth, after I had the baby, I kind of lost interest in going back to work. In addition, my husband got a promotion that required us to move from the L.A. area up to the San Francisco Bay area. So, that kind of settled that.

After having five children, I went back to work in 1979. I got an offer from the Navy down at Point Mugu and worked there for 17 ½ years. That's when I got into the flight test engineer position for the unmanned air vehicle Predator. The joint services were looking for an unmanned air vehicle, and before they decided on the Predator, I went around and looked at some other unmanned air vehicles. One of the places I went to was Burt Rutan's place out in the Antelope Valley. I flew chase with him and observed his entry into the competition. If you're not into aircraft, the name Burt Rutan probably doesn't mean anything to you, but he's a real hot designer who got involved in commercial spacecraft. So, I thought it was really a treat for me to be able to get in the aircraft with Burt Rutan and follow his unmanned air vehicle.

I realized after working for the Navy for a couple of years, that although it had been awhile since I had last worked, I had the same kind of relationships with the guys I worked with in the Navy that I'd had back at North American. I felt accepted and like a valued asset, and I was happy to be there. When I went to North American, it was very hard for a woman to get a job in engineering. But when I went to work at Point Mugu, the person who introduced me and sent in my resume got an extra bonus because I was a woman. I thought that was kind of a kick that things had changed so drastically in that twenty-five years. I met more women in engineering, but I was still surprised there weren't more. The ones that I did meet, however, usually had a story of how someone had encouraged them to pursue their interest in the field. I wish there had been more of that when I went to school.

I went back to school in the 1970s. I was always an admirer of the Montessori Schools and got the bright idea to start one. So, in order to get a little credibility, I signed up for grad school U.C.S.B. in the graduate school of education. I spent about three years in the Ph.D. program before I realized that I did not sincerely want a Ph.D. So, I took my master's and left. But I also volunteered for a program to encourage older women to return to school. (I was really just someone to call for advice.) However, the question everybody asked me was, "How did you get your husband to let you go back to school?" I was just dumbfounded. It never occurred to me to ask him if I could go back!

Advice

I think we should all follow what interests us. I know with my own children, I always tried to expose them to as many different things as I could and to encourage them to pursue what they were interested in. I think that's just the right way to live. I've been very happy with the choices I've made. I think the most important thing I learned in college was that just because I go to sleep doesn't mean my brain stops working. Anytime I ever had a problem to solve or a decision to make, I'd sleep on it, and I never failed to waken with a good solution or a good decision.

Barbara (Quinn) Carter

Barbara graduated with a Master of Science in Zoology in 1952. She worked as a research scientist at both the University of Michigan and Parke-Davis, as a Professor of Biology at Onondaga Community College, and as a technical writer for Shared Medical Systems. Barbara has four children.

Interview with Barbara Carter

April 9, 2007

Growing Up

I grew up in a town called New Rochelle, New York, just outside of Manhattan. My father was in real estate, and my mother stayed at home. I didn't do well in high school science at all. I couldn't stand chemistry, so I dropped out to take art, which is really funny. It's taken about sixty years to come full circle, because of course, I'm very interested in science. It has been my life.

I graduated from high school in 1944, but I was not college oriented. It was the middle of the war, and there was only one college on the East Coast that seemed to have any real social life because there were no men around. That was Connecticut College for Women in New London, Connecticut. I applied there and was put on the waiting list, because everybody in the country was applying there. There was a big feature in *LIFE* magazine about the school, because it was the only one in the country where anybody was having any fun. So, I went to take what is called the "fifth year" of high school at a prep school in upper New England. My father didn't want me to go to a co-ed college, so I went to one of the Seven Sister Colleges in New England - Mount Holyoke.

University of Michigan

After I graduated from Mount Holyoke in 1949, I went to work for the Rockefeller Institute. I realized that I really couldn't do anything in my field, except grunt work, unless I got a graduate degree. At the time, every famous scientist in the world worked at the Rockefeller Institute. I worked with the people that developed the polio vaccine, Dr. Salk and Dr. Sabin, but I was mostly typing letters for them. Back then, all of the

research assistants were women. We had our own dining room separate from the Ph.D.s and M.D.s. It was not a real democratic society by any means.

I applied to some of the big Midwest colleges for graduate school. I also applied for an assistantship, and I got one at Michigan. I was a research assistant for a very nice man, Dr. Kemp, in the Zoology department. He was working on the development of certain cellular structures in embryology. It took me two years to get my master's degree in bacteriology. I would say I spent more time in biochemistry and bacteriology than I did in zoology, so it was almost as if I had a triple major. I remember that I was the only woman in the zoology department my first year, and there was only one other woman who graduated with me.

Overall, my professors were nice to me. I remember auditing a physics course because I hadn't had the proper amount of physics. There were a bunch of freshmen boys in the class, and that was a big change for me, as I had always been to school with returning veterans that were always either my age or older. I just couldn't stand this class because the boys were always made comments like, "What is an older woman doing in physics?" I never felt this way in the other departments.

I lived in a graduate dormitory the first year. I believe it was Alice Lloyd. One of the units was for all female graduate students, and we had a great time. I worked in research and took courses, but a lot of my friends were in the School of Education. They always went swimming in the afternoon when I had labs. I remember going to meet the head of



the zoology department, Dr. Brown. He introduced me to another faculty member who interviewed me because I would be taking some of his classes. He asked me where I was living, and when I told him Alice Lloyd, he said, "Why aren't you shacking up with some man?" That really is where women were at that point. Most people questioned what you were doing if you were a woman in science.

Alice Crocker Lloyd Hall for Women, 1949²³

I remember attending a party with Dr. Nungester and my husband my second year of school. It was held in the School of Public Health. Dr. Nungester was a bacteriologist and the head of that department. At the party, I met the two men that founded the double helix for DNA, Watson and Crick. They were describing what they were doing, and to be honest, it was way over my head. Once DNA came out, however, I recognized it, so, that was exciting.

Career and Family Life



Barbara Carter, 1952²⁴

I met my first husband at Michigan when he was getting his master's degree. I got my master's and went to work at Parke-Davis as a research associate in bacteriology. I call myself a P.H.T., meaning Putting Husband Through school! After we got married, I worked in the Women's Hospital as an OB-GYN research assistant for Dr. Riley. My job was to find out what the liver does to the hormones in the body. I left after about a year when I had my first child, which was a big choice. Back then, unless you had a Ph.D., there were very few people who worked after they had children. Looking back, I wish I would have gone on for my Ph.D. I actually had 6 months on my Ph.D. after my master's, but I ran out of money. I had four kids, and we were really in debt, because my husband stayed at Michigan for four more years. His veteran's pay ran out, so I never could've

gotten my Ph.D., paid a sitter, and everything else. In fact, at Parke-Davis, I don't think I really would have gone any place without a Ph.D. It was a big pharmaceutical house, and they had just lost an awful lot of money with a drug called Chloromycetin, because it caused some kind of anemia in people. It was pulled off the market, and they were after the new polio vaccine like crazy.

When my children got older, the high school was in need of substitute science teachers. My husband did not want me to go to work. He wanted me barefoot, pregnant, and in the kitchen. Somehow, I talked him into allowing me to go to work. I substituted for four or

five years, but I could only do it for twenty days a year, because I wasn't certified to teach in New York State. So, I went back to Syracuse University to get my certification and went through the master's program. It was during the Vietnam War, and with half of the student population stoned most of the time, high school teaching was almost absurd. So, I ended up teaching at a community college. I had to turn down the full-time job, because my husband wouldn't let me go full-time. After I got remarried, I worked for Shared Medical Systems - they did the medical system software for all of the hospitals around the world. I worked there for 10 years, first in marketing, then as a technical writer.

Advice

I don't have any regrets about my choices, but a lot of them weren't really choices. Thankfully, that's not the case for women now. We just assumed that if we had children, then we would be at home with them. It was the odd woman that went to work. I remember there was a woman in my neighborhood who taught math. We thought that was very strange because she had children and went to work. (Many women volunteered for things like the League of Women Voters instead.) I'm kind of glad that I didn't have that choice. If I had, I don't think I would have had four children. I'm just glad that women have more choice now.

Anne (Campbell) Natvig

Anne completed a Bachelor of Science in Engineering Math and a Bachelor of Science in Engineering Mechanics in 1956, as well as a Master of Science in Engineering Mechanics in 1957. She worked at Bell Telephone Laboratories, as an instructor at the Marquette University College of Engineering, and as managing abstract editor for the *Journal of Plastic and Reconstructive Surgery*. Anne has three daughters.

Interview with Anne Natvig *January 8, 2007*

Growing Up

I had wonderful parents. My mother was trained as a vocalist - a soprano, and my father was a banker, who eventually became the president of the bank in a small town. He also came to Ann Arbor for several summers and studied with Palmer Christian, who was the organist at the Presbyterian Church at that time. My father was a wonderful keyboard artist on both piano and pipe organ. Two weeks before he was to ship out for France in the ambulance corps, they discovered he could type, and thus, transferred him to Newport News in hospital administration. It was nice for him.

I'm the youngest of three. My brother was 13 years older than me. He earned a degree in economics from the University of Michigan in 1943 - the time of Tom Harmon and one of the Wistert Boys. My sister went to Michigan for a year and then transferred to another state college for a degree in education and later a master's degree. In our family, there was only one university: the University of Michigan. I listened to football games when I was four years old sitting on a little ottoman in front of an Atwater Kent radio. (Those were the days of no TV and only one radio in the house.) I was cheering for Michigan even then and could even sing "The Victors" fight song. In my family, academics were stressed, but it was more important to always do your best - whether you were playing the piano or tennis.

In high school, I had the most wonderful teacher for all of my math courses and a senior course in physics. He was a huge influence on my interest in science. When I was a junior, he received notice of an open house in the engineering college here in Ann Arbor and asked four or five of us if we wished to attend. That was when I learned that Michigan had an engineering math degree - and the day I decided to be an engineer. I'll tell you something that I would never say to any theoretical mathematician. The

difference between a practical mathematician and a theoretical mathematician is as follows: they both learn a math theorem and then prove it. After that, the practical mathematician uses it, and the theoretical mathematician worries about it forever!

University of Michigan

The University of Michigan had a reputation, so only two people from my high school went to U of M. It was a Class B high school, and there were only 70-some in my graduating class. Usually you'd get one, maybe two, that would go to Michigan. The rest went to Michigan State, because quite frankly, they didn't have the academic status that Michigan required. My parents, especially my father, were very supportive. In September 1951, I reported to orientation at U of M and registered in engineering math with the idea that I would eventually pick up a second degree in engineering physics. Then during my sophomore year, I took a course in strength of materials with a wonderful professor, Dr. John Van den Broek. Dr. Van den Broek asked me if I wanted to work on some extra research for him the next year. That was how I got interested in engineering mechanics instead of engineering physics.



Barbour Gynasium in foreground, ca. 1950-1960²⁵

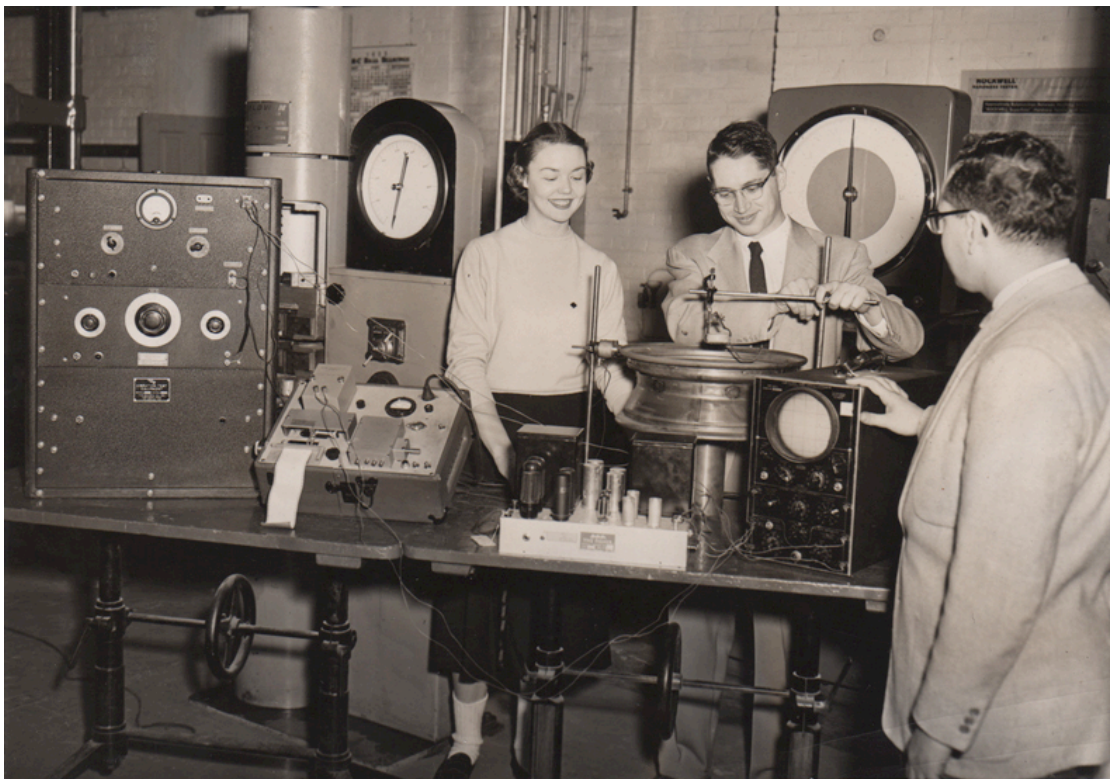
Freshman year I lived in Helen Newberry. I chose Helen Newberry because it was small, because my sister had lived there when she was a freshman, and because I liked its proximity to State Street. Then I pledged to Alpha Chi Omega and lived there. Being the only girl in a lot of my classes didn't daunt me - it couldn't. There were three women, including myself, in our orientation class a week before classes began. One has to understand what things were like in the '50s and several years beyond that. The University served *in loco parentis*. No student cars unless you lived in Ann Arbor, and women had a curfew of 10:30 p.m. on weeknights and 12:30 p.m. on Friday and Saturday. You signed in and out, and God forbid if you come in late!

They kept track of you quite well. I

also remember that Barbour Gym was the women's gym, and Waterman, next door, was the men's gym. We ran around that gym one day during orientation week in just skimpy

little hospital gowns flapping in the back taking all sorts of examinations from doctors and nurses. They even had you step in water to check the arches on your feet, and they looked carefully at your fingernails. It was quite thorough. And then we had to take a health course. Once a week, for six or eight weeks, we had to go to Haven Hall for a lecture. Attendance was taken, and I think there was a final exam. There were a lot of dire warnings about what would happen if one did this or didn't do that.

I didn't mind being the only girl that I knew of in engineering. Of the freshman that I knew, one gal left after two or three weeks. The other gal, who I knew fairly well, transferred out after the first semester. The University had recently added an advanced chemistry course for engineers, which required passing a comprehensive orientation test. I went to the chemistry auditorium to take this test, and I saw hundreds of fellows cramming with chemistry books galore. I was prepared with just two pencils and my slide rule. I missed passing the test by one point, but was very happy to pick up 8 hours of "A"s in two semesters of chemistry. I'll bet you anything that both the male students and the professors had a little kitty for betting on how long each woman would last. They lost on me, and I reaped the rewards, because the fellows who scoffed at me were the first ones to come and ask for help. This was true even in my freshman algebra class! I had fellow students that came from Grosse Pointe High, whose reputation was touted as one of the best high schools, asking me to tutor them.



Anne Natvig in the Strength of Materials Laboratory, 1954-55²⁶

In terms of professors, I was eventually accepted as a student, but I had to prove myself. For example, one day in my arc welding class, the T.A. announced that we would have a demonstration. He usually did the demonstration, but he said that we would learn more if a student did it. A light bulb went off in my head, and next thing I knew, the T.A. said, "I think Miss Campbell should do the honors." I was used to this by now. It was like brushing your teeth - you know it's you automatically. I finished about forty-five minutes later, filthy and sweaty in my little booth. He took my little hockey puck, showed it to the rest of the class, and explained each puddle. He admitted that they were good samples, but he never said a word to me until I went over to the sink to wash up. Then, with not another student in sight, he got real close to me and said, "You can weld for me any time, Anne." He never let any other student hear what he said, but it was his apology and congratulations for a doing good job. That's what I mean about proving yourself. I knew I always had to. I didn't take exception to the rule. And I wasn't offended at all.

In my junior year, I was honored as a woman's badge member of Tau Beta Pi, the Phi Beta Kappa for engineering. Additionally, I was very active on the Michigan *Technic*, our glossy magazine, as the illustrations editor. I also went to every football game. Football tickets were included with registration. We filled out a railroad ticket each semester for registration. They ripped it up on multiple perforations, and it was sent to different university departments, including the athletic department. We had, at that time, a plastic-coated student ID card that was punched every time we paid our tuition each semester. We would get together a group of sorority sisters, pool our ID cards, and all get football tickets together. Stadium seating was based on class: freshmen in the end zone, seniors nearer the fifty-yard line. I was a big football fan. Bennie Oosterbaan was the coach - he took over after Fritz Crisler. I also went to basketball games at Ferry Field House. They were free with a student ID card, and they were happy to have a crowd. I also went to several hockey games that were played in the Coliseum on Hill Street. Hockey, with our student ID, cost 35 cents, and we'd sit really close to the glass with our noses right up against it and watch the skaters whiz by.

My senior year, spring of '55, I was an Honor Council Representative and was invited to the President's house for afternoon tea. It was also the year that I received the Oreon E. Scott Award for outstanding science. The prize was a Webster's unabridged dictionary, and it was the last year Oreon E. Scott was there to present the awards. My parents and I had to rush from State Street to the tea. My father lugged the heavy book down South University and up the steps to the President's house where I promptly said, "Mrs. Hatcher, I'd like you to meet my parents. Is there someplace I can park this book?" Mrs. Hatcher was always the gracious hostess, and we temporarily secreted the dictionary in the President's study.

I accomplished a few firsts for women at the University. In my senior year on the Honors Convocation Committee, I got a big picture and a write-up in the *Michigan Daily*. I knew I was going for a master's, and said I was considering Berkeley or perhaps Brown - both excellent schools for engineering mechanics. Professor Dodge, the head of the engineering mechanics department, called me into his office and said, "I read the *Daily* article. Would you be interested in staying here at Michigan?" I answered, "Well, of course, that's always a consideration." He replied, "Would it make a difference if you received the General Motors scholarship?" So, he recommended me for it, and I was the first woman to receive it.

I was also the first woman engineer to become a member of the Honors Convocation Committee and the Calendaring Committee. That's when I met Fritz Crisler, the Athletic Director, in a conference room in Angell Hall. Foreign territory to me, of course. I was probably also the first woman President of the Engineering Honor Council; the first woman Vice President of the Class of '55; and maybe, the first woman's badge number for the Michigan Gamma Chapter of Tau Beta Pi. I am now an official full member. I was initiated in December 2007, and I am undoubtedly the oldest initiate, 53 years after receiving the woman's badge. I was also the first engineer that was tapped for Mortar Board. It's a senior women's honorary that is sort of the equivalent of Michigamua. Mortar Board was for women with high academic achievement and most of the women were in the literature school.

Career and Family Life

The summer of 1956, I was between semesters for my master's and had a teacher, Joe Shea, who received his Ph.D. at Michigan. He worked for Bell Telephone Laboratories in Whippany, New Jersey, where he headed a small group of engineers who were the go-to, last resort group of problem solvers. He arranged for me to work at the Laboratories that summer. So, I went out to New Jersey and worked on the initial designs under an Air Force contract to put a man on the moon. There were seven engineers in our office, and each of them had expertise in different fields. It was very interesting and diverse work. When I left that summer, my boss told us the space program has just bought a launching pad at Cape Canaveral, Florida.

I intended to go back to Bell Labs after I graduated, but I met my husband-to-be, and he wouldn't wait. He had both a D.D.S. and an M.D., and he was finishing his residency in plastic surgery. Being a native of Wisconsin, he insisted on moving to Milwaukee, where I ended up teaching at Marquette University for a few years. That was where you might say that I had a little trouble being a woman. I remember walking into a sophomore daytime class, putting my textbook on the desk, and turning around to write my name on the board. I turned toward the class when I finished on the board and most of the students were picking up their books and starting to get out of their seats. I said, "Wait a

minute, I'm your professor." (I believe they thought I was a secretary.) So, I said, "Hold it. I'm it!" After a while, I think they kind of liked me. I do believe that I was the first female engineering teacher at Marquette. I taught there until the family increased - we eventually had three girls.

Then I learned a lot about medicine by helping out in my husband's office. I started out doing secretarial work. I used to write his reports to attorneys and handle other duties on a medical case. I threatened at one time to go to medical school, but it was not at all a popular idea with my husband, who insisted I was too old. Later, he accepted an appointment as the abstract editor for the *Journal of Plastic and Reconstructive Surgery* - a well-known, respected publication. He said, "You may put my name on the masthead, but my wife will do it." So, I did it under his name. After he died, several other plastic surgeons were named as editors, but I continued to do the work. It wasn't until I moved to Florida and I kept getting mail addressed to other doctors, that I insisted the *Journal* put my name on the masthead. I don't know what took me so long. I remained the abstract editor for a total of twenty-three years and just resigned about five years ago.

Advice

My advice for future women in engineering is to go for it! It's a lot easier now. I waited to get final initiation into Tau Beta Pi for many years. It wasn't until 1969 that they had reached over 600 woman's badges and finally decided to initiate women. I spoke at the banquet, and in truth, I'd never seen so many women engineers in years. That was really weird for me, because in my day, we probably stuck out like a sore thumb. In fact, mine was the only girls' bike parked at West Engineering. I liked when I had the respect and camaraderie of my professors and when they accepted me and recommended me for different things. That was wonderful, but it was also hard work. A fellow in a man's field could do pretty well even if he only did a mediocre job, but a woman in a man's field had to be exceptional in the 1950's. So, I think if I had any advice for kids, it would be not to accept mediocrity, and try to do your best.

Paulita Buckley

Paulita completed a Bachelor of Science in Engineering Physics in 1957. While studying at the University, she worked at the Willow Run Aircraft Research Center and for Smith, Hinchman & Grylls. Since 1959, Paulita has been a professional conference interpreter for the U.N. family.

Interview with Paulita Buckley *March 26, 2007*

Growing Up

My mother was from El Salvador. She met my father on a ship traveling between New York and Central America. My mother took one look at him and decided that she had to know who he was. He took one look at her and said to his nephew, "I don't care if our luggage doesn't come aboard because that is the woman I am going to marry." As my mother used to say, "Your father didn't know how to swim dear, he had no choice." So, in the eighteen days it took to go from New York to El Salvador, they wooed each other. That was in the fall of 1927, and they got married in January of 1928. My mother never worked, but my father graduated from the University of Michigan Law School and went on to serve as clerk for the Michigan Supreme Court. Then he went back to Ann Arbor and became the manager of the Union, which was presumably the equivalent being the of Dean of Administration because he was responsible for all the University housing, in addition to the Union. He has a room in the Union named after him.

I moved around a lot because my mother had friends in different places. We lived in Washington, El Salvador, Rhode Island, San Francisco, Philadelphia, and New York. I remember when we lived in El Salvador, I met my three maternal uncles who were all engineers. One was civil and the other two were electrical. They influenced me to get into engineering, but I also loved taking things apart. When I was younger, I was known as "the breaker." If it could be taken apart, I would do it. I just couldn't put it back together. I also had very brilliant math teachers at Manhattanville College in New York. When I graduated from Manhattanville, I was accepted to engineering school.

University of Michigan

I don't think my father approved of my going to Michigan, because my mother said he was not particularly in favor of co-educational institutions. But I just told him, "I'm going to go into engineering." I always wanted to be some kind of scientist. When I was at the engineering school, there were approximately three thousand students and only thirty were women. I never crossed a single woman either in aeronautics or in physics, but I did meet one other woman student who was the only woman in naval architecture and marine engineering. Since women in engineering were not common, registration for classes was in the field house. There was a table for each faculty, and you would pick up the relevant forms, go to another table, sit down, and fill them out. I got the medical form, and it was for the male sex, so I walked back to the table and said, "Look, sorry, I'm not a man." They looked at me in utter disbelief and had to rummage to find a medical form for a female student. I think I was the only woman enrolling in February of '53 in the engineering school.

Back then, there were several University rules that treated women differently. When my mother married my father and they went to Ann Arbor, women could not go in the front door of the Union except on football Saturdays. At the time, it was a fact of life. People used to grumble about it occasionally, but women's lib hadn't reared its ugly head yet. Even though I knew most of the staff at the Union, I never have walked in the front door except on a football Saturdays. I never set foot in the League. I just felt that the Union was my place. In the women's dorms, one foot of each participant had to be on the floor in the living room at all times. (Those were the days when gentleman callers were not allowed above the ground floor.) And at Pretzel Bell, you had to be twenty-one to sit at a table with your parents if they were drinking beer, because in those days, Washtenaw County was dry, and the only thing you could get in town was beer or wine. You had to cross the county line to get



Company B-4 entering the Union at chow time, 1943²⁷

hard liquor, and you could not sit at the table with someone who was drinking if you were under twenty-one.

Generally, my male classmates were very respectful. Everybody treated me like a human being. Of course, we teased one another, but it wasn't malicious and it wasn't vicious, and we got along well. I did have a tough time with one of my professors, however. Professor Swinton was a graduate of the University of Michigan who had gone to the Philippines before World War II. The Japanese captured him, and he spent the war in the Santo Tomas Prison Camp where he was the commander of the civilian population. The first semester that I had Professor Swinton, we became quite good friends. However, he admitted to me, "I cannot see women in engineering." After I took the final exam, he flunked me. I had to take the same course again, and he failed me a second time. When I registered for the course a third time, I got Professor Swinton again. I went to Dean Emmons's office, and I explained the situation to him. He switched me to a different professor, and I finally passed my third semester. That's how I stayed in the engineering school.

Professor Swinton was the only man who simply couldn't swallow a woman in engineering. I didn't have any problems with the others. They might have thought, "Let's make her sweat a bit more," but I never noticed it, and I didn't really feel that I had to work harder than anybody else just because I was a woman. In fact, I had another professor who was great. He taught Descriptive Geometry, and he was blind. Get someone to explain to you what Descriptive Geometry involves and you'll understand how difficult it was to have him for a teacher. We had to sit in the same seats at every class, because that way he knew whom he was talking to. If you made a mistake and went to his office to explain to him what you had done, he would say, "Say that again," and you would suddenly realize the mistake that you had made. He was one of the best professors I had.

I do have a favorite memory of my time in Ann Arbor. I remember walking with my mother down the Miner Quad by the Women's League and the School of Music when I saw this strange car go by that looked like a top hat. I asked, "Mom, what's that?" She said, "Oh, that's Mrs. Lloyd." Because she knew the Lloyds, she told me more about their electric car. It had two seats facing one another with plush upholstery and antimacassars, rounded windows with bud vases, and a flower in each bud vase. It used a tiller to steer, but it didn't have gears. So, if you wanted to change direction, you moved to the opposite seat and twisted the tiller around.

Career and Family Life

I never worked as an engineer after graduating. The Dean of Administration got me a job at the Willow Run Aircraft Research Center where I did some engineering work, but I wasn't an official junior engineer. After that job, I went to work for a private company on the other side of the airport - Smith, Hinchman & Grills - where they did air icing research. Apart from my immediate superior, I felt that they had the attitude of "What the hell is a woman doing here?" I got a minor raise in pay from \$1.80 to \$2.00 an hour, but I was doing donkeywork that three engineers had been doing before. So, one day I walked into the boss's office, and I gave him a piece of my mind. I said, "You can take your raise back, and I will go back to my original boss. He appreciates my work." He apologized to me, sent me back, and did not take my raise away. That was the only time that I ever felt stepped on because I was a woman.



Willow Run Research Center, June 1954²⁸

I applied for graduate school, but my marks didn't hack it. In addition, I couldn't find a job because I was a woman. Pan-American turned me down for Cape Canaveral, and an oil services company in New York turned me down because they said they couldn't send a woman to Latin America. I was finally accepted at the interpreter school in Geneva, and I've never looked back since. After graduation there, I worked as an escort interpreter for the State Department for visiting trade unionists. Only once was I refused a job because I was a woman, which was for a position serving some Spaniards who were meeting Americans in Spain.

Advice

My advice for future women engineers is to make sure that they give it their best. Women should not be afraid to become an engineer. If they can do it and stand on their own merits, then good for them.

Dorothy (Lewis) Patterson

Dorothy graduated in 1958 with a Bachelor of Science in Aeronautical Engineering. She has worked as an aerothermodynamics engineer at Chrysler Missile, as an aerodynamics engineer at General Dynamics, and as an engineering librarian at General Dynamics/Hughes. She has three children.

Interview with Dorothy Patterson *June 10, 2007*

Growing Up

My father was a lithographer, and my mother was a housewife who later became an accountant. My sister, Pat, was an aeronautical engineer. I grew up during World War II. Because of the war effort, books were hard to come by, so I really appreciated my set of “child-friendly” encyclopedias. I would only read the parts I was interested in, which was always animal life or other sciences. When I got into grade school, one teacher would always go over to the high school library to get books for us to read in our free time. I remember her getting one called *A Junior Science Reader* once. It had an explanation of the solar system, among other things, and I was hooked. I begged her to get more books like that, but they just weren’t available. Many of the new books back then were printed on very poor paper, which just kind of crumbled. I’m sure most them don’t even exist anymore.

So, I always liked reading and learning. Even as a child, I didn’t read fiction. I remember all the girls in my class telling me, “Oh, you really ought to read the ‘Little House on the Prairie’ set.” But I didn’t want to read about a little girl. I really wanted to learn. That was my goal, and I don’t remember ever being any different.

When I was in high school, I just assumed that I would go to college. We were raised that the natural transition after high school was college. My mother made sure of that. Neither my mother nor my father ever actually got high school degrees, but my mother was a self-educated woman because she read a lot. There were always books in the house.

University of Michigan

My sister Pat went to the University of Michigan, so I just assumed I would go there too. When I started college, I was a chemistry major. I really liked chemistry in high school, so I thought it was a terrific thing to do. I was not happy in the lit school, however. So, I muddled around for a while taking some courses that interested me, including an art history course that had a great influence on my future career. I really liked the architecture, and I enjoyed seeing the Greek construction and learning about how it failed. I also loved learning about the Roman architecture and how it allowed greater expanse in a building. I was absolutely fascinated with the idea of the stresses and strains and how everything on cathedrals was necessary to keep the thing standing. It was just amazing. At one point, I also took an aptitude test to see what I was suited for. I remember breezing through it, then looking around to see everyone else sitting with their heads in their hands. When I got the results back, it said mechanical engineer with a question mark because I was female. So, I go into aeronautical engineering. I felt much more at home in those classes. My fellow students, while obviously very different from me because they were all male, were more like me in personality.

I lived in Stockwell Hall when I was on campus. I lived with the same roommate for four years and just loved it. When I was thrown out, I lived in a League House for graduate students. There was a woman who rented out the rooms to us, but you had to arrange for your own meals. It was just a place to sleep and study. I was close with my roommate, but mostly, I just studied. I remembering working in the dining hall and hearing girls talking about H.O.B., which was Hand Of Bridge. Well, that would go on for hours, and surprise, some of them weren't there the next semester. Whereas I would get home, grab my books, and start studying. I put my schoolwork first. It was my main focus, and I always had more homework than I knew what to do with.



Stockwell Hall, ca. 1940-1950²⁹

I met my husband, Bob, fairly early on in college, and any spare time I had, I spent with him. There were always football and hockey games to go to, but mostly we went to fraternity parties. Occasionally we went to the movies or for a walk in the Arboretum. As far as clubs for women in engineering, there was nothing. There were no organizations, or support groups, or anything of the sort. I had orientation when I went in

as a freshman in lit school, but when I went to engineering school, I was strictly on my own.

The Korean War definitely impacted my college years. We had returning veterans from the Korean War who came and wanted to get a degree in aeronautical engineering. Many of them already had degrees from places like West Point, so they were looking to get their master's. In order to get a master's in aeronautical engineering, however, they had to take all the undergrad aero courses too. This made the competition pretty stiff. They had to maintain a "B" average, so I was competing academically against these guys that had much more experience.

Aside from one huge lecture hall, where there was one other woman, I was always the only woman in my classes. It didn't bother me though. Once my male classmates knew that I wasn't there to try to charm them, but rather to get an education, I never had any problems. There was one math professor that I don't think liked women, and he made my life a living hell until I finally just dropped the class. He would call on me frequently, and just as frequently, I wouldn't be able to answer his questions. It got to the point where I was so intimidated, I didn't even want to go in class. So, I decided to drop the course and take it again the next semester. I did fine with a different professor the second time around.

There is one particularly memorable experience I had at U of M. When I was moving out of the dorms, I heard these girls talking. They were getting ready to leave with degrees in English or something, and I overheard them saying, "Oh, I wish I'd gotten a degree in something I was going to be able to use." I thought it was too bad for them. I believe that education is what it does for you, although I do appreciate education for its own sake.

Career and Family Life

Believe it or not, I met my husband on a blind date. I was up late one night when one of the girls came in looking for two girls to date a couple of guys in her boyfriend's fraternity. I thought, "Oh, what the heck, I need a night out." It turned out that Bob and I liked each other, and we've been married now for fifty years.

When I graduated, I went to work for Chrysler Missile in Warren, Michigan. I had an offer from Douglas Aircraft on the West Coast, but because my husband hadn't finished his degree, we had to stick around. Chrysler Missile was building Redstone and Jupiter missiles in cooperation with the Redstone Arsenal in Alabama where Wernher Von Braun was. He was the German scientist who had developed the V1 and V2 missiles in World War II. V1 and V2 missiles were fired from the coast of the Netherlands towards England as part of Hitler's plan to conquer Great Britain. They were quite frightening. The missiles we manufactured were kind of an offshoot of those missiles. I worked there

for a while until I got pregnant and had to give up my career for a “twenty-year maternity leave”, as my husband always refers to it.

The one thing I hated about my job at Chrysler Missile was the fact that it was an old factory, and I had to walk up a flight of stairs to get to the women’s restroom. This meant walking through the assembly line of jerks with their catcalls. I wanted to go over there and say, “Would you treat your wife or your daughter this way or would you like to see your wife or your daughter treated this way?” I never did, but it used to really annoy me. Those were also the days when you wore hose and high heels to work, which didn’t make it any easier. It still makes me mad to think about it. There were other women working there, but they were secretaries, not engineers.

Overall, I really enjoyed staying home with the kids. In truth, I didn’t have any ambition to go back to work. I felt like if I was going to have these kids, I might as well raise them. I definitely raised them to be open-minded and accepting of women in any role, as well as to understand that women were every bit as intelligent as men and entitled to the same rights. I think it helped, but I ultimately had to go back to work to afford to put my kids through college. So, I went to work for General Dynamics in the aerothermodynamics department. It was terrific, but I had left engineering twenty years before using a slide rule and a Friden calculator, and when I came back, they were using computers. I worked with an aerodynamicist who showed me how to use a computer program that could take wind tunnel data and reduce it to the form needed to compute the different aerodynamic forces on missiles. General Dynamics was working on Standard Missiles - a naval, ship borne missile system for the Navy - and that was what I worked on quite a bit. They also had another program for the Stinger missile, which is an Army weapon. The Navy owned the building I worked in, and they didn’t want anybody working on an Army project in their building. So, they split off and had an Army division set up in a separate building about twelve miles east of Pomona. There was an opening for an engineering librarian, so that’s what I wound up doing for the last several years of my career.



Dorothy Patterson, 1956³⁰

I am happy to say that there was progress in reducing discrimination against women while I worked for General Dynamics. When I first started, there was a very disturbing poster on the wall in somebody's office. I would always see it when I walked down the hall. It was a pin-up girl, bending over, showing too much from behind, and talking about getting in your drawers or something. I found it quite offensive, and finally, it disappeared.

Advice

My advice for young women pursuing a career in engineering or the sciences is not to let anybody discourage you from it. I had some mentors, but I pretty much had to blaze my own trail. If I had been really competing, and really trying to move up in the engineering field, I might not have had it so easy. So, figure out what you want - whether it is career, family, or both - and stick with it.

Founders



Science Day on Campus, including Barbara Sloat on far left, second row, 1984³¹

History of WISE: Pioneering Contributions and Visionary Leadership and Future Achievement

In the late 1980s a group of women faculty at the University of Michigan expressed concern about the severe underrepresentation of women in undergraduate science, technology, engineering, and mathematics (STEM) disciplines. For several years, these women conducted ad hoc programming efforts to recruit and retain women in these concentrations. In 1980, supported by a small research study that documented very similar high school mathematics and science accomplishments for incoming Michigan women students, the women faculty approached the central administration to establish a permanent Women In Science and Engineering (WISE) Program. The University agreed, and Dr. Barbara Sloat, a research scientist in biology, was the first director. Housed in the Center for the Education of Women, the WISE Program first focused on the issues of undergraduate women. Slowly, however, WISE expanded to include considerable pre-college outreach efforts as well as confront graduate women recruitment and retention issues. Dr. Cinda-Sue Davis, a biochemist, became the director in 1984.

In 1993, the WISE Residence Program (WISE-RP) was launched. This living-learning program, a joint undertaking by the Housing Division and the WISE Program, had 150 first year women in STEM fields living contiguously in the same residence hall. There were study groups, WISE program nights, and a community of like-minded individuals supporting each other. Longitudinal assessment has shown that women who spend just their first year in the WISE-RP are more likely to graduate with a STEM degree than those who do not. In 2002, the WISE-RP was named a “National Exemplary Program” by the congressionally mandated Building Science and Engineering Talent (BEST) Committee. Currently, the WISE-RP is located in Mosher-Jordan Residence Hall.

Today, WISE serves girls and women from the pre-college years through graduate study with a host of offerings tailored to their needs. WISE provides programmatic support, research, and advocacy, which has made it a national model for mentoring women who are interested in the enormous career opportunities available in the STEM fields. During the academic year, the WISE Program offers to undergraduate and graduate women students a number of workshops and informal meetings to explore, understand, and learn how to cope with special pressures or barriers they may face. In addition, WISE collaborates with or supports several student organizations that share a similar mission. WISE also sponsors several summer programs for middle school girls as well as FIRST Lego Robotics teams. Some years more than thirteen-hundred girls have come to our campus to meet with faculty and students, tour our facilities, and engage in hands-on activities.

The WISE Program has received formal recognition, including a National Science Foundation Recognition Award for the Integration of Research and Education in 1997 (RAIRE) as well as the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring in 2000. WISE was also given a Model Diversity Program Award from the University of Michigan in 1991 and a “Can-Doer” Award in Recognition for Excellence and Innovation in Science Education from the Michigan Technology Council in 1993. Today, the program highlights have included coordinating campus-wide forums, coordinating Sally Ride Science Festivals, hosting exhibits, and providing research opportunities. To the women profiled in this book, such a comprehensive institutional effort might have been unimaginable. It is due to the intellect, sacrifices, tenacity, and spirit of the early achievers that WISE continues to serve generations of women who aspire to careers in engineering, mathematics and the sciences.

Barbara Sloat

Barbara's research and publications focused on multiple forms of lysosomal enzymes, cellular morphogenesis in yeast, and the recruitment and retention of women in the sciences. In addition to her scientific work, her experiences as a woman scientist have guided her career and professional contributions in many ways. She was the founding director of the University of Michigan's Women in Science Program, now called Women in Science and Engineering (WISE), a model program nationwide. She also served as associate director of the Honors Program in the University of Michigan's College of Literature, Science, and the Arts (LS&A).

In recognition of her work on behalf of women in science and medicine, she received the Sarah Goddard Power Award for "distinguished service, scholarship, and commitment to



Barbara Sloat, Sarah Goddard Power Award, 1984
(Photo by Robert Kalmbach)³²

the betterment of the status of women" at the University of Michigan, and the Grace Lyon Alumnae Award from Denison University for "her outstanding contributions to the advancement of women in science." She is listed in American Men & Women of Science, Who's Who of American Women, and Who's Who in America. In addition to membership in national scientific associations, she has served on the national executive board of the Association for Women in Science (AWIS), and on the Board of Directors of the HIV/AIDS Resource Center (HARC) of southeast Michigan. She is presently on the Board of Directors of Jewel Heart Tibetan Buddhist Center, an international organization devoted to Tibetan education and culture, headquartered in Ann Arbor, MI.

Barb met and married J. Barry Sloat in Ann Arbor (he was from Los Angeles, educated at UCLA and MIT) in 1968. He had a successful and happy career at Ford Motor Company until his brain tumor diagnosis in 2002. He died four years later. Their son, John Andrew Sloat, age 40, (attended Oberlin and University of Michigan Law) lives and works in Chicago, and their other son, Eric Furin Sloat, age 28, graduated from St. John's College, Annapolis, MD and is a Ph.D. student in Classical Studies at Columbia University, NYC.

Interview with Barbara Sloat

March 26, 2007

Growing Up

I grew up in Youngstown, Ohio as a child of two immigrant families. My father owned a grocery store until I was eleven, a family grocery store. We lived above the store, looking over the steel mills, kind of like a scene right from the Deer Hunter movie, truly. My parents were teachers. They were both the first in their families to go to college. My own father did not work in the mills, but all of my relatives did. As I look back, my mother, my father, all their siblings, and all of my cousins have done extraordinarily well. My father's family was from Russia, and my mother was from Czechoslovakia. I grew up with Italian, Irish, Polish, Hungarian, and Greek people all coming into the store. It was a very ethnic neighborhood. I don't think I ever met anybody that was English, or German, or anything like that until I went to college. The Furin Store was a very nice place to grow up because there was always a lot of interaction with people.

And so, I went to a local grammar school in my neighborhood - Penhale School in Campbell, Ohio - and when I was eleven, my father decided to sell the grocery store. (He had taken it over from his father, an immigrant from Russia, when he died.) The A&Ps were popping up at that time, and he was not having as much business, because we had a typical grocery store where he cut meat and delivered on Saturday and Wednesdays. So, he sold the family store, and we moved to Boardman, Ohio, seven miles away. We were still in Youngstown, but Boardman was kind of a new and up-coming suburb - one of the first suburbs in the area. Around 1953, we moved into a Cape Cod house in a muddy field. Boardman was an old community, however, founded way back in the early 1800s and had a very fine high school. So, I ended up going to Boardman High School, which I hated. I didn't like moving from my small community with the grocery store and all of the people who knew my family, but it was actually a very good high school. Sputnik went up at the time. We were all excited about science and were encouraged to study science and math. They subdivided the classes in those days according to how bright you were. So, I was in the bright section, Section A, and there were perhaps eight other sections. We got a lot of attention in high school. As I look back, I can see that.

In high school, I wasn't that interested in science. My mother was an elementary school teacher who was a natural lover of botany and the outdoors, just like my grandfather. She was always identifying birds and plants. My brother, who was two years younger than me, was like my mother. They just loved going into the woods and hiking, but I was never that type. I kind of suffered for that, because I didn't like to go along with them. I was always a great reader, and I ended up going to college at Denison University in

Granville, Ohio. Ironically, my father had graduated from there in 1934. How my father, the youngest of his Russian family, got to college period (much less to Denison) is an interesting story, but it just was one of those things. So, I ended up going to the same school he had, and I got some good scholarships. My mother wanted me to stay in Youngstown and go to Youngstown College where everybody else went. Even though I was in the bright group in high school, I would say only 20% of us went to college, if that. It wasn't a college bound town.

So, I went to college to become an English teacher like my parents. My mother loved teaching. My parents got married when they were both thirty, so she taught after college, as did my father. After attending different colleges, they met at an elementary school in their hometown of Campbell. My mother quit teaching when I was born, as women did in those days. My father went into the Navy during World War II. He was a Lieutenant, and he was gone for almost four years. (My brother was born during those years.) When he returned from the war, my father bought the grocery store, and my mother ran it with him.

When we moved to Boardman, I was a young teenager and my brother was nine. My mother went back to teaching, and both of my parents taught until they retired. My mother really loved it, and she didn't want to retire. (I get that from her.) I wanted to be an English teacher, which is what girls did at the time. My father said, "Barb, get a master's degree. Don't stop at the bachelor's degree, because you'll get paid more with a master's." So, that was kind of my goal.

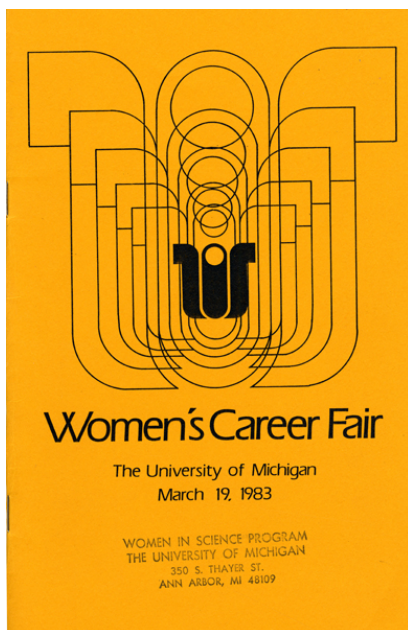
Denison University

I went to Denison, and I took my first wonderful biology course as a first year student. I had nothing to inspire me in terms of science in high school. My teachers were all male, and they only read from the book. But at Denison, I took Biology 101 in my freshman year, and I fell in love with biology. I still use that term; I fell in love with biology. I tell that to my students. I tell that to anyone. I literally fell in love with cells. It sounds crazy, but it's true. I had a wonderful teacher, Dr. Gail Norris, who I was fortunate enough to run into about fifteen years ago. I won the Grace Lyon alumna award from Denison, and I was invited back to give a speech on campus on women in science, and he came to it. He's still there.

I took biology and I loved it, so I decided to take another biology course my sophomore year. I signed up for histology, and oh God, I just loved it. I loved tissues. I'd take one look at a slide and know what it was. It was kind of magical. I took chemistry too, but I didn't feel the same way about it. While I did okay in chemistry, I didn't like it at all. I didn't like physics very much either. For me, it was all about cells and tissues. I got my hands on every cell biology-related book in the Denison library and went to the Ohio

State library as well. My love of biology, however, didn't extend to "outdoor" biology. When I had to take a botany course in order to graduate, a field course, I took spring flowers. Denison is a gorgeous, beautiful place with extensive woods and grounds, but I struggled to get a "C" in that course. I just didn't want to memorize that.

I struggled with my decision of what to major in because I had come to college to be an English major, but I really liked biology too. I spent many sleepless nights trying to decide. Finally, I decided (in my junior year) that I would major in biology and take as much English courses as I could. My theory was simple: I could always read books, but this is my chance to study science. So, I majored in biology. Unfortunately, the one thing I didn't have time to do at Denison was to take education courses in order to become a teacher. So, I applied to the University of Michigan School of Education for one year, which would give me my teaching certificate. I was still going to be a teacher.



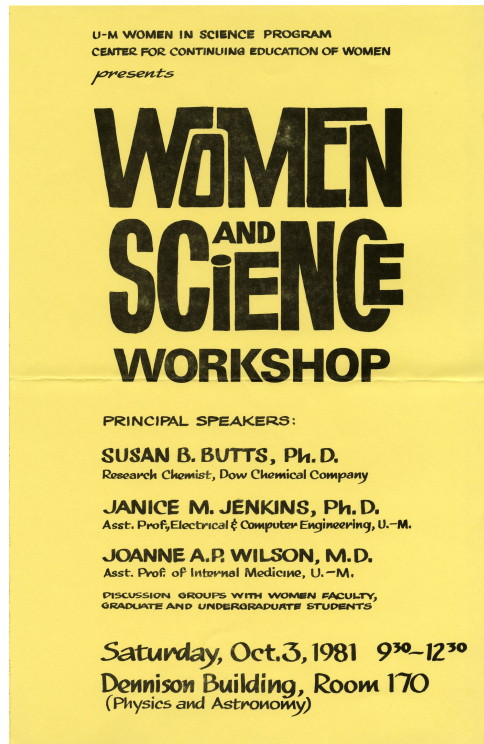
Looking back, I feel almost sad about how things ended up. I really loved cells, tissues, and anatomy, and in my heart, I really wanted to go to medical school. But I never articulated this desire, because there was nobody in my family who was a doctor or could even aspire to it. I don't even think my going to medical school really came up, and I wonder why. I wish I had some friend who could have helped me, but I was not encouraged at Denison to go to medical school either. When I asked my professors about it, they said, "Barb, you are going to get married and have children. Why would you want to do that? You're not going to want to be a doctor. You're going to have a family." I even rationalized not discussing it with my parents. I figured that I could get my way paid to graduate school, and I wouldn't have to burden them with debt.

Women's Career Fair Program, 1983³³

Interestingly enough, my parents encouraged my younger brother to go to medical school. My father often said, "Greg, you have to have a good career. Be a doctor! You know, you can belong to the country club." (My father played wonderful golf, but he played at the public courses.) Our family didn't have any money, but my brother did end up going to dental school. It was his second choice. (He was not as good a student as I.) After my Dad died, I found the meticulous files he had kept on our educational expenses. My brother didn't have scholarships like I had, so they spent four times as much to put him through dental school as they had spent for my education. It was quite a revelation.

University of Michigan

As it turns out, I never did get to the School of Education. In the spring of my last semester at Denison, I saw a poster in the basement of the biology building that said, “NSF (National Science Foundation) Summer Fellowships at the University of Michigan.” I can still see that poster in my head. It was just the opportunity I needed because I didn’t want to go home to Youngstown and work another summer at J.C. Penny. In truth, I didn’t really know what NSF was, and I had never been to Michigan, let alone Ann Arbor. I did have a friend, Bill, who lived in Grosse Point, however, and he offered to show me Ann Arbor. Before I knew it, I had been accepted to a six week summer internship in the UM Anatomy Department. It was the summer before I was to start in the education program, and here I was, in the anatomy department with Dr. Robert Hunter, professor of anatomy. I was preparing acrylamide gels, and Dr. Hunter said to me, “Barbara, why are you going to the School of Education? Why don’t you do more biology? You can always get that teaching degree later.” I knew he was right, so before I knew it, I applied to the UM Zoology Department and got admitted with a TAship. Dr. Hunter became a mentor for me and remained so for many years. So, you don’t need female mentors. Male mentors are terrific too. Bob later moved to California, but we kept in touch. I give him so much credit for guiding me in the right direction.



Women and Science Workshop poster, 1981³⁴

In the graduate school at Michigan, you can either stop with a master’s degree or go on for a Ph.D. In those days, you had to take courses in all fields. So, my first semester I enrolled in cell biology, ecology, and evolution. My cell biology professor, Dr. John M. Allen, picked me out of a class of about forty-five people because I was so avidly interested. He talked to me after my first exam, learned that I had been in Bob Hunter’s lab (he knew Bob too), and asked me to do a project in his lab the following semester. I ended up getting my Ph.D. with him, so you see how these things unfolded.

I found my first year of graduate school to be very difficult as Michigan was so focused on memorization. On the first exam in cell biology they wanted to know how many microns were between one membrane and another. How many? I ended up with a “C-” on that exam. At Denison we didn’t memorize; we talked about ideas. In fact, that exam was why John Allen

called me in. He said, “Barb, your questions in class are so terrific, but you got a bad grade on this. What’s going on here?” So, that’s how I ended up in John Allen’s lab - and how I ended up with my master’s, and ultimately, with a Ph.D.

It took me two years to get my Ph.D., and I remember the moment when I decided I was going to do it. It was during the Nixon years, so there was plenty of money around for science. It was the post-Sputnik era, and I didn’t pay a cent for my graduate education because I had various fellowships. It was a sunny Saturday in the lab. I remember I had corduroy Levi’s on (it was one of those moments), when I happily called my parents to say, “I got a fellowship. I am going to go on for a Ph.D.” My father replied, “What the hell are you doing that for?”

Looking back, I realize my father’s concern was that nobody would marry me if I had a Ph.D. He wanted a good life for me. He wanted me to marry a guy with a good job and to do well in life, which was the kind of thing we women had to fight. I struggled. I wish I had been more confident and said, “Screw it, Dad. I’m doing this.” But I struggled. “Am I doing the right thing? Am I not doing the right thing?” That’s what women have to face when they’re in these positions.

As I moved up in graduate school, I definitely saw fewer women. In fact, I never had a female professor of science in high school, college, or even graduate school. It wasn’t until I started going to conferences - the last year of graduate school and once I was working - that I realized there were no women speaking. There would be the very rare female presenter, but there weren’t many women around. There weren’t many women in my classes either, although I had quite a few female graduate student friends, mostly in “outdoor” biology.

Career and Family Life

As women, we never talked about our struggles in graduate school, not until later. We never talked about how difficult it was or about the fact that we weren’t expected to do the same things as the men. As we got Ph.D.s around 1968, ’69, and ’70, people started getting married. Pat Brown married Steve Brown. Joan Martin married Mike Martin. They were all graduate students, all 25, 26, or 27. It was becoming clear that the women weren’t getting the jobs the men were, or the women were following their husbands. I think slow resentments and some questions started to surface, but we were all still of the mindset that you get married and follow your husband.

In some ways, that mindset wasn’t such a bad thing because I got married within two months after I got my Ph.D. I met my husband on a blind date. Somebody came into the lab and said, “Barb, this person moved into my building. He’s come to work for Ford Motor Company, and I’m really thinking that he might be a good match. Would you take

a date from him?” At that point, I was so tired of all these incestuous relationships at the zoology department that I agreed. So, my future husband, J. Barry Sloat, had a master’s from MIT in management and was an engineer from U.C.L.A. who had been recruited to work for Ford. He was new to the area when I met him, and I think my friends in the biology department were outraged that I would date somebody who wasn’t in the department!

We got married a year and a half after we met, and soon after, the zoology department offered me a job as a lecturer. It was the year after I got my Ph.D., 1969, and the departmental chair said to me, “Now, Barb, you know you can’t expect to earn what a man would earn. After all, doesn’t your husband work for Ford Motor Company?” I was beginning to think that something is not right, but we didn’t talk about these things. We didn’t know these experiences were so damaging. In fact, I was earning \$9,000 a year that first year, and Barry was earning \$12,000. But industry was really looked down on in academia, and once you got married, they figured you were set.

I think I felt lucky to get the job. It’s hard to describe, but I think I assumed that he had the more important job. There was this notion that the man needs to have that important job, and somehow, we’ll find something that works around it. It may sound shockingly passive to you, but at the time, we were thinking that way. In fact, over the years, I’ve thought about how things turned out and how grateful I am that I met a terrific person. Things could have been very different. For example, my thesis led to an invitation to do a post-doc at Stanford, but I was already dating my husband. I regretted that I had not gone to Harvard or Stanford because I could have been admitted, but nobody in my family or at Denison encouraged me to apply. I later realized that if I had been five years older or ten years younger, I probably wouldn’t have gotten married immediately. I didn’t get married until I was twenty-six, so I wasn’t exactly young, but I was unusual, because all of my Denison roommates got married soon after graduation at twenty-one.



Summer Internship in the Sciences poster, 1984³⁵

I bring that up because as I got into women and science work, I was even more grateful that I had my husband. He died three years ago of a brain tumor, and it was a dreadful

situation. Fortunately, he had a very happy career at Ford, and we had a long marriage that produced two wonderful sons. I also had a good career, so I was lucky. I've met so many women in science who didn't find a partner, didn't marry, didn't have children, or who got divorced because life in science is really difficult. I look back and think, "God, I was just on that line before feminism really took off." We were still the generation getting pinned and married early. In addition, none of my friends had mothers who worked. My mother was a pioneer. I was sort of a pioneer. Then everything changed. The Vietnam War. Feminism. Everything. I was so independent-minded. Had it been a few years later, I probably would have said, "I really like this guy, but I am going to do the post-doc." Who knows what would have happened?

I kept working when my kids were born. The only year that I have not worked since I was fifteen back in Boardman, Ohio, was the year my husband died. It just became too difficult. I did work part-time, however, because I was a lecturer and a research scientist on grants. My son was born in 1970. At the time, I was filling in for a cell biologist at U of M Dearborn, who was away for two years. I was recommended and they invited me to teach there. So, I taught one course each term, and I was happy to do it. I was a new



Left to right: Barbara Sloat, Sally Dunnick (WIS Program Assistant), and Addie Hunter (CEW/WIS Secretary) at the Women In Science office at Center for the Education of Women, 1983³⁶

Ph.D., they really liked me, and as it turns out, they wanted me to apply for a job opening they had, but I decided not to.

So, my career could've been much more demanding and maybe more successful too. At many points I chose not to, for example, apply for the Dearborn job, which I probably could've gotten. I had some sort of inner sense that my family life, my marriage, and my child were more important to me. In fact, twelve years after the birth of my second son, I was offered a job as an associate professor at Adrian College. Well, I drove to Adrian in every possible way I could, but I couldn't get there in less than an hour in good weather. So, I said, "No, I am going to stay here teaching." At that time, I was starting at the Residential College. I was associate director of the Honors Program, so I was busy. But I am a woman who didn't go 1000% for a science career, and I am glad of it because I don't know how I would have done it. I couldn't imagine both my husband and I working because his life was very busy. He loved it, but he left at seven in the morning, and he didn't come back until seven at night. He was relentlessly busy, hard-driving, and very successful. When he left Ford at the time of his diagnosis, he was Director of Health Care Finance. He really loved his work, but he was not around much, and I couldn't imagine having a child and leaving in the morning to drive forty-five minutes to work. In a strange way, it's become harder for me to encourage women into science unless I know they're really, really, really, really, really love what they're doing.

Women In Science Program

When the Women In Science job was posted in 1980, I was working in the biology department as a research scientist. I worked with a research person in the bio department, John Pringle, who was a new professor. We were both interested in yeasts and cell biology, so we worked together. I was constantly writing grants to support my salary, and I was doing good research. In fact, I was published as a first author in *Science* in 1981, but I was only funded for 50%. It was a difficult time, and I was getting restless in the lab. My son was ten when I saw a posting in the *University Record*: "Women In Science Program: 50%." I thought, "Well, 50%! This is interesting. I already have 50%, so I am going to look into it." Once I went to the employment office and read the posting, something struck me about it. My Denison experience clicked in and a deep passion surfaced. Yes, this would be good, to encourage women into science!

So, I applied for it, and I got the Women In Science (WIS) position. It was housed at the Center for the Education of Women (CEW), and I didn't know a thing about them. The position was funded for one year for \$25,000. If you could make it work, CEW and Women In Science, you would have to find your own money to keep it going. It was a complete seed program that some women from the Academic Women's Caucus had been working on for five years. Billy Frye was Provost at that time. He was also a biologist,

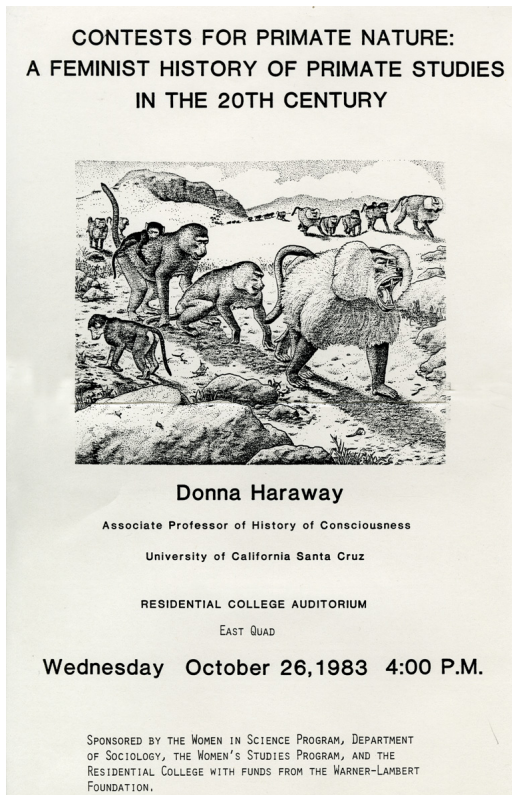
so the women knew they had a scientist in a high and important administrative position. Frye had been a professor of mine and was very open-minded, so I knew he was our chance. I got the job and sat at a desk at the bottom of the stairs in the basement of CEW thinking, "This is it, girl! You have one year." That's how WIS started.

My interview was set up at CEW. Jean W. Campbell was Director of CEW, and she was a very, very visionary woman. Anne Cowley was on the interviewing group. Anne was an Assistant Research Scientist in Astronomy, as well as the only woman in Michigan's Department of Astronomy. She was married to Charles Cowley, who was the Professor of Astronomy. Patricia Wulp, the Associate Director of CEW, also interviewed me. There was a fourth woman there too, but I can't remember who she was. (They tried to get some women in science involved in the interviews.)

The goal was to develop a program to encourage women and faculty to get into science. In fact, I pulled this out for our interview: "Established in 1980, the goal of WIS (engineering wasn't anywhere in sight at that time) is to increase the number of women students who choose majors, advanced degrees, and careers in science, mathematics, and engineering." That was kind of it in a nutshell. I didn't think CEW was a very good place for WIS, because CEW didn't deal with undergrads, so I quickly formed a Women In Science Advisory Committee so that WIS was more than just me. I had Sally Allen from the biology department - she was one of two women professors in biology at that time, and Sayhan Ege from chemistry, who was the only female chemistry professor at that time. There was no one from physics because there were no women faculty. We also had Anne Cowley from astronomy, Anita Payne from the medical school, and Pauline Sherman, a professor from the School of Engineering. She was the only female professor of engineering at that time. She came from California and was a full professor in aeronautical and space engineering. A woman from the School of Public Health, Jane Schultz, also joined us. They all liked me and I liked them. We would meet monthly at the Michigan League to talk and plan. Our meetings went something like, "Well, the first thing we need to do is get a program in place for the women who are coming to UM in September. How do we find out who is coming to Michigan as a freshman? How do we know if they have an interest in science? And who can we get to have a panel?" All this planning takes a lot of time because you end up having to go talk to Admissions, and then you have to get permission from UM to release the names of the incoming women. I mean, you probably couldn't even do it now!

So, I really began directing undergrad programs, bit by bit. We had a very successful initial program in September. Then I got a phone call from another biology professor, Al Sussman. He was a botanist and had been in my department, but he wasn't my professor. He was now Vice President of Research at the University. So we had Billy Frye, who was high in the administration as Provost, but whom I never really saw. And we had Al Sussman, Vice President of Research. He called me because my appointment was announced and said, "Barb, I'm so glad that you took that position. Let's get together.

There's somebody I want you to meet." It was Jerry Weisbach, the President of Warner-Lambert at the time. (Warner-Lambert later changed to Parke-Davis and then it became Pfizer.) He was here from New Jersey, and we met for breakfast. It was my first 7:30 a.m. breakfast at the Campus Inn. I had suddenly gone from being in the lab to having breakfast at the Campus Inn with the UM Vice President of Research and Jerry Weisbach! Fortunately, I always felt confident in such situations though I don't know why.



Warner-Lambert Lecture Series poster, 1983³⁷

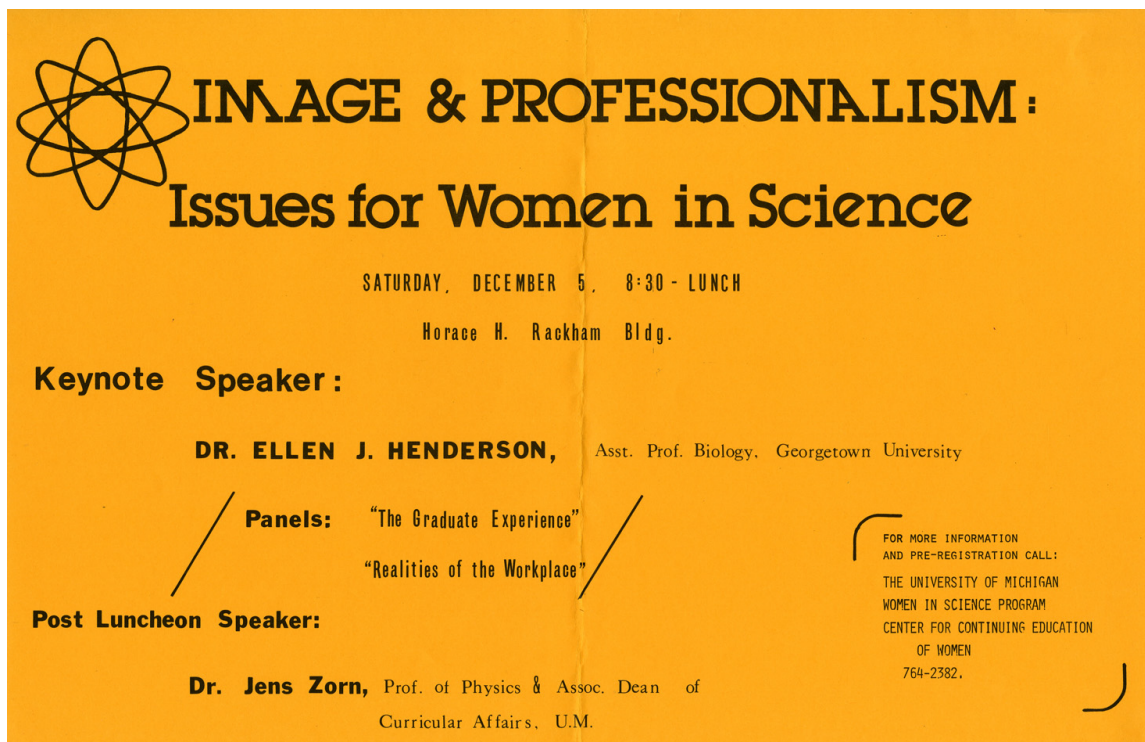
Jerry was very interested in women in science because there weren't many at Warner-Lambert, and he was willing to provide some grant money if I wanted to write a grant. So, the three of us started talking, and I became very good friends with Jerry Weisbach, who gave us a grant of \$25,000 to set up the "Women In Science Warner-Lambert Lecture Series". The idea we (myself and the WIS Advisory Committee) came up with was to invite various departments to apply to us for money. We would give them all the money needed for an honorarium, travel - basically anything needed to bring in a female scientist. Soon, word began to spread, and people began to apply to WIS for funding. We learned a lot in the process because eventually we took the term "woman" out of it. We just called it the "Warner-Lambert Visiting Scientist Lecture Series". Women don't want to be thought of as women scientists; they want to be thought of as scientists, right? We had people coming in from all over the country and all the departments:

Anatomy and Cell Biology, Great Lakes Marine Water Center, Biophysics, Microbiology and Immunology, Atmospheric and Oceanic Sciences, Mathematics. Physiology, Pharmacology. They were all applying to us for money. It was terrific.

I think there were department chairs and people who didn't like the idea of making the lectureships for woman, but it was a good idea. In fact, the money from this three-year grant allowed me to apply for other money. We applied for - and got - money from the U.S. Department of Education to do summer internships, but still there wasn't enough money to provide for the program. The \$25,000 Weisbach gave us was used for the lectureship program. As Director of Women In Science, I went to various Deans every year to ask for money. After the first year, the University said, "If you can survive, it's because they want you." So, I would get \$5,000 from the Dean of Pharmacy, \$5,000 from the Dean of the Medical School, and \$5,000 from the School of Engineering.

Jim Duderstat was Dean of Engineering at that time, and he later became UM President. He was really keen on women in science. He was terrific. If you ask me, you need to find these people who know how things work. His daughter is an M.D., so he knows how it is. Every year I tried to get \$5,000 from LS&A, which was the hardest part. My heart was in undergrads and in trying to get them to stay in science, but the Dean of LS&A didn't want to give any money. He said, "I can think of a lot better things to do with the money." So, we pieced money together, and I ended up with some female student interns. You know, there were some terrific young interns who really helped me to do a lot of things.

Word really spread about WIS in 1982 when I came up with the idea for WIS to sponsor a conference at Rackham called "Image and Professionalism: Issues for Women In Science". It was designed to address the special problems of graduate women, post-doctoral women, and professional women in science, and it was terrific. We filled the downstairs of Rackham, which I don't think you could do today. Most of WIS's focus was on undergraduates, but of course, these departmental talks affected faculty and graduate students too. We also had a speaker from MIT, Margaret Rossiter. She was from Harvard, and she was the first woman in the chemistry department there. She also wrote the first book on women scientists in America, a seminal book: "Women Scientists:



The poster is orange with black text. At the top left is a stylized atomic symbol. The title "IMAGE & PROFESSIONALISM: Issues for Women in Science" is in large, bold, sans-serif font. Below the title, the date and time "SATURDAY, DECEMBER 5, 8:30 - LUNCH" and the location "Horace H. Rackham Bldg." are listed. The "Keynote Speaker:" section features "DR. ELLEN J. HENDERSON," with her title "Asst. Prof. Biology, Georgetown University" to the right. The "Panels:" section lists "The Graduate Experience" and "Realities of the Workplace" separated by diagonal lines. The "Post Luncheon Speaker:" section features "Dr. Jens Zorn," with his title "Prof. of Physics & Assoc. Dean of Curricular Affairs, U.M." to the right. A box on the right side contains contact information for the University of Michigan Women in Science Program.

IMAGE & PROFESSIONALISM:
Issues for Women in Science

SATURDAY, DECEMBER 5, 8:30 - LUNCH
Horace H. Rackham Bldg.

Keynote Speaker:

DR. ELLEN J. HENDERSON, Asst. Prof. Biology, Georgetown University

Panels: "The Graduate Experience"
"Realities of the Workplace"

Post Luncheon Speaker:

Dr. Jens Zorn, Prof. of Physics & Assoc. Dean of Curricular Affairs, U.M.

FOR MORE INFORMATION
AND PRE-REGISTRATION CALL:
THE UNIVERSITY OF MICHIGAN
WOMEN IN SCIENCE PROGRAM
CENTER FOR CONTINUING EDUCATION
OF WOMEN
764-2382.

Image and Professionalism Conference poster, 1981³⁸

Struggles and Strategies to 1940". (She later did one on women scientists after 1940.) We shared a lot of things. When all was said and done, we ended up with nineteen female lecturers. I think we learned so much about what the "game" of science was all about. I learned it's definitely not a meritocracy. It's not the good, hard work you do that brings advancement, but who you know. After that, we tried to have a big conference every year, so between that, research, doing the undergraduate things, and applying every year for money from the Deans, it was pretty busy.

We also did a program for incoming students every year in September. We did, of course, feature the ongoing women scientists coming in as the lecture series. We did counseling, and we put programs together on marriage and work. We tried to do one or two things like that each semester. Meanwhile, CEW had a couple of researchers who wanted to start a project on the decisions that science-bound women make when they come to Michigan as first year students. We wanted to know how many of them actually went into science and what decisions they made along the way. There was a lot of talk in those years about the "leaking pipeline" because the women in science idea was alive at that time. You know, the American Association for the Advancement of Science, (AAAS) had its first female president at the time. I remember going to their big conference every year and being shocked when she gave a talk on the "leaking pipeline". People were



Barbara Sloat talking to Joyce Friedman (Computer Science Dept.)
at the "Image and Professionalism: Issues for Women In Science" Conference, 1981³⁹

definitely talking about women and the sciences, so CEW and WIS launched a research project: “An Analysis of Factors Affecting Choices of Majors in Science, Mathematics, and Engineering at the University of Michigan”. We launched it in 1982, but it wasn’t finished until 1989 after the students had graduated.

I left the Women In Science job in 1985. Cinda Sue Davis became director, so she’s named on the project as well. I left following a phone call I got from John Mersereau, the Director of the Residential College (RC), shortly after the WIS lecture where Margaret Rossiter spoke. John heard me giving some introductory words as the moderator, and he wondered if I would be interested in teaching some courses for him. I said, “I have no idea,” but I wanted to teach a course on gender and science in the biology department. Well, the biology department basically told me that I was crazy. Not only that, they told me I was wasting my time. They said, “Barbara, you know, you’re not serious if you’re doing this Women In Science stuff.” So, I left the biology department to teach this seminar in the RC. Compared to the huge biology classes in the Natural Science Auditorium, I really liked teaching a small seminar. I also continued to do talks about women in science for a long, long time. It really did become my “thing”.

In the seminar, I always insisted on having LS&A students as well as RC students, so a typical class of mine was usually fifteen people - half of whom are pre-meds, senior biology majors, or chemists. Even though they were a lot younger than I was, I think the course opened their eyes. In this course, we discussed some philosophical issues about how the whole structure of science was established using male-dominant metaphors about “conquering nature”. We also talked about the notion of “thinking like a man”, which women in the sciences are often told they do.

I think in the harder sciences, like physics, (in which you find fewer and fewer women), “thinking like a man” means thinking very objectively, not subjectively. The truth is that science is very objective and very specific. If you’re good at physics, or if you think that way, you are told you think like a man. It’s been told to me a number of times. It even happened when I took the WIS position at CEW. When I came into a CEW meeting I wanted the facts. I wanted to know why people had not done this or that and the next steps. Then somebody says, “Barbara, you’re thinking like a man. You’re acting like a man.” If you look at the statistics of women in science, you’ll find that young girls start losing interest in science around the age of twelve. In high school, an interest in science becomes associated with not being feminine. Fortunately, it’s getting better, much better I think, and girls are getting much more confident too. Unfortunately, however, there are still many women affected by the societal pressures. For example, seven years ago I was counseling a female student from Detroit. She was a first generation college student and a senior majoring in chemistry. She wanted to switch majors and came to me for counseling. I finally got it out of her that her family didn’t think anyone would marry her if she continued in chemistry, because it was in too masculine of a field. In my opinion, unless you have a very strong support system, that kind of thinking can really mess with

your self-esteem and confidence. Fortunately, Women In Science is that support system for so many young women. It says to them, “Hey, science is really fun. It’s great. There are a lot of us doing it. You’re not different. It’s okay, even if you love physics, that’s terrific,” whereas your parents might not agree.

As wonderful a program as Women In Science is, it’s sad that it became a reality the way it did. Back then, Billy Frye, the Provost at the time, had the attitude of “If you women want to try this, go ahead. We’ll give you \$25,000. Otherwise, you’re on your own.” Granted, that initial money was a huge step, but I wouldn’t really say UM was very supportive otherwise. When Cinda Sue Davis took over the job after I left, things really “jelled”. It was five years after WIS had started, and now, it was working and more people were more on board. As I recall, UM and CEW firmed WIS up as a partial appointment. Aside from that, however, they were not very supportive as they were very suspicious about putting the name “women” on anything.

Despite the frustrations, I am extremely proud of the program and the fact that it has not only survived, but also thrived. We were one of the very first programs of our kind in the country, and we became a model program that the University could support. Looking back, I think the Women In Science Program is probably the most gratifying part of my whole career. Individually, I’m a good teacher, and I’ve done good research, but I think this program really influenced many more people to become scientists than I ever could on my own.



Barbara Sloat, Women In Science office, 1983⁴⁰

I’ve also met wonderful women through this program, and I learned that science is not as disconnected, domination-driven, and factual as I once thought. For example, during my pregnancy with our second child in 1982, you wouldn’t talk being pregnant with another female professor from the medical department who was also pregnant. You just pretended you weren’t pregnant, and you came back to work two weeks after giving birth to stay on track. It’s not like that today. Thankfully, now it doesn’t have to be.

Oh the future! I remember back when the field of computer science was coming out, and we thought, “Oh my God! A brand new science field! This is going to be equal from the get-go here at Michigan, at MIT, everywhere!” Unfortunately, that hasn’t panned out at all. In fact, there are relatively

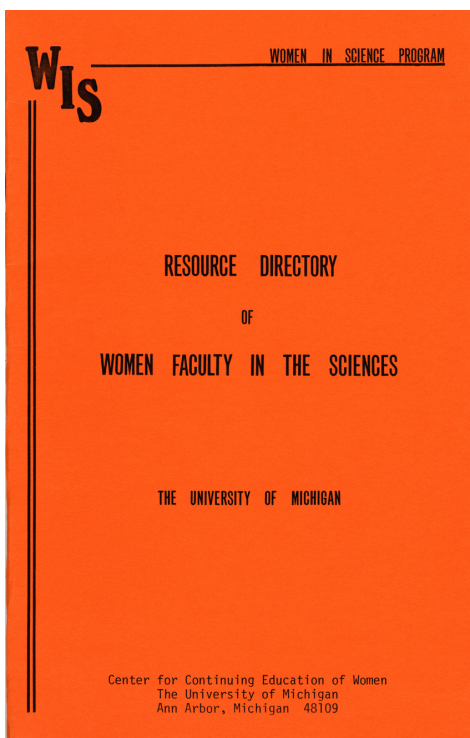
few women who concentrate in computer science. Now why is that? I try to convince my own students to get advanced degrees, M.D.s, Ph.D.s, because they'll have more power in the world. I have power because I have a Ph.D., I can afford child care, and I can follow my interests. I think there's so much room for this kind of encouragement still.

I feel very lucky to have been on the cusp of something so exciting. I think others, like the founders of the program, CEW, and James Duderstat, felt the excitement too. In fact, the phrase "sea change" was one we threw around at the time, and it was appropriate. Something big was happening with regards to feminism, women, and objectivity, and we were part of it.

Now, the thing I haven't addressed is all the guilt that I had to suffer by getting involved in all of this. Because the biology department thought I was nuts, they said, "You're not serious about science." There's nothing worse for somebody who has trained all along, has a Ph.D., and is trying to compete to be told you're not serious. I kept thinking, "Oh God, I shouldn't be spending time on this. I should be doing more experiments. I should be applying for more grants." I mean, this notion that you're not serious is very difficult. When Cinda took over the WIS job, she had to make a decision too. "Am I going to keep working in the lab?" You really can't do all of this, so again, it takes courage, and it takes

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womenin science

Warner-Lambert Lecture Series poster, 1983⁴¹



Resource Directory of
Women Faculty in the Sciences⁴²

support. I think nowadays that would be easier to do too because there aren't so many jobs around, you know what I mean?

WIS also had something that reached out to high school students. We had a lot of fun. We did a lot, but we did something called "Women Faculty in the Sciences Resource Directory". Early on, I decided I had to find every woman scientist anywhere nearby who could be a resource for us. And my husband loved computers, so he used to computerize all these contacts for me into a directory. We eventually ended up taking these directories out to high schools and having some programs in high schools in Ann Arbor, so that the high school teachers would know that we were here if they needed something. So, I do see a future for the program. I think, you know, whatever you can do to bring students in who have that wonderful interest, who need the encouragement and the support.

And I think it's still very difficult for a woman in science. In fact, it's gotten more difficult in recent years, because of the economy and the reduction of jobs in the academy over the last ten years. Unfortunately, when jobs are cut back, women aren't necessarily the ones who win out in the interviewing process. The *New York Times* ran an article this winter on women in science. It was a whole page in the *Science* section on the struggles women face when trying to make it in science and balance a family as well. I thought it was a good thing. As far as I'm concerned, the more awareness of the issues and how wonderful these women scientists are, the better.

Advice

I love science. I fell in love with cells when I went to college at was seventeen, and I truly loved it and all the opportunities it's brought me. My hope for all students is that they find something they really like as well as the support they need to really stick with it. It breaks my heart to see how science-adverse our culture is and our students are. People almost feel like they can't understand science and math, let alone something like chemotherapy. They think that science is somehow for these other people. I just wish that we could encourage the study of science more in our kids.

Image Citations

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36. Barbara Sloat, Sally Dunnick (WIS Program Assistant), and Addie Hunter (CEW/
WIS Secretary) at the Women In Science office at Center for the Education of
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37. Warner-Lambert Lecture Series poster, 1983, Box 3, Women in Science and Engineering Program (University of Michigan), Bentley Historical Library, University of Michigan
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42. Resource Directory of Women Faculty in the Sciences, Box 2, Women in Science and Engineering Program (University of Michigan), Bentley Historical Library, University of Michigan