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Your work centers around TonB, a signal-transducing protein that shuttles between the inner and outer membranes of *E. coli*. How is TonB important?

The TonB system is the only known means by which transport processes in the outer membranes of gram-negative bacteria can be energized. In the case of TonB, the signal is energy. Outer membranes pose a bit of a dilemma for gram-negative bacteria. While they protect bacteria from harmful environmental agents, they also limit the availability of nutrients that can diffuse through the protein pores in the outer membrane. In the model system we study, *E. coli*, the TonB system is required to energize transport of iron-siderophore complexes and vitamin B12. It

couple the cytoplasmic membrane ion gradient to active transport across the outer membrane. Recent exciting results from other labs indicate that the TonB system is required for transport of nickel, carbohydrates and possibly sulfate—anything the cells need to acquire through high-affinity active transport. We have recently begun to reconsider whether TonB actually shuttles between the two membranes or remains continuously associated with the cytoplasmic membrane (based on some recent data that open other possibilities).

Do you think TonB can reveal anything about managing disease?

Once it is better understood, we think the TonB system could serve as a target for a novel antibiotic. The ability of bacterial pathogens to acquire iron during an infection can play a key role in the course of the disease. Some pathogens, such as *Neisseria*, can obtain iron from the human iron binding protein transferrin. They use the TonB system to energize that acquisition.

After spending your whole career out west, in 2005 you moved your lab from Washington State University in Pullman, WA, to Penn State. How has the move impacted your research?

I was at Washington State University for 19 years. It was a very supportive academic environment and Pullman was a wonderful place to raise a child. However, I feel it is often good to shake things up in one's life and the timing was right. The move itself was demanding, but by moving in stages, first my home and then later my lab, it was more manageable. In terms of my research, the effect has been very positive – a whole new group of colleagues to synergize with and discuss ideas, new lab space, new equipment, and access to expanded research facilities. The only negative was that it diverted time and energy away from the usual activities, such as writing manuscripts.

What research direction will your lab take in the future?

We would very much like to know how the ion electrochemical potential is used to energize the conformational changes that occur in the proteins of this system.

What do you think is the most understudied microbial system?

The microbes of the oceans.

What is your favorite microbe? Why?

It would have to be *E. coli* of course, because there is such a wealth of information about it available and because it has only one set of *tonB-exbB-exbD* genes. Many of the bacterial genome sequences have revealed two to nine *tonB* genes, which make them hard to study genetically.

What advice would you give students about life as a microbiologist?

I would advise them to lobby for and find work environments that are supportive of families, if they plan to start one. Especially women scientists, whose numbers decrease drastically between undergraduate school and a postdoctoral position. The issue of childcare for women scientists looms large in their decisions about whether to pursue a demanding career in science. On-site or near-site quality childcare is an essential ingredient in bringing more women into science as a career. I would also encourage them to consider how we scientists need to take social responsibility for our discoveries. Jonathan Beckwith's book, *Making Genes, Making Waves: A Social Activist in Science* is a good source to engender thinking about this issue.

What is something about you that most people don't know?

I enjoy cooking, when I have the time.