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An Interview with William Fuchsman: The Life and Work of Oberlin's Retiring Chemistry Professor

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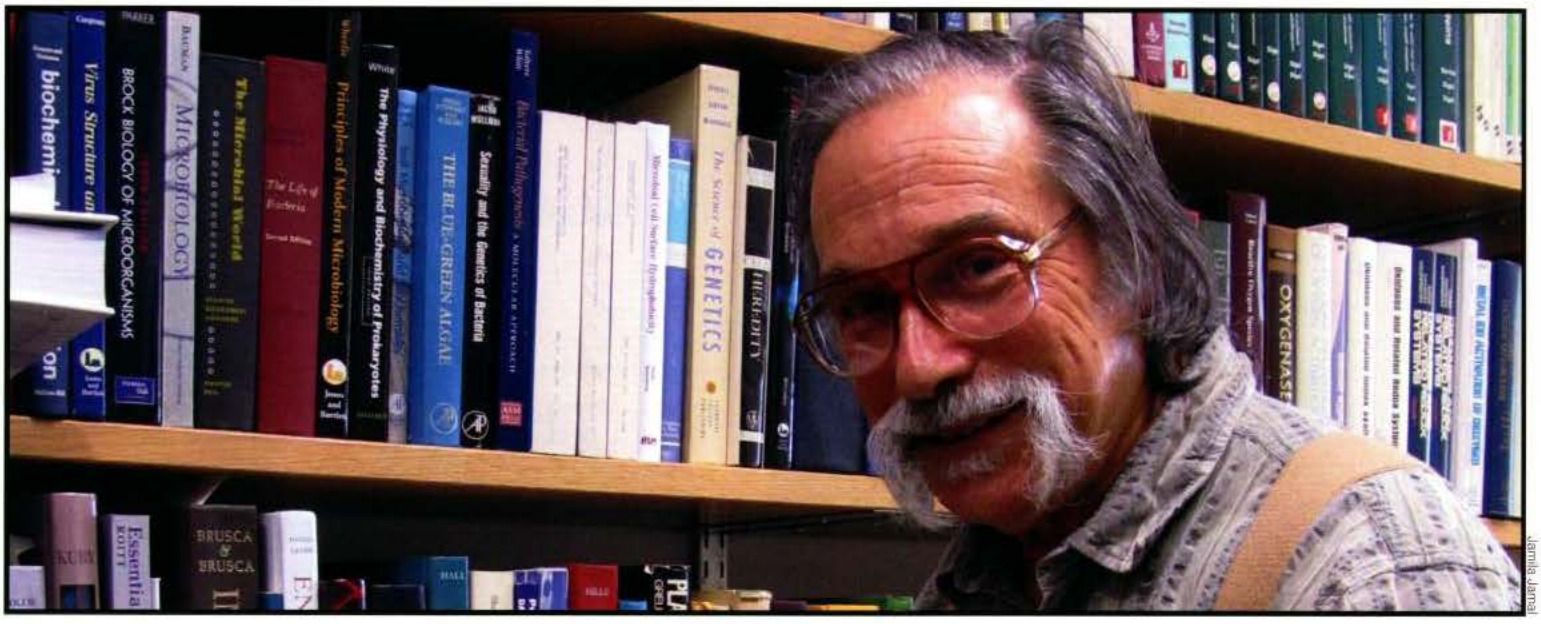

Jamila Jarrah

An Interview with William Fuchsman

The Life and Work of Oberlin's Retiring Chemistry Professor

In his many years as a valued professor at Oberlin College, Dr. William Fuchsman has taught a number of chemistry and biochemistry courses. Now in his final semester here at Oberlin, Fuchsman is teaching Bioorganic Chemistry, the couse he is most well known for, and finishing up a number of research projects. The Synapse sat down with him to discuss his research, career, and various other pursuits.

I was trying to understand your research. Among other things, you're trying to characterize the abilities of hemoglobin and myoglobin [proteins in red blood cells and muscles, respectively] to catalyze reactions of oxygen, right?

That's what it [says online]. My background from graduate school on has had something to do with heme proteins, if that has meaning for you. The heme is the red component of hemoglobin [the protein which transports oxygen on the red blood cell], and it's found in other proteins, and it's important. Hemoglobin, myoglobin, that's what makes muscle red. The heme is ... an aromatic, organic material. That's where the color comes from. It's also a very good ligand [or binding molecule], and it's a ligand to iron. When the iron is in the plus 2 state, and hemoglobin or myoglobin [and] oxygen combine, ... hemoglobin carries oxygen around and myoglobin serves as a depository for oxygen in muscle cells and also facilitates and speeds up diffusion [movement to areas of lower concentration] of oxygen. Oxygen is very small, so it should move rapidly. However, its diffusion requires a concentration difference. Since oxygen is practically insoluble in water you can't get much of a concentration difference, but you can sure get a concentration difference for oxygenated myoglobin in two places. ...[T]hen oxygen is getting where it needs to be in a cell. And it's going there, being carried by myoglobin.

So there are a lot of heme-containing proteins, [like] the soybean leghemoglobin. It turns out that in legumes — soybeans are one of those legumes — nitrogen fixation [plant pulls in atmospheric nitrogen, necessary for survival], which requires a lot of ATP [cellular energy], and one of the ways of making a lot of ATP is by using oxidative phosphorylation.

So you need a lot of oxygen, and the only problem is that the enzyme that does nitrogen fixation is very sensitive to destruction by oxygen. So what you need is to have something that can carry oxygen, something like myoglobin [but functions at very low oxygen concentrations], in the plant cells that have the symbiotic bacteria in them, because the symbiotic bacteria are the things that under low oxygen conditions will [fix nitrogen in the plant]. So you've got to keep low oxygen conditions and provide lots of ATP. This is essential for the plant cell to provide an environment in which the symbiotic bacteria will actually fix nitrogen, [and leghemoglobin serves the role of facilitating oxygen diffusion at very low oxygen concentrations].

I'm still winding down. This is my last year of teaching here at Oberlin.

It is?

Yeah. So I'm trying to finish up. The faculty have a career sabbatical for the semester and winter term after stopping teaching, so I still can do some research, but [after that] there's not room. I can't stay here.

I did a kind of triage on my many unfinished laboratory research projects, to try to figure out which ones nobody would do if I don't. Which ones also do I have a chance of getting done before I retire? And one that I've been playing around with for literally decades, which is not my main line of research, was something I had found by just investigating a little further a procedure that we used to measure quantities of reducing sugars ... Reducing sugars are a class of sugar ... You can detect their presence quantitatively or qualitatively because they serve as reducing agents. They will reduce certain things whose reductions you can monitor [with] a spectrophotometer, or [by] looking at color change for quantitative or precipitation for qualitative assays.

And it is well established in the literature — what happens to reducing sugars — they either have or form aldehyde groups and the aldehyde groups get oxidized to carboxyl groups at high

pH ... and I just started checking out one such procedure that I was using in teaching laboratories first in the biochemistry course and then I shifted those experiments to the bioorganic chemistry course ... that I am now teaching.

I found that the behavior of this procedure did not fit what people said was going on when reducing sugars acted like reducing sugars. And so I've been exploring that because that's been a settled issue for generations, and what all the textbooks ... say is wrong! That's not what's happening to the reducing sugar.

Are you going to write to textbooks?

No, we'll publish this in a journal and hope that textbook writers ... notice.

I'm sure they would be reading it, right?

One hopes.

You've mentioned you had a graduate school background in hemes and hemoglobins. How did you first get led into that area?

Well, I was doing graduate work in a biochemistry department and I had known that I was interested in biological chemistry, probably before I even went to college. I was just interested in chemistry particularly, and I was interested in living things also, and I was interested in combining that. When I got to graduate school, I found that I was more interested in doing... more chemical aspects of biology, rather than more biological aspects. In the department that I was in, the major researcher who was doing more chemical work was the one who was working on hemes, so that's what started it.

So it was kind of almost accidental, then, it was just that he happened to be working on hemes.

Right, because I didn't know much about hemes before starting work there.

You said that you were interested in biochemistry before you even went to college. Do you remember what got you interested in it to begin with or was it just school in general?

The things I was interested in doing, as ... a child was collecting insects ... [and keeping] various creatures as pets. In high school, I worked at the Cleveland Natural History Museum. I went to high school in the Cleveland area, and before that I was in south Texas. I was fascinated by marine biology. Before Padre Island became a national seashore and a "spring break" destination, it was a place near where I lived... We could drive to Padre Island. We could drive on that beach, and we could go where there weren't other people. And I spent some time when I was in ... junior high school ... with a family friend who was a marine biologist, to learn some more about purple sea snails, [and various other marine creatures]. So I was fascinated by these living things and was also interested in chemistry, so I wanted to combine those interests.

Why Oberlin? How did you end up here and why have you stayed?

I had not intended, necessarily, to be teaching at a liberal arts college. Oberlin was the only college I applied to. I was interested in academic work and I applied to some university jobs as well, but I got the Oberlin job, and I have not had any regrets.

What's crucial to my satisfaction in the Oberlin job is two things: working with motivated and capable and interesting students, in terms of courses, but also being able to do serious research. Because there are, as you may know ... liberal arts colleges where the faculty are so pressed to teach what they have to teach that there is no opportunity ... or very little opportunity to do research. Oberlin not only has the opportunity, but expects faculty to be active in their fields.

I like both the teaching and research aspects of my job.

So you've really enjoyed leading a focused academic life.

Yes. But, as you know, it is not so completely focused [on academics]. I am also involved in the Guatemala work, which has nothing to do with my scholarly work.

And how did you fall into that?

During a period of time, when terrible things were happening to Mayan people in Guatemala, there was a human rights effort by people were working with refugees who were then in Mexican refugee camps — refugees from Guatemala. And then [there was] the coincidence of two people who had been working in human rights work in Guatemala, coming to live in Oberlin at the same time as [former Dean of Students Linda] Gates' daughter was about to graduate from Grinnell College. She wanted to do human rights work and the people who moved into Oberlin wanted to form a new organization to help with human rights work in Guatemala. My wife, who has long been interested in anthropology, has a master's degree in [anthropology] from Oberlin College, which once upon a time, offered such degrees. [She] knew terrible things were happening to the Maya but couldn't ... do anything about it, didn't know details. It all came together and they formed an organization, which is SEPA [Santa Elena Project of Accompaniment]. And I was not involved in it for the first two years of SEPA's existence, But when SEPA's first delegation was being organized to visit Santa Elena in Guatemala ... I said two things to my wife. One was, "That's not a safe place to go. You're not going alone. I will go, too!" And the other thing I said was, "Why don't you schedule it for January?" Because then we can take Oberlin College students. ... January 1999 was the first time I went to Guatemala with my wife and some other townspeople ... We met [the student group] in Guatemala City and all went to Santa Elena and I was hooked and I have been back many times since ... and have been involved for many years as the SEPA treasurer and ... have been the faculty sponsor ever since [1999] for the winter term Guatemala project.

Do you have any other main interests or hobbies outside of academia, which you like to pursue or are active in?

I do enjoy gardening. My house is one [where] ... most of the front yard is garden; the entire tree-lawn is garden. My wife and I like to plant. We do a lot of planting of native [to Ohio] plants.

My interest in animals has continued, so I do have pets at home. Currently it's just cats, parrots, turtles, and fish.

I had a pet skunk [once]. I had a hedgehog. The skunk was an interesting character, but the hedgehog seemed really much less interesting ... in terms of its interaction with us.

If you had any advice for young science majors, what would it be, as they try and pursue their careers and get jobs in the academic market?

My advice would be to students who think they are interested in the sciences: at some point, earlier is better, get some experience in a research lab, and find out. Because for some people, research is really attractive, and it's maybe what in the end turns people on to a career in science. And for other people, research is not a comfortable activity. You want to find out early on, instead of thinking that research seems like a very attractive thing to do, and perhaps finding out once you have committed to doing it, say in graduate school, that actually you don't like it so much after all.

Interview by Lizzie Roberts