

**American Philosophical Society
oral history transcript
Rowena Green Matthews
04/27/2023**

Anna Doel:

Today is April 27th, 2023, and I, Anna Doel, am talking with Rowena Matthews at the American Philosophical Society in Philadelphia. It is lovely to meet you, Rowena.

Rowena Matthews:

Very nice to meet you, Anna.

Anna Doel:

What is your current academic position?

Rowena Matthews:

I'm retired. I'm Professor Emeritus at the University of Michigan.

Anna Doel:

How would you describe your discipline and your research area?

Rowena Matthews:

My discipline is biochemistry, structural biology, biophysics. I'm kind of in that interim there. And I worked particularly on the chemistry of vitamins, in particular of folic acid and vitamin B12.

Anna Doel:

If we could go back to the very beginning of your story, when were you born?

Rowena Matthews:

In 1938.

Anna Doel:

Where did you grow up?

Rowena Matthews:

I was born in England. My father was a biochemist who was doing his PhD at the University of Cambridge. And my mother was English. Because my father was an American citizen, when war broke out, America was neutral and he was told that he had to leave or he'd lose his citizenship, lose his passport. So, they took a boat across the Atlantic in 1940, right about the time of Dunkirk, and came to the United States where he got a job at the Harvard Medical School. I was born in England but born as an American citizen.

Anna Doel:

Could you tell me a little more about your parents?

Rowena Matthews:

Yes. My father, as I mentioned, was a biochemist. He came from Brooklyn and went to Cambridge, which is quite a change.

Anna Doel:

What was his name?

Rowena Matthews:

David Green. And he married my mother, who was an artist. They actually met mountain climbing. And my mother was really artistic, but she had always wished that she could be an astronomer. She was a child of the depression, and so there wasn't money in the family for her to go and study astronomy. But for the rest of her life, she subscribed to magazines about astronomy.

Anna Doel:

Do you have siblings?

Rowena Matthews:

I have one sister.

Anna Doel:

Could you tell me a little more about your childhood?

Rowena Matthews:

We moved a lot, from England to Boston to New York, where we were for quite a few years, and then to Madison, Wisconsin. And I had a pretty happy childhood, rather ordinary. I liked school from very beginning. I liked school a lot.

Anna Doel:

What did you like about school?

Rowena Matthews:

It just was interesting, and particularly, I guess I liked biology pretty well. But I also liked English, and I did a lot of debate and forensics, that kind of thing, which I enjoyed very much. I was more of the nerdy type than the particularly social type.

Anna Doel:

What kind of schools did you go to?

Rowena Matthews:

Public schools. The University of Wisconsin had a laboratory school where they taught teachers, and I went to that for high school. But before that, all public schools. And then finally to Radcliffe, which is not a public school.

Anna Doel:

Did you enjoy reading?

Rowena Matthews:

A lot. And I read very widely.

Anna Doel:

What kind of books did you enjoy reading more?

Rowena Matthews:

Pretty serious books. I was reading Tolstoy and Dickens. That kind of thing. I actually read pretty widely. As a fairly young girl, I subscribed to a book group called *The Heritage*, which published absolutely beautiful books. And they were all classics, things like *The Adventures of Marco Polo*, that kind of thing. But the illustrations were lovely. I still have those books and I read every one of the ones that came. And they widened my scope because I liked them because they were beautiful. But I was reading things that I might not have read otherwise and enjoyed very much.

Anna Doel:

Did your parents have books at home?

Rowena Matthews:

Lots, yes.

Anna Doel:

Were you encouraged to read them?

Rowena Matthews:

I didn't need encouragement. I didn't read my father's technical books. That was really probably beyond me. But I read a lot of my mother's art history books and books about embroidery and things like that, because they had lovely illustrations. I actually knew how to embroider.

Anna Doel:

What kind of relationship did you have with your father?

Rowena Matthews:

A very close one. On Saturdays, he would often take me to work. He was the head of the Enzyme Institute at the University of Wisconsin, and he would bring me to campus. I must have been around eight or 10. No, I must have been over 10, because we moved to Wisconsin when I was 10. And he would basically give me some things to play with and then do his work. And we would go home for lunch, but we'd be there all morning. And he would do things like, he would give me pH reagents so that I could titrate with acids or bases, so I could see the different colors and they had little white trays that had dimples in them. You could make different combinations. And I just played with it. And I don't know that I understood what I was doing, but on the other hand, I thought it was rather amusing. And then later on, I actually worked in his night crew. They worked on mitochondria, and they prepared their mitochondria by getting pig livers from the slaughterhouses in huge amounts. And we would do 40-pound runs of pig livers to make mitochondria at night for their experiments during the day. And he was never there, but I worked with the technicians that were responsible for this. And surprisingly, I thought it was amazingly interesting and I kind of enjoyed that. We were sometimes up to our armpits in pig livers, but still, the process of getting to these very refined, tidy mitochondria after you start with this stuff was interesting and I thought it was kind of fun. I ran centrifuges, that kind of thing. I already had some experience, but I had no idea that I wanted to be a scientist. And partly that was because the models I saw for women scientists were all women who had given up everything to be a scientist. They weren't married.

Anna Doel:

Who did you know?

Rowena Matthews:

He had a very tough woman in the lab called Elisa Tetes, I believe her name was, or Tets, who was Israeli. And she looked like she'd been part of the Israeli defense force. But she was not married. She was very independent, and she was a very fine scientist. But that image just wasn't what I thought I wanted in my own life. Though he had another woman named Priscilla Heal who was from Cambridge, kind of a big, hefty woman who, again, wasn't married, kind of eccentric. I liked her a lot. She was very funny. And she did cartoons and things. She would do cartoons of the science they were doing like the "Cyclophorasaurus", which was mimicking the citric acid cycle. But again, just not the image of what I thought I wanted to be. So, I went to college claiming that I was going to major in either Russian and government, or social science. And didn't major in either.

Anna Doel:

Could you tell me more about that decision?

Rowena Matthews:

I'm not even quite sure where that came from, but of course it was a time when we were all thinking about Russia a lot. I thought that might be an interesting subject to study. But the only person I knew at Radcliffe when I went there was my cousin who was older, and she was majoring in biology. And in the course of my freshman year, she began talking to me about the

revolution in biology and how they discovered DNA and how that was changing everything. And I just got hooked. And I decided in my second semester to take biology and took my first course in biology and that was it. I knew I was going to major in science after that. I loved it.

Anna Doel:

How did you choose Radcliffe?

Rowena Matthews:

Partly, again, I had a cousin there. And partly, I knew that it was rigorous, and I wanted to be in a place where there were lots of smart people. And Radcliffe, and it was, even though they called it a women's college, it was clearly co-educational. At that point, all our classes were together. Our grades were the same. They called it a Radcliffe degree, but it was a Harvard degree. And I liked that. I liked the fact that it was a big university in a town that I thought was appealing. My father, I remember, complained that it was going to cost him about 10 times as much as if I'd gone to the University of Wisconsin. And as a professor, he wasn't terribly wealthy. But I persevered and said that I thought it was important. I wanted to also leave home, go on my own.

Anna Doel:

When you were in high school, your family was living in Wisconsin, Madison, right?

Rowena Matthews:

Yes.

Anna Doel:

And your father was a full professor?

Rowena Matthews:

Yes.

Anna Doel:

Did your mother have a job?

Rowena Matthews:

No. She did not work after they married. Actually, she subsequently had a job. When I had left home, when the children were grown, she took a job as the head of the costume laboratory at the University of Wisconsin. She did all their costumes. She was an amazing sewer.

Anna Doel:

Fabulous.

Rowena Matthews:

And very creative. And the costumes were amazing. And she actually made costumes for me. I was in a couple of school plays, like *Pygmalion*, and she made my costumes. And they were amazing.

Anna Doel:

Did she teach you any of the crafts that she knew?

Rowena Matthews:

I know how to sew. I'm quite good at sewing. I haven't done much of it lately, but I could definitely make an outfit, tailor a suit, that kind of thing. And then my son, who was quite young, said he wanted to go and learn how to make patterns. A skill I don't think he used afterwards, but he went by himself to her to learn.

Anna Doel:

Was there an expectation in your family that you would go to college?

Rowena Matthews:

Yes, definitely. I mean, didn't require much push on their part, but they just assumed that I would.

Anna Doel:

Did your parents want you to become somebody?

Rowena Matthews:

If they did, I don't think I was aware of it. And I actually think that my father might have been kind of surprised that I became a scientist, simply because I hadn't moved in that direction, even though I'd worked in the laboratory. He was pleased, but I don't think he expected that after I married, I would pursue a career. And I actually was married when I finished college, married just before I graduated, like a week before I graduated. I don't think they really expected that I would have a career.

Anna Doel:

What was your college life like?

Rowena Matthews:

I loved it. I met my husband in that first biology lab. And my husband was wanting to be a doctor, but very interested in research as well. And he had this most amazing group of friends. They were Jared Diamond and John Terborgh, who are two now of the kind of tremendous people in biology. And since my parents had met mountain climbing, they were very okay with the fact that, despite parietal rules, I might want to go camping with these people. I had permission from my father to go anywhere I wanted, and Radcliffe honored that. In my sophomore, junior, and senior years, I would go and spend weekends camping with these guys.

We spent a lot of time together as a group, and it was wonderful. Our conversations were amazing.

Anna Doel:

Where would you go on these camping trips?

Rowena Matthews:

Oh, we'd go to New Hampshire, Rhode Island, to the swamps of Rhode Island, various parts of New Hampshire and of Western Massachusetts. Mostly that. And Mount Katahdin in Maine, which is this wonderful mountain. And that was wonderful. And of course, at the time, this was viewed as slightly scandalous, although with four men in a car there's not a whole lot you're going to do.

Anna Doel:

Were you the only woman on those trips?

Rowena Matthews:

Not always, but often. Sometimes not. Sometimes there were others. But it was an amazing experience, and it very much enriched the biology I knew because these people, even then, were keenly interested in ornithology. And although my mother had been quite interested in birds in a casual way, I wasn't thinking about ecology at that point. And we had actually not ever done camping or anything like that. This was all new and I loved it. College was amazing.

Anna Doel:

By the time you graduated, did you know where to go next? What to do next?

Rowena Matthews:

I don't think I thought I was going, this is a story where I may be a little embarrassed, but I'm going to tell it anyway. I knew I liked biology, but I wasn't thinking in terms of getting a PhD and a career. I thought I'd just want to be a scientist. And I worked for George Wald when I just finished college and Larry was in medical school. And of course, he was gone all the time. Medical school at that point had night duty every other night. He wasn't around much. And Wald was wonderful. It was a very interesting small laboratory. Wald went on to get a Nobel Prize. He worked on vision. But he was a very humanist scientist, very well acquainted with literature and history. Had amazing friends too. This kind of a renaissance man. And this was wonderful for me.

And he gave me a project. They were going off to Woods Hole and he said that he wanted me to look at frog retinas because there was something strange going on there and he didn't quite understand it. And he wasn't really able to tell me what I was going to be looking for. Okay, I'll do it. And I discovered an intermediate that had not been seen before. And I'm sitting in front of my Cary spectrophotometer all by myself and going, "Oh my God. It's a reversible intermediate. Nothing known in this pathway from rhodopsin starting where light hits says it was reversible." Rhodopsin has a co-factor, vitamin A, the retinaldehyde, and that retinaldehyde undergoes an

isomerization. A bond breaks and reforms, and that makes a shape change that the protein responds to. And then you go through this cascade of intermediates that end up with the visual signal. But all the cascade we knew about at the time was irreversible, and my step was reversible.

And that meant I had to use physical chemistry to look at the equilibrium and what factors affected it. But the exciting thing was it became apparent working with another colleague in Wald's laboratory that this was the step that elicited the signal. This was a big time intermediate. And that was my first paper. And I was the first author, I had a BA, and that's what I had. I gave a paper at the federation that my father said was incomprehensible, because I didn't know how to give a talk. But I was hooked. But what became apparent to me, socially, this is the embarrassing part, is that because I didn't have a PhD, I was just a technician to the eyes of the other young people in the laboratory. And I wasn't invited to their parties. I just was part of the furniture.

And it got my back. I got kind of angry and said, "Well, if I have to have a PhD to be invited to those parties, I'm going to get one." It's not a very good motivation for being a scientist. I knew I loved it, but I realized I needed their credentials to do it, and I got them.

Anna Doel:

How did you navigate choices for a PhD program?

Rowena Matthews:

Partly, because I was married. It's where my husband was going to do an internship because he could apply to many places, but he would be chosen by some of them and then make a decision. And his choice was to go to the University of Michigan. So, I was going to go to the University of Michigan. And there, the people that were working on vision were not that appealing to me. And I decided to major in biophysics because I began to realize that I wanted a molecular understanding that would allow me to really understand this intermediate that I discovered. And even if I wasn't going to work on that, I needed that toolkit. So, I decided to be a biophysics major rather than a biochemistry major, because at that time, structural biology was almost entirely nascent and in biophysics. That was a good choice as it turned out. And again, we began seriously to study this revolution that was occurring. We were now learning how proteins were made, and all of that was brand new and incredibly exciting. And those papers were wonderful to read. So, it was a very pleasant experience.

Anna Doel:

Could you tell me a bit more about the state of the field when you started your career? Because it looks like you were witnessing a breakthrough.

Rowena Matthews:

Absolutely. It was a revolution—that is the only word to describe it. And at the same time as we were beginning to realize that there was DNA and then RNA and the RNA made protein and all of those details were being discovered. The genetic code wasn't worked out when I was a graduate student. It was being worked out. But at the same time, structural biology was in its nascency. This is the time of Kendall and Perutz, and we are just starting to see with great labor

what you can do. And a very informative thing was that there was a young woman professor, a married young woman professor, in biophysics named Martha Ludwig, who was doing the structure of a very small protein called flavodoxin, which has a riboflavin co-factor. And she was a little distant and I was a little scared of her, but at the same time, I really was fascinated by what she was doing. It turned out we became lifelong colleagues. We worked together for the rest of our lives. And as structural biology grew in power, the combination became a very important one in my life and altered very much the direction that I took.

Anna Doel:

What happened after you received your doctoral degree?

Rowena Matthews:

Let's think. Okay. I have to go back a little to the complications. During my second year of graduate school when I had just had my first child. No, was pregnant with my first child. Larry was subjected to the doctor's draft, and we moved to South Carolina for a year. And then he went to Vietnam for a year and so I was a single mother with a one-year-old working on my PhD. Fortunately, it was still mostly in the class phase so that it wasn't as difficult as it would've been had I been at the research phase of the graduate degree.

Anna Doel:

So how did you manage taking care of a young child and do coursework?

Rowena Matthews:

Fortunately, there was a woman up the street who took care of three or four children. I could just carry him up the street to her house when I went to my classes. And then I brought him home. He was a good baby, he would play while I was working. And I worked a lot at night. So, it wasn't my favorite year, but we got through it.

Anna Doel:

Where you very worried about your husband?

Rowena Matthews:

Of course. I mean, he was in An Khê the middle of a... It was a MASH hospital. It was a scene right out of MASH. It was under fire quite a bit, but fortunately, he was very tough and he didn't get hurt.

Anna Doel:

What kind of communication did you have with him?

Rowena Matthews:

Letters. And they would come in a bunch, every 10 days, and then you'd wait and wonder. You'd hear about horrible things happening and you wouldn't know if he was alive or dead. And at one

point, somebody knocked on the door in the middle of the night. I lived in a house that was rented, me on the bottom floor and some students on the top floor. And the policeman banged on the door, and I thought they'd come to tell me my husband had died, because that's how they would do it. And I said to him, when he told me he was trying to deliver a subpoena on the upstairs, I said, "If you are ever going to do that again, you're going to call me first." I just about collapsed, but it was okay. He got back safely. Amazingly, unhurt by the experience. In fact, very experienced surgeon by then.

Anna Doel:

He was a surgeon in a MASH hospital for a year?

Rowena Matthews:

For a year, yeah.

Anna Doel:

Did he ever talk about these experiences of his, or did he just store them away somewhere in memory?

Rowena Matthews:

No. He had a lot of photographs... He's a storyteller. We had a lot of conversations. I knew a lot after he got back about what had happened.

Anna Doel:

Do you still have the letters and the photographs?

Rowena Matthews:

I'm not a saver. I found, recently, letters he'd written his mother. She was a saver. And those letters were in a suitcase up in our attic and I've kept those. And I'm very sorry I didn't keep the letters. I'm not a good archivist. I don't keep things. And I've realized that when I was supposed to give my archive to the University of Michigan to their library, that I had a very thin archive.

Anna Doel:

At the early stages of your career, how much presence and visibility did women have in your field?

Rowena Matthews:

More than you'd think, particularly in structural biology. We'll start with Dorothy Hodgkin, who is, of course, for us, the lode star, and who'd first worked on my favorite vitamin, vitamin B12. And she too did not have a degree at the point where she was, an advanced degree, at the point where she'd done that critical structure. And so Dorothy Hodgkin had a huge influence on Martha Ludwig, although Martha was not, at that point, even thinking of working on vitamin B12. I'm the one that started working, well this is a funny story, I'm the one that started working

on first tetrahydrofolate reductase, which is a flavoprotein, so it uses riboflavin, and does a reaction. That was chemistry that was familiar to me and intrigued me. And then because the next enzyme in the pathway was a B12 enzyme, methionine synthase, I began working on that too. And Martha was uninterested in that until a graduate student candidate came who had actually worked with Miriam Rossi.

Miriam was Dorothy Hodgkin's student. And Miriam had helped determine the structure of methyl cobalamin, which is what methionine synthase uses as a co-factor. And so Cathy Drennan arrived in Michigan, interested in working with Martha, but she talked to me and she said, "Oh, you're working on methionine synthase. I want to do that." So she goes to Martha and says, "I want to work with you, but I want to work on Rowena's enzyme."

And that was it. I mean, we'd collaborated before, but only on the flavoprotein kind of things. And all of a sudden, then we were working on this very difficult problem. It was very hard to get the protein. Lots of struggles. And Cathy Drennan was amazing. Her father had been in the Polish resistance, and she had some of that in her. She was not going to take no for an answer. And she is now a full professor at MIT, probably will be elected to the National Academy in the next five years. I hope someday she will be a member of the APS. And so that combination: Cathy, Martha, and me, was amazing.

Anna Doel:

Could you tell me a bit more about laboratory life? What I'm hearing now from you is that research is getting excited about projects. And do I understand correctly that all these projects would require laboratory work?

Rowena Matthews:

Yes, absolutely. I mean, I was in experimental science, not theoretical science. And so the answer is, a huge amount of time was spent preparing enzymes, working out ways... With methylenetetrahydrofolate reductase, you start with four kilos of pig liver, you end up with one milligram of pure enzyme. It's about a 14,000-fold purification to homogeneity, and you need homogeneous clean enzyme, homogeneous in the sense you see a single band on a gel, because otherwise you don't really know what you're working on. And the dogma in the field that I very much believed was don't waste clean thoughts on dirty enzyme. You need to have it clean. And that was a huge amount of time. This is before cloning and overexpression. You just brutally had to extract these things. That was, my experience in the lab with the mitochondria was extremely useful there.

Rowena Matthews:

I had an Italian postdoc who was Maria Vanoni. I love her dearly. Maria was extremely useful there and I did a lot of that myself. And in fact, we had a poster in the lab, a Chinese poster. It said, "this is the year of the pig".

Anna Doel:

Because you had to work with pig liver so much?

Rowena Matthews:

We'd go to the slaughterhouse once every two weeks, and we'd get masses of pig liver, and then we'd start work. And we spent a huge amount of time. So that kind of lab work. And then of course there's the lab work of taking that clean enzyme and beginning to question it, to ask questions about how it works. I was in a wonderful place. Michigan had a very collaborative atmosphere. Students that I worked with that I'd known since I was a graduate student and who were now working their way into the professorship who did things like stop flow spectrophotometry, which turned out to be incredibly useful to get information about what was going on.

But a real challenge was because we had so little material. We were working with typically one 10th of what they'd like to work with. And you could only do maybe 40 shots. You needed to think very carefully about what you would do with those 40 shots. And that was useful. And so there was a lot of hands-on work. And then as you proceed through the field, it's very curious. You, at a certain point become more of a director than an actual doer. It's a dangerous thing in some respects, but it is true. There's the running of the lab, there's the managing of the budget, there's the writing of the grants, and the papers. And teaching the students and postdocs to write papers. So you're going to spend more and more time on that and less and less time on your own individual research. Although some people never give up the actual research.

Anna Doel:

What are some joys and frustrations of Lab Life?

Rowena Matthews:

I can tell you that when you make a discovery, particularly at the point where you make your own, but also when you see it emerging from the work in your own lab, it's like drugs. It's so thrilling that you can't sleep at night. And I had that first feeling when I'm sitting in front of that Cary and saying, oh my God, I have a reversible step in an irreversible process, and I need to understand that. And when these things just click into place, it's so exciting that first it's confusing and frustrating. And then you look at it and you've got it. And there are other fields in which that happens. But it's an amazing sensation that totally makes you love ~~for~~ what you do.

Anna Doel:

What is your experience with the social life of a lab?

Rowena Matthews:

It's almost like a family. If it works well, these are your children, if you like. And I mean, I was quite young when I started, but nonetheless, they were younger. And they need help. They need guidance, they need encouragement. And particularly women often are kind of insecure about their own abilities and they need to begin to respect themselves to realize their potential. And so raising children was actually a very good experience to being a lab mentor. Which is not to say that I was at all perfect, and I certainly didn't have any of the modern instruction about mentoring that I could have used. But nonetheless, you've done some of the experiments and some of the bad things along the way. And you have a little more experience working with people. And you

want a social environment in which people are helpful to one another, excited about their work and competent. You want them to learn how to be accurate and to keep good records and to interpret things correctly. So especially when they're starting out, you spend a lot of time with them.

I had young students that I would meet with literally every day to talk about what they've done and how they've done it, and what it might mean. So that they would learn how to manage themselves. And it just was fun. I enjoyed that. But that also means you're not in the lab yourself by that time. You have five or six or seven students. Now, the hard transition was that, at first, I was non-tenure track. The thought then was that if a man had a job, then the woman shouldn't. You should go somewhere else to work. But of course, if you're married and your husband has a job, you can't go somewhere else. As I kept pointing out to them. I had sort of temporary positions. They weren't tenure track. They would allow me to get a grant, have a laboratory. I was called a professor, but I wasn't tenure track. And navigating the transition between non-tenure track and tenured was hard.

Anna Doel:

How long were you non-tenured?

Rowena Matthews:

Probably seven or eight years. Probably seven years.

Anna Doel:

What helped you get a tenure track?

Rowena Matthews:

Actually, my husband was exceedingly helpful and first with an idea, and then later with some actual help. The first thing he said to me was, "You need to let your chairs know what you're doing." And this is before we automatically gave reports. "Every year you should send your chairs a letter, and you should show them your publications, and you should tell them what you've talked about, and you should outline the most important findings from your laboratory." And this was totally unheard of at that time, but it had a very powerful effect. I did it religiously. And in fact, when I came up for a promotion to associate professor with tenure, I gave them the folder of all those letters of progress because I thought you might as well see what I've done, instead of just talking about a CV.

And so that turned out to be very, very good advice, which I had given to all my students then. Every year you give me a progress report, you tell me what you've done. And now that's standard practice, but it was not. And the second thing is, at a certain point when I was getting frustrated that they were saying that they were going to put me tenure track but weren't. Larry was getting offers from other places. And he went to the dean and said, "We will leave if she doesn't get a permanent position." And so they scraped together a permanent position and we stayed.

Anna Doel:

It sounds like your husband was always very supportive of your professional work. Is that so?

Rowena Matthews:

Not at the very beginning. When we were first dating and I was doing electron microscopy and working at night with a young electron microscopist, he was very jealous and threatened to date other women if I didn't stop. But that was the era. And he changed. He was a very good man and he changed. I think he realized that I could never be happy if I didn't have this dual life where I was both just like him, had a career and had a family. And he became very supportive. And he totally understood that I wanted to do this and that it was important for me. And he understood it in the same terms. It mattered for him. But I do remember him one night when things had gone particularly badly saying, "Rowena, we need a wife."

Anna Doel:

How did you navigate family things between you and your husband?

Rowena Matthews:

Rather conventionally. I cooked. And then my children cooked one night a week. We had a charge account at a local grocery store. We lived in a very safe area. They went to school by walking. They went to the dentist by riding their bikes. And they had a grocery store where there was a charge account. And I said to each of them, "You get to choose what we have for dinner. You go to the grocery store, you buy what you want, and then you cook it." And of course, the younger one tended to make things like macaroni and cheese, or taco salad, that sort of thing. But the older one who was not that old, 15 perhaps? Yeah, he started cooking when he was 12 and he was cooking. They each had one night a week to do. And we got some very interesting meals.

Anna Doel:

And you have two boys?

Rowena Matthews:

I had two boys, and they were six years apart. One had been born just before I got my PhD and the other had been born just before I started my PhD. Larry spent a year in Sweden. That was the one year I didn't work because they didn't have care for newborns in Sweden because every woman had maternity leave.

Anna Doel:

I saw that comment in your autobiographical article. And it struck me as unique. Everybody tends to be very happy about maternity leave that long, nine months, especially back then. And you were the only person who wasn't happy about that.

Rowena Matthews:

Well, it just was difficult because it was this... Sweden is a place where the word "hemmafru", a wife who stays home, is not considered attractive. And here I was having fought all my life to be not a hemmafru, and I was a hemmafru. But it was okay. It worked fine.

Anna Doel:

So did you end up going to Sweden and not working at all?

Rowena Matthews:

Not working at all.... I had the baby very shortly after we arrived in Swede—about a month later. And then when I came back to Michigan I worked as a postdoc three quarters time, so that I would be home by three, so that when Brian got out of school, I would be home. And we hired various students to stay with Keith when Brian was old enough to manage on his own. But Keith was little, and I would leave before school started. So, we had a series of engineering students who came and did projects with him, which was very nice.

Anna Doel:

What was your husband's job at home?

Rowena Matthews:

Oh, at home. He fixed things. He was the one that could fix anything. He was a farm boy. Mechanical things were his thing, and he could fix things. He wrote the checks. I did the income tax. He definitely did his share. He didn't do housework. Even then we had just enough money that we could have somebody come in once a week and clean. And that helped. Yeah. And he would come to PTO meetings if I couldn't make them. Even though he was a surgeon, he would figure out how to get there.

Anna Doel:

Could you tell me more about his professional life?

Rowena Matthews:

Yeah, he was... Let's see. He's a farm boy. He was born when his mother was 47 and his father was 51, and they hadn't had a child for 30 years. And as the doctor said, "The cancer had a heartbeat." And he was pretty independent. And he too had a sister 30 years older whose son had gone to Harvard. And he became the first child from his county to go to Harvard College with a little help with the application from his older sister. And he did research and he loved it. And he did research. Not many orthopedic surgeons do research, but he was one of the ones who did. And very hands on. He once had a prosthesis on the cover of Scientific American. And he knew what research was like and that helped. And he was very good at managing his time. He could manage to take care of children when necessary and manage the surgical life. And occasionally we had to just rely on others to help that. But we did have help with childcare.

Anna Doel:

Did you ever have a division in your family that these are things we do for work and these are things we do for fun?

Rowena Matthews:

No, we were pretty clear about the fact that it was, you needed breaks. Our view was that you never wanted to be around a Christmas vacation. We always took a family vacation at Christmas.

Anna Doel:

Where would you go?

Rowena Matthews:

We went to Tahiti a couple of times. We usually traveled outside the United States. Let me think. We started with just Brian. We went to Europe for... It was he's first trip to Europe. We went to Europe for two weeks with a three-year-old. And our deal with the three-year-old who, as I said, was a very good baby, was if you go to dinner and be nice with us and well-behaved, we will take you to a zoo every day. So, in every city that we were in, we went to a zoo in the morning, and he was nice at dinner. And it was all new to him. He wasn't used to people speaking in other language. We were mostly in the Netherlands, and Germany, and Switzerland. And he didn't know a word of those languages.

And I remember him once, we were probably at the end of the trip, and he had gone off to the bathroom by himself. And on the way back he ran into a table where they were speaking English. And we heard this little squeaky voice in the back saying, "Mommy, there's people here from Ann Arbor. They're speaking English." We did that from then on. We would go off somewhere, the Caribbean, or Hawaii, or whatever. And spend a couple weeks at Christmas and really just a total break with what we were doing.

Anna Doel:

Between you and your husband, do you speak any foreign languages?

Rowena Matthews:

Really bad French. High school kind of French. We once did a bicycle trip through France, that was one of our family vacations. That was great fun. But we also had hobbies, particularly Larry did. He liked to fly model airplanes and the boys flew model airplanes with him a lot. And I liked to garden. And I think Larry liked to garden a lot too. Turned out we both had gardens when we were little, and we didn't know that when we met one another. But we spent a lot of time on the garden. It was a small garden, but we did it. And so that was my hobby. And I like to cook. I have rather conventional hobbies as a woman, cooking, sewing, gardening. In some respects, the division was the very old-fashioned one of, he fixed things, the car was his problem. And I did the things more associated with women. But that was okay.

Anna Doel:

Only both of you had professional lives that were very different from a lot of other people.

Rowena Matthews:

And then curiously, my niece, who's now a senator. She's Senator Tammy Baldwin. She too, they all laugh at her because she's a senator, and she's on the governance committee, and she's very serious about all this stuff. But at the same time, she loves to sew and cook. It ran in the family.

Anna Doel:

When your kids were young, did you visit your parents with them?

Rowena Matthews:

Occasionally, but we didn't live close to my parents. And they came to see us as well. Larry's mother died when Brian was three. Because she'd had Larry when she was 47. And so there wasn't a lot of family, there were very few of, we actually knew some of them, but not others of them. There wasn't a huge family to go to.

Anna Doel:

You mentioned managing a lab as you would treat family. Did you learn some of it from your own mentors? Did you have mentors in lab life?

Rowena Matthews:

I did. And actually, that would fit very well. George Wald was a wonderful mentor in two senses. One, every so often, Larry and I would be invited to their house for dinner. Sometimes with some visiting guests, sometimes just ourselves. But not necessarily was it a lab party. We were invited for our own and we loved it. I mean, the conversations were amazing. And so that was a real experience for us. And so we were being treated like children to a degree there. Also, the laboratory also had a group lunch. Everybody in the lab took their turn shopping. We had a sort of budget for the shopping and chipped in money for the lunch. And then we all ate lunch together. And occasionally people would drop in and join us and we'd have amazing discussions with them too. And we talked about everything from science to politics, current events, art, music, and that was like family too.

Anna Doel:

What was so nice about these conversations? Why did they matter, do you think?

Rowena Matthews:

I guess the answer is that through other people's experiences, you broaden your own. You learn about things you haven't thought about or points of view you hadn't taken into account. Before I wanted to be a scientist, my dream was to run a salon in the French style. I thought it would be incredibly fun to have brilliant people around me who would have interesting conversations. The APS is my dream come true. It is exactly that on a slightly larger scale. And so that was a very important part of life for me, was to have a dinner table at which conversations with your children, with your colleagues would be interesting.

Anna Doel:

Did you have that at Michigan as well?

Rowena Matthews:

Yes. My mentor at Michigan, Vince Massey, loved to entertain. He and his wife very frequently entertained. And we were often at their house with our children or without our children. And my postdoctoral mentor also. We were very close, and I still am close with my postdoctoral mentor, still alive.

Anna Doel:

What's his name?

Rowena Matthews:

His name is Charles Williams. And he too was an amazing mentor and his wife. And also a friend. He was a little older than I was, but our children were the same age and played together. So it was very much like a family. And I think that that was a good thing, though. Not all labs are like that. But I think that's a very important way for a lab to be. Because research can be scary. You can begin to think less of yourself because you get frustrated that you can't figure out the answer. And that's when people need some emotional support. It can be very challenging, and it can be very, very frustrating. Cathy Drennan struggled for three or four years. We almost were considering putting her on another project until it broke. And you have to have emotional support through that period.

Anna Doel:

Could you tell me more about your own research?

Rowena Matthews:

How technical do you want me to get?

Anna Doel:

Oh, as technical as you want to.

Rowena Matthews:

Okay.

Anna Doel:

Because I'm curious about those breakthroughs in your own research.

Rowena Matthews:

I started out my independent research partly because of this colleague (Dave Ballou) that I did stop flow with, who said that he had done some stop flow with a man in Utah who was working on an interesting enzyme. It was a flavin enzyme. And I was working on flavin proteins when I did my graduate work. Flavoproteins have a co-factor that undergoes oxidation and reduction. And so the oxidation and reduction in flavin is an essential part of what the enzyme does with this vitamin. The vitamin is the only thing that can do the oxidation reduction in this case. And it has three rings. And folate, which was the substrate has two rings that are identical to the... Or almost identical to the three rings of the flavin. And he said, "This is an interesting enzyme, you should look at it." I did and I thought, oh my God, this is a very interesting enzyme and it's perfect.

I have some credentials on working with flavins. And what I'd like to ask is, so folate clearly could be a redox cofactor too. But this reaction doesn't seem to be a reaction in which the folate's

going to do that. Let me have a look at these enzymes and see whether there are what I would call, undiscovered oxidation reductions occurring. So that was what started me. And I wrote my first grant to say that that's what I wanted to do. And it was very well received, and I got my money. So even though I had a kind of tenuous position, I had a grant, and I was given space and I could do this work. It turned out it did not involve oxidoreduction. But this actually is probably the reason I'm in the APS, one of my colleagues was the brilliant chemist, Steven Benkovic, who's a member of the APS, a very distinguished member.

And Steven met me at a Gordon conference. And he gave me all kinds of ideas based on his knowledge that I would never have thought of on my own about possible mechanisms. He explained to me some of the more complex reactions that were going on with folates that did involve oxido-reduction. And I thought that was absolutely fascinating and he was incredibly generous to share it with me. He was working on, not those enzymes, but similar ones. He could have kept it for himself, and he didn't. And so, I figured out how to do the experiments that would tell me if these were indeed the mechanisms. And they worked. It turned out to be rather simple.

Somebody had canceled at the Gordon Conference when I was a fairly young assistant professor. But my grant was for three years. It was right at the end of my third year. I knew I had to get a renewal of my grant. And he suggested to the organizers that I be invited to sub for this person who'd canceled. So I'm giving my first talk at the Gordon Conference about my work. And I can see in the front row everyone who was going to be reviewing me for my first grant. And I proceeded to tell them what I had learned and they liked it. And I remember I was so terrified that even though I never talk with... I never read a talk, I had written out the first couple paragraphs of my talk so that I would not forget what I wanted to say. After I got going, it was okay. But I was terrified when I started. But it was a really good experience.

And Steve's attitude, which I then found in many other enzymologists was that we want to share an exchange. And I had incredible conversations with many colleagues. Chris Walsh, who wrote the book basically on enzyme reaction mechanisms became a really good friend. And here's where being a married woman helped because I could have friendships with people like that without there being anything untoward about it. We were both safe in a certain sense. And it was okay to go swimming with somebody or canoeing with somebody without it being viewed skeptically. And just as I had done when I was camping with people when I was an undergraduate, I could do the same kind of thing as a professor. And that I thought was really helpful. I think it would've been much more difficult if I'd been a single woman. So there were advantages as well as disadvantages to having a family.

Anna Doel:

How do you find research topics?

Rowena Matthews:

Well, part of it this kind of serendipity. Somebody who's heard an interesting story, who tells you about it and you say, oh. But then it's almost organic. I'm working on this one enzyme that takes tetrahydrofolate, which has a methyl group on it. So methyl tetrahydrofolate. And it does an oxido-reduction. It actually starts by condensing. It starts with methylene tetrahydrofolate. That's

a CH₂ group. And it transfers a hydride to make a CH₃. And the question was, does that hydride come from the co-factor? Answer, no. Comes from an NADPH, which is sort of a universal reductant in biology. But once you get to methyl tetrahydrofolate, it has only one place it can go. And that is to make methionine the amino acid, which is an S methyl group. You're going to go N methyl to S methyl. And that reaction is the vitamin B12 reaction.

I'm getting into vitamin B12 purely because it's the next step in the process. And then the more I learned about methionine synthase, the more fascinated I was with it. It's an enzyme that has two substrates and it inactivates, and then it has a third compound that it uses to reactivate itself. You have this protein, and we're just beginning to use structural biology on big things. And it has these things and I'm thinking, how does it do these? These are all big substrates. Is it doing this? And if so, where's that one coming from?

And so at that point, what we began doing was cutting the enzyme up. It's a very big protein relative speaking, a 136 kilodaltons. And it turned out that it was pretty clear that it had cutting points with enzymes that cut proteins up. And the cutting points would be where you had a little flexible connection between two more compact regions. And there were four compact regions. One of them had the B12 in it. That's what Cathy crystallized. She didn't know it. She was trying to crystallize the whole enzyme. But what came out was this domain that had vitamin B12 in it. But then the others, what were they? And then we began doing sequencing. Sequencing was incredibly tedious then. I had a brilliant postdoc named Ruma Banerjee who had come from chemistry, but who mastered sequencing technology. I didn't know how to do it myself. And she figured it out with a little help from colleagues and did the first sequence of the B12 dependent enzyme, at a time when it was like 0.4% of the entire E. coli genome. This was huge. But at looking at that, we could tell where the B12 part was and then we could begin to isolate either one or two domains at a time and see what they would do. And the enzyme was very good to us. And if you isolated the part that bound methyltetrahydro folate, it would actually transfer that methyl group to free vitamin B12, which was unexpected and very useful.

And if we isolated this piece that took the homocysteine, that will become methionine from the methyl B12, you could add methyl B12 and it would catalyze that reaction and it would be free methyl B12, not bound to the protein. So then the question is, so why do we bother with having B12 on the protein? What's that about? And that was very hard to figure out. The question was, it clearly wasn't that you needed it for catalysis because you could do it with free B12. And many simpler organisms did exactly that. They did these transfers with free vitamin B12 forms. So what we discovered was that the vitamin B12 was actually orchestrating who comes over me when, and that was totally unexpected and absolutely thrilling. And so that was work that my postdocs worked out, but it was very much a group effort. So maybe that gives you a little idea about what we've done.

Anna Doel:

Over the course of your professional career, what are some of the newer technologies, scientific discoveries or just lab techniques that helped you move on?

Rowena Matthews:

Well, of course, first and foremost, structural biology. Because as we were exploring what these pieces were and how they would work, my postdocs were working with Martha to get structures of them. And we actually got structures of all the parts. We never got structure of the whole thing. It's been done by a former postdoc of mine, but not by us. And Martha died before we got the whole thing. And it was really difficult because the whole thing wasn't stable. And when you were trying to crystallize, it would fall apart. But we got the pieces. So we had the two pieces that bind a substrate. We had this and we had the activation domain. So that part was structural biology, which was going through its own revolution in terms of how rapidly and how accurately and to what degree of resolution you could get structures. But of course, a structure doesn't mean much if you don't have data to interpret it.

And the collaboration that we had was, "Okay, I know what it's doing and what it looks like. Now, how do we put that together?" And I can't tell you how many hours Cathy and Martha and I would sit and argue and talk about how to interpret what we were looking at. But I think you've seen that quote that's in the exhibit about how collaboration is an art, because that was absolutely critical in getting these structures to talk to us. And Martha tended to write papers that were very straightforward. There's this molecule, this atom here and that atom there and kind of talked about it. And she was very reluctant to draw conclusions if she didn't have really hard evidence to support them, which made her a wonderful scientist. But the papers were very difficult to read, and I was always pleading with her, "Let's talk about what this is telling us. Don't get lost in the details."

We came at it from very different aspects and points of view, but the result I think was better than either one of us alone, that between us, we got papers that mattered. I had been on a PhD thesis for somebody in chemistry who was using XAFS spectroscopy to look at metals and their ligands. Cobalt in vitamin B12 is a metal, and the ligands are amino acids, or in the case of vitamin B12, some of them are internal ligands. That is the vitamin itself provides ligands. And I was very interested in how a homocysteine might be bound to a zinc in my enzyme and very interested in cobalt, which was going to be more difficult. But we started with the zinc that we'd discovered. We had no idea what the zinc was doing. And because I'd been on this PhD committee and knew about this new technique, EXAFS. I went to them and said, "Can we look at this enzyme and see what this zinc is doing?" And we added homocysteine and we saw the sulfur on the zinc, and we went, "Oh."

And it was a new technique, probably had been little used in biology itself, and we had gold. It turned out there were a lot of zincs in very similar enzymes, and they were all doing somewhat similar things, binding a sulfur to activate it. And so that was a new technique. So you'll see that I am not ~~th~~ technique driven. I'm the user of the technique. That was my niche in all of this. But to do that, you have to begin to understand at a pretty deep level what that technique entails.

Anna Doel:

I'm sure people have asked you this before. What are some of the practical applications of your research?

Rowena Matthews:

In the case of methylenetetrahydrofolate reductase, this is the flavoprotein. There was a very interesting finding. This is before the enzyme was even sequenced. I would go to these meetings, the FASEB meetings, and they would have a meeting on one-carbon metabolism. And I got to know a lot of physicians and a lot of geneticists who are doing very different things than me. And it emerged that there was a very common polymorphism, that means that it's a genetic variation in humans, which has some phenotypic consequence. And it was obvious that this C677T mutation was leading to a heat sensitivity of the enzyme. Well, I thought that was immensely interesting and quite important. They said it looked like this might be correlated with incidents of neural tube defects, for instance. Folate being the key vitamin in neural tube defects. And so I got very interested in that. And first, we tried to clone the enzyme, but it was exceedingly difficult. And a colleague of mine and that I met at these meetings named Rima Rozen told me she'd cloned it. And I looked at the sequence and said, "No, you didn't clone it. You cloned acyl CoA dehydrogenase, so that's not what you want." And then we worked together with our peptide sequence to design the right primers for her to clone this enzyme. And we got the sequence of C677T, the whole context of it. That's how we knew it was C677T. We didn't know that until then. And indeed, what intrigued me was the enzyme really was heat sensitive when we made our own version of it, we made an E. coli version of it. It was heat sensitive, all right. And then we realized it was losing its flavin. And when we saw the structure, we were able to figure out why it was losing its flavin.

And this was important because when you treat patients with folic acid, it works for... You can almost prevent neural tube defects, but not completely. And all of a sudden you knew that maybe 20% of your patients have this C677T mutation, and then maybe they need riboflavin because they're losing their flavin. The Irish, who are very interested, there's an enormous incidence of neural tube defects in Ireland. And the Irish who were very interested in this did these studies to see whether or not the combination would be important. And it was easy to test people to see if they had 677T and then you could modify it, not just give them folate, but give them riboflavin as well, which seemed to work. And I'll never forget, I was at a meeting in Dromoland Castle and we were discussing exactly these things.

And the maids would come into my room in the evening and hand me a little glass of whiskey and say, "So what did they say today?" And never in my life have I had the staff at a hotel wanting to hear what science we were talking about. And so we would talk for an hour or so about what we were learning. And it was a wonderful experience, and I really felt good about it because in their families, this was something they'd worried about. So that was an amazing experience. So that's one example of a somewhat practical application.

What else? I would say that's probably the most practical application of the work I did, which was much more, how does this chemistry work? Why do we bother with vitamins? What are they really doing?

Anna Doel:

Once you got tenure, did you have to teach?

Rowena Matthews:

Always, yes, but not... I'm in a medical school, and so the teaching load was always rather light, but I love teaching. And quite surprisingly, the first course I taught when I was still non-tenure track, they actually did something that they probably weren't going to do for another 30 years in teaching. The staff who were teaching would sit in the back of the room and critique your lectures, and that was extremely helpful. And they were very nice about it, but they would calmly say, "That was too fast, that was too much. You weren't hard enough there. You didn't go deep enough." And in fact, it was Martha's husband who was the director of this course, and he was an MD, and we were teaching a class that had first year medical students in it. And so that was enormously helpful. So that was something, again, before its time, but it was an awfully good way to learn how to teach.

Anna Doel:

And you, of course, advise graduate students as well. Right?

Rowena Matthews:

Well, ultimately then I began teaching graduate students, but at first, I wasn't teaching graduate students. And in fact, the year that I had Brian, so that's when I was still before I had one year of graduate school, but I got a job teaching at the University of South Carolina, which was a part-time job teaching nurses. And that was fun too, because it's really great to be married to a doctor because you're able to pepper what you're trying to teach them with some practical applications that make it more palatable. They don't really want to study biochemistry. They view it as an obstacle. And when they have to learn it, you have to make it palatable. You have to help them understand how it might be useful. And it was very useful that I'm married to a doctor.

Anna Doel:

Could you tell me about your graduate students?

Rowena Matthews:

The first ones were quite brave because they had to basically sign that they knew that I was non-tenure track and that I might leave during the course of their graduate degree. I had a young woman named Colette Daubner, who was my first student who worked on methylenetetrahydrofolate reductase. And she was really, very good. I mean, as we said, the purification of this enzyme was an uphill battle, and she was as much a part of it as I was. We worked very closely together through that, and she did really nice work. At first, most of my students were women, but that changed. It gradually I got so I had a mix of men and women. I always had quite a few women in the laboratory.

Anna Doel:

Do you know why?

Rowena Matthews:

I think because I was a woman and that there probably were a lot of men who thought that, no, that wouldn't work. And because it also, the fact that I was non-tenure track would've convinced a lot of people, particularly people who were quite ambitious, that was not a good place to go.

Anna Doel:

That makes sense.

Rowena Matthews:

But I also recruited some people, very brilliant postdocs to a laboratory because they were men, but their wives had demanding jobs. And they knew that I would be sympathetic if they said the baby's sick and I have to stay home. And I was because I'd been there myself. And that actually mattered that I could do good work in my laboratory and not have to work nights and weekends. I did not typically work on weekends. I rarely worked at night. And that was simply because I had to organize my day so I did my work during the day and then it was done. And that's, of course, not the way science was practiced and went against the grain. And I argued that you work there all the time, but you're not very efficient. If you want to do it that way, that's okay. But if you don't want to do it that way, you can get things done if you organize. You should walk into the lab quite sure of how you're going to use your time.

Anna Doel:

Did you succeed in convincing others that there's more than one way of running a lab?

Rowena Matthews:

Yes, I think I did. I mean, they gave me tenure and then more than that. And I never really deviated from that. I didn't. I might work at home at night, but I did not work at work. I just didn't. And I didn't believe in this business, if you stay in the lab, you better be in the lab seven days a week. Now I'm sure there are people that are utterly unconvinced by that. There are still people that expect everyone to be in the lab seven days a week. But I always believe that there should be a life as well.

Anna Doel:

That's wonderful.

Rowena Matthews:

And that is a message that I have been quite open about, that you don't have to work 24/7 in order to be a good scientist. You might get more papers if you do that, but I'm not sure you're going to actually make more of a difference.

Anna Doel:

Do you keep in touch with your former students?

Rowena Matthews:

Yes, I do. Yeah, quite a few of them. And in fact, after I retired and moved to Arizona, many of them came to visit me and my colleague from Montreal came to visit me as well.

Anna Doel:

When did you decide to move to Arizona, by the way?

Rowena Matthews:

My husband had Guillain-Barre when he was 40. He was never really totally recovered at all. He probably lost more than 50% of the muscles in his legs. And he was, as he got older, the winters were terrible in Ann Arbor because it's icy and cold. And he would fall, and he couldn't get up. When he retired, and he retired before I did, he wanted to have a place in the winter that was warm, and Tucson was a place we'd gone for Thanksgiving and things like that. And we decided that that would be a good place to buy a house. We bought a house there, which was empty most of the time. But we would go there. And the arrangement I had was that I went from a 12-month appointment to a nine-month appointment so that I could have three months during the winter that I was not officially working.

And I would manage my lab remotely during that period. And then the whole lab would come to Tucson for one week.

Anna Doel:

And it worked out like this?

Rowena Matthews:

At the beginning. And then as I went on what's called phased retirement and phased retirement meant that I actually had three years during which I had one third off each year. So with the four months. But at that point I thought, no, I need to close the lab pretty soon because I don't think you can manage a lab at a distance for that long. The productivity does begin to drop. And you also, the mentoring, the individual mentoring is beginning to be harder because I just don't think Zoom does it. I just don't.

Anna Doel:

What's wrong with that? Why is it not working, you think?

Rowena Matthews:

Partly the social aspect of it. You have people over, you just shoot the breeze, that's gone.

It's got to be much more intentional. And so much of it emerges when you don't think it's going to, when you're just shooting the breeze with somebody. And so that's much harder when you're in a distance. So I'm not a fan of doing much work totally remotely. I'm still a reviewer for the Howard Hughes Medical Institute. I'm on their medical advisory board. And we have now gone to doing all the reviews of the investigators by Zoom. And you lose something. Partly, you lose the calibration of the other members of the board who are doing the reviews, where you know what their strengths are and what their weaknesses are.

You know how to calibrate what they're saying and when to argue with them and when not. And that's gone. You kind of don't know the new people. I know the people I've been on the board with for more than 10 years now and that I miss that. And they were also friends, you got to know them really well. We spent a lot of time together and they're really interesting people, part of the salon environment. So that's why I don't like remote.

And when you interact with your laboratory remotely, the social life isn't there, the emotional support's much harder. And you lose the day-to-day interactions, such as when you look at a plot for bacterial growth and say "No, no. When you're graphing that you're putting a straight line through data that isn't linear." There's an awful lot of that, that you're just not seeing.

Anna Doel:

I know you have an extensive list of professional service at the university, in professional societies, on editorial boards. Which of these assignments hold special significance for you?

Rowena Matthews:

Oh, okay. Let me think a minute about that.

Well, certainly APS for me has been phenomenal. My husband hated to go to the National Academy with me. He thought they were very elitist. They don't have a building that can accommodate enough people. So, the spouses would be left behind on a regular basis and they wouldn't be in the auditorium when Obama spoke, because there were too many people that had to be in the auditorium. You'd be relegated to your hotel room or to a back room with a microphone. Also, because he was handicapped, there was a lot of standing up eating. And of course, he couldn't do that, and they just couldn't manage the things like that. And he would not go with me to the National Academy. But after our first meeting at the APS, he said, "I'm going to be angry with you if you don't go to these meetings." He loved it, and he felt as much a part of it as I did, because they treat spouses amazingly. Here you're as a spouse, if you outlive your member, you remain invited, which I think is lovely. And the spouses are just as interesting here as the members. That's a generalization, there must be some examples to the contrary, but it's generally true. This was something he loved. And of course, for me, yes, it's the salon. I love it and have loved it all along. This is definitely one of the activities that I've enjoyed the most and has meant the most to me. At the National Academy, I was pretty involved. I thought it was extremely interesting, but it's just kind of big and unwieldy. I think they do very important things. I'm very good friends with John Hildebrand, the foreign secretary of the National Academy and who's from Arizona, have had wonderful discussions with him. But I just didn't feel the same feeling about the National Academy. The meetings are too big, and I didn't feel I was having the exciting conversations, the ones that enlarge your life, maybe that's my fault. So what else?

Anna Doel:

Just for the record, how are you involved with the APS activities now?

Rowena Matthews:

Well, of course, I'm just finishing two terms as a vice president. Before that, I was on for many years on the membership committee for group two, I believe it's called. And so that was an activity I absolutely loved. I mean, it's what I do at HHMI. And that's maybe the other thing I might talk about. So I really, really enjoyed trying to build a portfolio of people who are very different, very diverse, from different backgrounds and different regions. I am a big one for remembering that we have institutions that are not on either coast and that we need to look at people from the middle of the country and that they're very clever and they're not getting their just dues. And that's true in the National Academy too in spades, but it's less true but true here. And I loved working with the people on my committee. They were terrific.

And we had Jack Liu, he was really very, really, very valuable in this because he represented ecology. He was from Michigan State. We were pulling in some very, very interesting people. And we had wonderful discussions in that group. So that, I really liked. And then of course, so you were asking about other things that really influenced me. So HHMI. I got a call from Tom Cech the year that I retired, asking if I'd be interested in being on the medical advisory board. And I was sort of stunned. I mean, I hadn't expected that at all. And at first, I felt like I really was out classed. I'm not famous in the sense, but here I was on a board with people who were like a Nobel laureate here and the Nobel laureate there and the head of Sloan Kettering over here and Cold Spring Harbor over there. And I'm thinking, why am I on this board?

But I found it incredibly interesting, and I was watching another revolution there because HHMI, which had been originally, you had to be a member of an elite group of medical schools in order to nominate people to Howard Hughes to become investigators. It was totally controlled by the bureaucracy of a series of elite medical schools initially. And HHMI moved from almost everyone being an MD to a much broader funding of biomedical research and biological research, where people could apply from any of a large group of institutions without nomination from somebody else. You could say, "I want to be an HHMI investigator." So that was revolution number one with Bob Tijan and a big one. And I think our pool got fantastically enriched by that. And now of course, we truly have a fiery revolutionary as the head of HHMI.

And the result is that we are thinking much more, not only about what you've done, but how you run the lab. And that's really interesting and quite difficult to assess. If you think about it, there's not really good metrics for that, but it's terribly important. A huge emphasis now on mentoring and learning how to do it and help with it, and a huge emphasis on science that matters, but also that is enriching for the people who are doing it, that these are not servants. And I like that very much. And as we talk about increasing diversity, I'm the voice on the board that says, "And don't forget geographic diversity."

Anna Doel:

Could you tell me a bit more about that and maybe the history of the Michigan Lab and how well, there's this lab in a Midwestern state, how connected was it to the bigger networks research?

Rowena Matthews:

I would say very well-connected. That was partly these meetings that were incredibly helpful. The Enzymes Gordon Conference where first I began to know people from MIT, Harvard, UCSF,

and I'm kind of an outgoing person, so I got to know some of them really well. And we became really good friends. Steve Benkovic from Penn State, another outlying place that he made famous in part. And also I began.... if you had a student who was at the right stage, you could get them into the Gordon Conference. I began, when I could, bringing a student who was ready to be a poster presenter. And then in Cathy's case, actually giving a talk, we got her to give a talk because she's very good at that. And it was amazing. And of course, at the One Carbon meetings, and I did go to both the Gordon conferences and the One Carbon meetings leaving Larry with the two kids, and he did that nicely.

The One Carbon meeting introduced me to a network of doctors and geneticists. And that was important too for... I had a long longstanding collaboration with the group in Canada where we actually had a grant together for a while and where we're still friends with those people. And so involving the students in those networks was very important. You could set up a collaboration if you knew that somebody was doing interesting work and you had a student that you thought could profit from that, you would bring them together for coffee or something and start discussing it. And lo and behold, you had a collaboration. And so I think we were very well-networked, and I always felt that people don't actually read papers unless they know what you're doing. It's very important to talk about your work in terms that they can get interested in, and then your work then leads to more collaborations, and that's just exactly what you want. I would say we're very well networked.

Anna Doel:

Was it like this when you first came or did it develop?

Rowena Matthews:

Michigan was actually... No, I would say that Michigan was actually very well networked. That was not a problem. Vince was in the National Academy, Vince Massey. There weren't a lot of people in the National Academy. Martha got in the National Academy, but actually, much later, after me, which was unfair. But it was partly that those papers were dry. She wouldn't love me for saying that, but it is true. But she was brilliant. I would say, yeah, we were very well networked. That wasn't a problem.

Anna Doel:

I know you have consulted outside academia. Could you tell me a bit more about these experiences?

Rowena Matthews:

So basically, I'd say the major consulting, two things. I worked on a NATO panel, that was very interesting for I guess about four years. NATO runs a series of scientific conferences in the summer and they are usually in different countries. And the idea is to involve young scientists and senior scientists in a collaborative meeting that may help people from Turkey who are not so well networked, attend conferences, that kind of thing.

This panel was extremely interesting and I was out of the blue. I don't know how they found me, but I found it enormously interesting. First of all, you're working, I was the only American on the

committee. There were people from Turkey and people from France and people from Germany and all the NATO countries. And that was great. And the meetings were quite interesting. We didn't usually attend the scientific part of the meetings, but we met once a year at the actual meeting site to see how things were working. And the other three times a year we met in Brussels, and I got to fly to Brussels three times a year. It was great. I know the Grand-Place well.

So that was fun. And then it was just playing fun. But HHMI, I think it's made me think much more broadly about how science is done. HHMI is a pretty major funder of science and a pretty elitist funder. They want to fund the cream of the crop, but the cream of the crop has been redefined. It's much more diverse than it used to be. Not just that they're not just all MDs, but now they have many different colors and different genders. Women are very well represented on both the board and the investigators.

Erin O'Shea has a board that's at least half women and they can hold their own. They're pretty impressive. And now, we have foreign members. The Zoom is good for that. Now it's not so difficult to have foreign members and we have some amazing foreign members. So that's I think, been an important evolution for me to think about science more broadly and think about how we're not trained to do much of what we do. Typically, you're not trained on running a budget, you're not trained on writing or you may be trained but there's no formal way in which you're trained and yet, it's terribly important... And speaking and you're not trained on mentoring. And those things need to be changed because the job is much more than just knowing the science.

Anna Doel:

How about teaching?

Rowena Matthews:

Well, teaching of course is part of presentation, isn't it? Yes. So yeah, teaching, I would say between mentoring and presentation, there's a lot of that. But yes, you may or may not be trained as a teacher, how to do it. And it's done badly by a lot of people, probably including me because I used to rail that education degrees were only about methodology, and they weren't about subjects. But the fact of the matter is biochemistry degrees are all about subject and not about methodology. And so all of that, you really going to ask people to undergo a broader training that's going to continue through much of their career in order to be all they can be.

Anna Doel:

Was the kind of research you have done all your life, are there any ethical concerns associated with it?

Rowena Matthews:

Well, sure. There are always judgements you have to make that have ethical implications. Who should be a co-author? What order should they be? Who should be first? If you had a collaborator who gave you something you couldn't have done the research without, there's an ethical argument about whether that constitutes co-authorship or not. Because in the end, every author has to be responsible for everything that's in the paper, which is unfortunate because

sometimes, there's stuff in the paper that's outside your expertise. But that's a discussion that has to be had. And I think it's very good to have that open discussion with your students in a situation where you're not trying to choose an author for a particular paper, but just what should be our criteria for authorship on a paper? What should the contribution be that merits your... And what are your responsibilities as a co-author? Then you have to actually care about what's in that paper. You don't let someone else write it.

How much of a paper a first author should write? What does it mean if you have two "first authors"? Something that happened during my life, during my career. So those sorts of discussions are ethical discussions. Then there's the question of you hear something, it's useful, you use it. Was that fair? Was that privileged? Did you acknowledge it? You run into a series of ethical things. What are your obligations to report behavior that you think is unethical? How you navigate that?

I'll give you an example of the kind of discussion you don't expect coming up, but it does. This first student, this rather shy first student, Colette, was going to have her prelim examination and there were three members of the committee that were going to be on it, and I would be present. And one of the three professors invited her for a date shortly before her prelim exam. And she was terrified. And I never forgave the guy for this, but at that point, reporting him, which I would do automatically now, would've backfired because there no were ethics that were written about, that kind of thing.

And I said to her, "Look, you have a steady boyfriend, you're about to be engaged. Tell him that. Say, 'No thank you. I'm not going to because I'm committed.'" So she did that and he accepted it, but she was terrified that he would seek revenge on her at the prelim meeting. And I said, "I'm going to be there and if he does that, I will bust him because then I will go and fight. Then it becomes an offense that I can defend." So that's what we did. And he was perfectly okay. He didn't do anything. But he treated women disrespectfully. I have had a colleague look at him and say, "Rowena, I'm walking you home." Because when he got drunk, he could be utterly obnoxious. And that's something we wouldn't put up with now. But it was there, and it was not common. But that's an ethical situation where you have to navigate within the rules of the time.

Anna Doel:

Oh, absolutely. When was that? Which year?

Rowena Matthews:

That would've been, let me think, 1974 or five, I think. And so yeah, the rules were very different then. I'm sure the behavior was frowned upon, but it would not have seemed quite so inappropriate as it seems today. We've evolved.

Situations came up at HHMI too. I didn't really know what implicit bias was, but I could hear that sometimes, what they said about a woman and what they said about a man seemed to be really similar, but one got a B and one got a C. And I started calling. I started saying, "I don't think that's fair. I don't know what you want to give them both, but they should both have the same grade." That's what I heard. And sometimes I said it out loud and sometimes I said it directly to the administration. Maybe that's why I'm still on the board, is that some of those calls had to be made.

And a colleague that I respect very much wanted to be critical of a young woman who was giving her presentation. But he felt that asking her a question that would've been hard for her to answer would've been considered improper. But then he damned her for that in the review. And I said, "Uh-uh, you got to ask her the question. You've got to give her a chance to defend herself." So those ethical issues. And often, these are perfectly well-meaning people. We all do that thing without realizing it. And someone needs to tell us that, "Uh-uh, that's not right." And you can't get mad or denigrate people because they make mistakes unless they do it consistently with malicious intent. Probably, that part of it is where I'm helpful.

Anna Doel:

Rowena, who are your friends? Who do you keep in touch with on a regular basis?

Rowena Matthews:

Who are my friends? Let me think. So several of my former students, I'm very close with. Ruma Banerjee, who's now a professor at the University of Michigan with whom I correspond. And we have many interests outside of science that we share. Vahe Bandarian, who's a former postdoc who I was enormously fond of and who's now probably going to become an administrator at the University of Utah, but is just a very exciting person. I like him very, very much. I have a very close friend who moved, actually he's from the University of Utah, but Vahe replaced him when he retired, he's named Dale Poulter. He's a chemist. And Dale and his wife are very close friends of mine. And Dale is also a member of the National Academy. But I've known him since we were at Gordon Conferences together. And he works on isoprenoids which is very different from what I do.

But we had a lot of fun together and we like to talk science together. Dale and his wife are very close friends. And even now that Larry's gone.

They actually stayed at our house when they were looking to buy a house to stay in in the winter. In the mud seasons, they live in Park City, and it can be pretty muddy in spring and fall. So, they started by staying in the mud seasons in Tucson. And they live two miles from me. John Hildebrand is a very good friend. So many of my friends are scientists, but not all. I also have friends who are not scientists and that I've met in other contexts, but I think most of my friends are probably scientists or doctors that I knew. Of course, we still keep in touch with John Terborgh who is a very close friend for both of us. My kids are friends.

Anna Doel:

Tell me more about your kids.

Rowena Matthews:

I have two sons. They're both actually interested in computer science. My older son is a consultant. He worked with Paul Horowitz at Harvard who wrote the book *The Art of Electronics*. And who was his mentor at Harvard. That was the person that gave him confidence when he was faltering, and we were far away. Brian does software for companies that make chips. And the chips are particularly challenging because A, it's enormously expensive and if the assembly line stops, you lose a chunk of money. And so the quality control issues are enormous.

And so he writes machine language programs to implement quality control for chip makers. It's an interesting job.

And right now, he's just got back from a bicycling trip in Italy with his family. He too believes in taking time off. And I don't see him that frequently because he's in Boston and he is working, and he can't work remotely. You got to be there when the chip fails, you got to be there. And my younger son I see more frequently, he's not married, he's actually with me here. And he lives in Pasadena, and he's been a volunteer with the Center for New Data doing data science and that he enjoys very much. So those are my two kids. And again, they have very broad interests too.

Anna Doel:

What are your own interests outside of science and the scientific life?

Rowena Matthews:

I'm a news junkie, partly because of my niece, but I read the paper religiously. I enjoy playing Wordle. I still love to garden. I have an acre in Tucson that I have to manage. And it's desert, so it's low maintenance, but there's a lot of work, a lot of clearing, a lot of stuff like that. I have scars all over me from the cactus. I love to cook. I love to entertain. And if I could run a salon, I would.

Anna Doel:

Do you get to entertain much in Tuscan?

Rowena Matthews:

I do, quite a bit. And when Larry was there, we entertained a great deal. We had people over. But I've discovered that yes, if you cook, you can have friends. And so I have a circle of people that are in varying degrees of friendship, acquaintances and some increasingly close friends. And it's curious because making a friend takes a long time and one of the problems of getting old is you make a move and you don't have the connections, the schools, the work together that bring you a community. So you have to think more creatively about how you're going to enrich your circle of friends. And so it's important. And as a widow, you really need friends because otherwise, you're going to be very lonely.

Anna Doel:

So life in Arizona doesn't feel isolated at all?

Rowena Matthews:

Well, occasionally, but no, not very often.

Anna Doel:

And people come to visit?

Rowena Matthews:

People come to visit. But of course, they don't come in the summer. They all leave in the summer. My neighbors all leave. My one neighbor, he was a cruise director for Holland American and he has a bungalow on the island of Texel, which I actually went to last summer. But they go away for four months of the year. And so, many of my neighbors disappear in the summer. I've got a little apartment in an independent living place, which gives me the ability to be social because there are people there that I've gotten to know quite well and I'm very fond of.

And so now I have some summer friends because I really thought it wasn't healthy to live by myself with everybody gone on my block and the Poulters go back to Utah in the summer. Summers are hot in Tucson, but they can be quite beautiful. Those things help. And of course, my HHMI friends, who I really miss. We used to meet in person four or five times a year.

At the point when I was doing my first teaching assignment, non-tenure track, I got a call from the head of my department, Judd Coon, who said, "Rowena, you're not going to believe this, but I have a friend at Michigan State who has a friend in the ad department and this ad department is trying to find women who are scientists and have children to do a Tang commercial." And he said, "You are the only married woman with children that I know." He said, "If you would be interested, would you send a picture to this address?"

Okay. Larry and I sat on a couch looking at photographs and laughing because they were so horrible. And finally, we found a less than horrible picture and sent it off to Young and Rubicam. And the next thing I know, I have a summons to travel to New York for an interview at Young and Rubicam and good thing I've had debate and forensics because there's these people and they're sitting at this table and they have this big console up there and they're video recording me as I'm talking to them, which could be very intimidating, but I'm not easily intimidated.

So we had a conversation like this where they're asking me questions and I'm just answering them off the cuff. And next thing I know there's a whole group of them coming to Michigan to interview the family. Well, I had adorable children at this point. I have this two-year-old who's blonde and just toddling and I have an eight-year-old who's talkative and blonde and very outgoing. And they thought the eight-year-old was just adorable. And it turned out that because the astronauts drank Tang, my kids were drinking Tang. They really were. It was all going to work. So, they said, "Okay, sign a contract. You're going to do a Tang commercial." All right, I'll do it." I thought it would be just a gas. I'd had a very beautiful sister. I was always a little bit the ugly duckling and this is going to be my revenge.

So sure enough, they came and brought a whole wardrobe, a hairdresser, the photographers and this whole thing. We had a whole day set out and we made this Tang commercial, and they did a scene outdoors and they didn't like it. So actually, we all went to the VA hospital without permission and filmed in the laboratory. They liked that a lot. We had a section in the laboratory and then there was a section in the kitchen, that's where the kids are going to drink Tang. And they recognized that my two-year wasn't going to drink very much Tang. So, if it wasn't a good take, they had to take the Tang away. And they were very subtle about it.

But finally, when he finally got the Tang, down it went. And Brian had this speaking part. He had the only speaking part of any child in a Tang commercial. At a certain point I ruffled his hair and said something to him, and he looked at me and went, "Oh mom." And I did it in part just because I thought it would be really fun to do this. I had no idea by the way, I sent them a bill for my time as a post doc when I went to New York because I'd missed two days of work. I think the

bill was for \$26. They must have laughed all the way to the bank because I didn't know about residuals. I didn't know that you got paid and each of your children got paid if you did a commercial. I had no idea what was going on in that respect. They just handled all of that and they were very good about it. I was a member of Screen Actors Guild for two years.

Anna Doel:

Thank you for the conversation.

Rowena Matthews:

It was huge. I just thought it was great. But one of my students said to me, "I work all day. You give me homework, I do it at night. I turn on the tube to relax and there you are."

Anna Doel:

Again. Was it a popular commercial? Did it run a lot?

Rowena Matthews:

Oh, yeah. It paid for the kids going to college.

Anna Doel:

What?

Rowena Matthews:

Really. Every day money would come into the mailbox. It was truly amazing.

Anna Doel:

That's amazing.

Rowena Matthews:

Each of us got \$35 every time the commercial was shown and it was shown a lot.

Anna Doel:

This is a fabulous story.

Rowena Matthews:

And they sent you a check for each one. So piles of envelopes in the mail.

Anna Doel:

Weren't the kids excited about those checks?

Rowena Matthews:

They didn't know about money at that point. They were really young, so no, they didn't. But Brian was recognized by people. He had a certain clout at school because he'd been on a commercial and they knew who he was.

Anna Doel:

Oh, that's such a wonderful story.

Rowena Matthews:

It was great. It was fun, I have to say. And I think my department chair was very amused. But I did it partly that... It certainly wasn't money because I wasn't thinking about that and didn't realize it would be so profitable. But I thought it was great instead of say a woman looking at her wash and saying the ring around the collar's gone, to actually show women scientists with families. I thought that was really rather advanced. And so that was something I was quite proud of. I thought, yeah, that's a good message.

Anna Doel:

Yeah. Yeah. It was for a good cause.

Rowena Matthews:

My colleagues kid me a lot about that. Years later they would show that commercial before I would give a talk. So there's something that probably most of your interviewers haven't done.

Anna Doel:

Feel free to say no to this question. I was curious if you wanted to talk about your sister.

Rowena Matthews:

My sister's an unfortunate person. She suffered, I don't know what was quite wrong, but she definitely had mental issues from the time she was a child. She had tantrums. The amazing thing is that her child is Senator Tammy Baldwin the most well-balanced, imperturbable, a woman who deals with huge security issues and certain dangers and at the same time, smiles and laughs and is calm. And I just feel it as a miracle. But my sister was difficult for Tammy and she was difficult for me. And so that's the reason I don't talk about her very much and I don't think she could help herself. So we all have those issues. Yeah. Did you know about her?

Anna Doel:

I didn't really, but you mentioned her in your autobiography and I think Tammy might have mentioned her publicly. I don't remember.

Rowena Matthews:

Probably did.

Anna Doel:

Yeah.

Rowena Matthews:

She came to Tammy's swearing in as a senator probably also for earlier ones. Yeah.

Anna Doel:

So I just saw a couple mentions in the public sphere and I guess I wanted to ask you how close you were with your sister and what being a scientist yourself meant for navigating this relationship?

Rowena Matthews:

I really saw most of her when I was not a scientist, when I was at home, when we grew up together and she was difficult. She was also very beautiful and I was quite jealous of her because she was the one that had all the boyfriends and stuff, even though she was four years younger than I was. And so I was a little jealous of her because of that. This commercial was when I leveled the score.

Anna Doel:

And on that note, thank you.

PART 4 OF 4 ENDS [02:00:43]