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faculty interview: pharmacology and toxicology

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Dr. Barnes is a Professor in the Department of Pharmacology and Toxicology with secondary appointments in the Departments of Biochemistry and Molecular Genetics, Environmental Health Sciences, and Vision Sciences. He is the Director of the Targeted Metabolomics and Proteomics Laboratory. Inquiro sat down with Dr. Barnes to talk about his experiences, his research and his advice to students who are interested in research.

Where did you attain your undergraduate degree and what subject did you study?
The University of Surrey in England – Applied Chemistry.

Where did you attend graduate school? What did you study to attain your PhD?
Imperial College of Science and Technology, University of London – Biochemistry – the application of radio gas chromatography to the study of carbohydrate metabolism.

Who is the most interesting person you have worked with, and what area of study did it involve?
Dr. Alan Hofmann – I began working with him in 1974 on bile acid metabolism and we are still talking about it today. When I meet with him, he has so many ideas. I'm exhausted at the end of it. I worked with him when I first came to America at the Mayo Clinic. He is somebody whom you can talk to for hours and hours. He and I have had a 36-year conversation about the evolution of the chemistry of the bile acids – how they're formed, all the forms you see amongst the species, and most particularly, how they conjugate with glycine and taurine. Issues such as, do elephants make bile acids? The grand questions of life.

When and why did you decide to come to UAB?
1977. It followed my visit to the Mayo Clinic with Dr. Hofmann. It was a difficult time in England and I decided that there were better opportunities for development in the USA. I had an offer on the table from Dr. Basil Hirschowitz to join his group.

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What would you say about the atmosphere of UAB's scientific community?

When I first arrived, there was a lot of opportunity to do cross-disciplinary research and few barriers because of the "young" status of UAB. It was a creative period. The atmosphere has changed because it's bigger. Bigger organizations get less personal, it's inevitable. Before, UAB was somewhat compressed. You would meet people much more easily. Now the senior people are more likely to meet outside UAB at an airport than inside UAB, where we are usually so busy. It's amazing how many people assemble at the Delta Airlines counter.

What research is your lab currently focused on?

We're interested in proteins, how they function and defining them using mass spectrometry. These issues have found application in breast cancer prevention, lens cataract disease and liver function.

How do you connect the dots from the biological observation to a discrete chemical explanation?

In the case of breast cancer, we've been trying to understand what the rationale is for the way early exposure to certain dietary compounds can prevent adult breast cancer. It seems that an exposure may occur 30 to 40 years before the first signs of cancer that regulates the extent of cancer risk. We want to know what is doing this – what proteins function as enzymes or signaling molecules?

Our lens research focuses on the biochemistry behind the formation of cataracts. Some proteins in the lens function as chaperones to keep other proteins from precipitating, and when these chaperones fail or are truncated by proteases, proteins precipitate and cataracts seem to be associated with this. What specific proteins lead to this result? Can it be prevented? We've found that external factors such as UV light exposure and diet can affect lens protein composition as well.

The liver function that we study is the conjugation of bile acids. This is important for everybody because these bile acids are the natural detergents in the body. If you can't make enough bile acids or do not conjugate them correctly, you end up with a deficiency of vitamin D, which can lead to rickets, or a deficiency of vitamin K, which will lead to inappropriate blood clotting. So sometimes kids with cystic fibrosis, for instance, who can't secrete enough bile acids, get rickets. It's curable – you give them conjugated bile acids. If you can supply them, the problem goes away. With genome sequencing, we can see where the enzymes evolved from.

What are the benefits to you of having undergraduates in the lab, and what are the benefits to those students from working in a high-activity research lab such as yours?

It's rewarding to be able to identify students with a strong interest in research. I was one myself! I like being part of their development. The right student can have the opportunity to use state-of-the-art equipment and discover if doing research is what makes them tick.

Describe how you feel about the relationship between undergraduate research students and their mentors.

Undergrads are usually good listeners; therefore, it is often an effective teaching experience for both parties. From the mentor's point of view, the undergraduate is usually technically very competent without being experienced. As a mentor you get a lot out of it, because in a short period of time, you can take somebody from a situation where they don't know how to do a thing to becoming quite expert. I know they enjoy the experience, because I enjoy the experience.

What should students consider during the search for a research mentor?

Choosing somebody who is going to teach you both technically and philosophically is very important. You want somebody who is technically able to take you down a research path and work with you to get you over different humps. But is a mentor there to strictly determine what you do? Or is your best course looking for somebody who gives you a bit of space and encourages you to think out of the box? To stop and think about a problem from a very different, elevated point of view. Most of the time, you look at the problem from up close. But can you get the bigger picture? Is the mentor clearly giving you the tools you need when you finish that period of your research training, such that you can effectively go to the next one?

Mentors can encourage thinking a little bit differently. They often won't correct you every time you make a mistake. Part of the learning is to recognize your mistakes and not be afraid of error. Error happens. If you focus only on being perfect, you end up not doing the experiment that your instinct wants to do.

What advice would you give to aspiring research students, or to students who are considering a career in research?

Research is very exciting and there are several ways to make a career in research. Becoming an independent investigator takes a lot of hard work and dedication, not just being bright. Successful investigators combine risk-taking along with systematic investigation. As much as research is needed, it should also be realized that it is a privilege to be allowed to work on your own ideas. Society is letting you do what it won't let other people do. Society is willing to pay for you to try. You are carrying out experiments that perhaps will have a reward for people in general. But maybe not. This was impressed on me, and I use it time and time again with students. When you have to work really hard to get something done, and it's difficult, just remember society is giving you a privilege.