Roberta Diaz Brinton—A Shining STAR

Dr. Roberta Diaz Brinton

"Typically, diversity is defined in terms of ethnicity, gender, or economic features. But I see diversity from a different perspective. It is at the core of the scientific enterprise. The scientific challenges that face us as a society are too complex, too pressing to be solved by one way of knowing. It is diversity of perspective, analytic strategy, and insight that will lead to diversity of solutions. " *–Roberta Diaz Brinton, Ph.D.*

This issue of *Links* profiles Roberta Diaz Brinton, Ph.D., an NIA-supported researcher. Brinton's compelling story starts with her childhood recovery from spinal meningitis and leads to her work today as Professor of Pharmacology and Pharmaceutical Sciences and Biomedical Engineering at the University of Southern California (USC) School of Pharmacy. At USC, Brinton explores the neurobiology of the aging female brain and its vulnerability to Alzheimer's disease. In addition to her research, Brinton serves as the Director of the USC STAR Science Education Program, an active collaboration with local schools to cultivate new generations of scientific explorers that is supported by the National Science Foundation. In the STAR Program, students join a research team to learn science by doing science in a way that is fun and that matters. *Links* writer Megan Homer talked to Brinton about her scientific interests and her unique personal history. The following excerpts from their conversation illustrate how Brinton uses her passion for science to advance what we know about Alzheimer's disease and make a difference in the lives of disadvantaged youth.

Did you always plan on pursuing a career in biomedical research?
Mine was not a typical career path—it is nothing short of divine intervention that I am a scientist. My family was, by American standards, not wealthy. We had a substantial number of economic, social, and health challenges. Despite these difficulties, at the core of my family was an incredible commitment to the work ethic and a dogged determination to persevere. Both of these traits have served me tremendously well. The cost of college tuition was beyond our reach, so I worked, saved money, took college classes at night, and finally was able to attend college full time at 25. It was not until then that my journey

to become a scientist started in earnest. From that point on, I was on the fast track. I graduated from college in 2.5 years and then went on to graduate school at the University of Arizona.

How did you choose to study cellular mechanisms of learning and memory?
In my first years of graduate school I found my life's purpose in working to understand the mechanisms of learning and memory and, based on those insights, develop therapeutics to prevent Alzheimer's disease. I was studying the neuropsychological profiles of people with brain damage when I observed a pattern. Every person with brain damage, regardless of severity, exhibited significant memory dysfunction. I was fascinated by this – no other domain of brain function was so vulnerable. I decided to figure out why memory was so vulnerable.

Can you tell me a little bit about how you came to investigate estrogen action in the brain?
During my postdoctoral fellowship with Dr. Bruce McEwen, I was invited to observe Dr. Howard Fillit's 8-week clinical trial of estrogen therapy in women with Alzheimer's disease. Howard was interested in pursuing the clinical significance of Dr. Vicki Luine's finding that estrogen increased choline acetyltransferase activity. During this time, I was fortunate to have the opportunity to observe and interact with women who had profound Alzheimer's disease. The effects of estrogen in women with Alzheimer's disease ranged from subtle effects, experienced by many, to a rare but substantial effect in one woman. I was hooked. I had to know how this molecule worked in the brain. This began what has now been a 20-year journey of discovery.

Following your decision to study the cellular mechanisms of learning and memory, how did you get started in the particular area of research on bioenergetics and estrogen?
Women represent 68% of all people living with Alzheimer's disease. So if we are to stem the tide of the Alzheimer's epidemic, it makes sense to determine whether there are features unique to women that makes them inherently more vulnerable to developing the disease.

Our research began with investigating what estrogen does in the brain. This work kept leading us into the mitochondria. The brain is the most bioenergetically demanding organ in the body and is almost completely dependent on glucose for its fuel. Estrogen sustains the brain's ability to use glucose as its primary fuel source, thereby preventing the switch to less

efficient fuel alternatives (such as ketone bodies) that is characteristic of Alzheimer's disease.

Currently, we are focused on determining the earliest events of bioenergetic dysfunction as indicators of impending Alzheimer's disease. We hope to develop interventions to prevent the dysfunction and Alzheimer's disease, particularly in postmenopausal women. At the same time, we are developing estrogen alternatives that will activate estrogen action in the brain (and bone) while being inactive in breast and uterus.

You have been the Director of the USC Science Technology and Research (STAR) program for 20 years. Can you tell me about this work?
People rightly expect that science will help us to discover how the world works and, armed with that knowledge, create solutions to the world's problems.

Dr. Roberta Diaz Brinton with Murchison elementary students

The STAR program is a collaborative venture with an inner city urban ethnically and culturally diverse high school, Bravo Medical Magnet, which is adjacent to USC's health science campus. STAR students conduct research as part of their academic year curriculum and during summer months. They work 50 weeks a year conducting real science aimed at results that really matter. STAR students learn science by doing science. They are valued members of the research team. Most of the students continue to conduct research in college and frequently return to their research at USC during the summer. Their contributions are acknowledged in publications and, when appropriate, the students are included as coauthors.

As I became more familiar with the school system in LA, it became apparent that STAR students were even more remarkable than I realized. They had survived an educational system that discouraged interest in science and math. This led to development of a project to see if we could reach back into the educational system and increase the number of math and science "survivors."

We provide mentoring to elementary school students in science, math and engineering with the expectation that they will eventually matriculate into the high school STAR program. The high school STAR students act as both teacher and role model for the young scientific explorers. Each year we have at least 25 Bravo Medical Magnet high school students in USC labs and another 25 preparing to enter our labs. Plus, we mentor approximately 300 elementary school students.

Creating a new generation of scientists and engineers is a long term, meaningful investment. My philosophy is to not lower standards but to give each student everything they need to succeed in science and math. So far this has been tremendously successful. The STAR Program is evidence that, even under the challenging conditions of urban America, young people can excel in science and math.

What take-away message would you give to students around the country who want to pursue science?
Scientists are real people, like you. The challenges society faces today requires diverse intellects from every sector of our citizenry. STAR students prove that disadvantaged does not mean unwilling or unable, it simply means undiscovered. So, regardless of your socioeconomic or ethnic background, if you want to change the world for the better, become a scientist.