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## Biophysicist in Profile



*Jacqueline C. Tanaka*

The lack of professional role models in her own life inspired *Jacqueline Tanaka's* commitment to make sure that young scientists today have those role models and the support to pursue research.

Born in 1945 in the small town of Zelienople, Pennsylvania, northwest of Pittsburgh, Tanaka was the eldest of six daughters. Zelienople was a homogeneous town with 3,000 residents. "I can't remember a single Jewish family," Tanaka recounts, "there was one Catholic church 'across town' and there were no people of color." It was a mining town, with open strip mines in the area, where many of the men commuted to Pittsburgh every day to work in the steel mills.

Tanaka's mother stayed at home to raise her children, no small task given that Tanaka was twenty when her last sister was born. Tanaka's father worked as a full-time laborer until she entered college, at which time he became a Methodist minister. For several years, he

also served as mayor of Zelienople, so Tanaka grew up under the watchful eye of the entire town. "My parents worked together to strengthen and build their small, rural church," Tanaka says, "and I saw the benefits a strong social fabric provided the community." In particular, Tanaka saw that everyone, from babies to the elderly, benefited from the sense of community within the church. Although she is not religious and has not participated in a church since she entered college, thanks to her parents Tanaka recognizes the benefits of strong community organizations.

Few in Zelienople, where getting an education meant finishing high school, were college educated. Women were encouraged to become elementary school teachers so they would have something to fall back on if their husbands died. But Tanaka's parents encouraged her to be the exception.

Although Tanaka was a strong student in high school, the school was small and non-competitive and did not prepare her well for college. During her high school junior year, she met *Duke Tanaka*, a Japanese-American who was born in a relocation camp at the end of World War II. They became friends through church and started a book club

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together, where they read and discussed books for hours. Tanaka credits Duke with first introducing her to an intellectual life. He also had a strong interest in biology and collected live animals (especially snakes),

as well as animal remains that he found in the woods. He then spent his time bleaching the skeletal remains and carefully labeling the bones with India ink. "Duke had a profound influence on my

life and expanded my small world through his vision and curiosity," Tanaka says, "he was my first mentor."

In her junior year at Geneva College, in Beaver Falls, Pennsylvania, where she received her BA in 1967, Tanaka married Duke and changed her major from Biology to Biology/Education so that she could teach while he went to graduate school. She describes Geneva College as "stifling in every regard, except that the science education was sound." Attending a small college "where the faculty does not do research" eliminates the opportunity for undergraduates to work in a lab. Luckily, Tanaka learned about summer internships and worked in a clinical lab, where she fell in love with research.

While Duke received a PhD from the University of Chicago in neuroanatomy, their daughter, *Vanessa*, was born. A few years later, Tanaka and Duke divorced, and Tanaka suddenly found herself a single parent with an 18-month-old daughter. While raising her daughter, Tanaka attended graduate school at the University of Illinois at Urbana-Champaign (UIUC), where she says the academic atmosphere was "wonderful."

The large UIUC campus offered her opportunities she never had before, including working in a lab, which she loved. It was also at UIUC where Tanaka met then-postdoc *David Jameson* and discovered a fascination with ion channels and nerve conduction. Jameson was immediately impressed with Tanaka's "incredible enthusiasm for science and her irrepressible 'joie de vivre'." He remembers how she wanted to understand how a frog could catch a fly. But just as important was her

tremendous effort juggling her lab work and raising her daughter. "She took both jobs very seriously under very difficult financial circumstances," Jameson explains, "graduate stipends then were significantly less, in both absolute and relative terms, than they are today, and she made a wonderful, nurturing home for her daughter." "Throughout her career," Jameson adds, "Jackie never let herself be pressured into working in research areas that were trendy or perceived to be the most fundable—rather she always concentrated on topics that genuinely interested her and which spoke to larger scientific issues. She also found the time to work with underrepresented and disadvantaged people, especially minorities

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Tanaka went to the University of Pennsylvania to do a postdoctoral fellowship with *Robert Barchi*, in both the Department of Neurology and the Department of Biochemistry and Biophysics. Working with Barchi, Tanaka characterized the ionic selectivity of purified, reconstituted, voltage-dependent Na<sup>+</sup> channels from skeletal muscle.

In 1986, she moved to the Biochemistry Department to work with *Paul Mueller*, examining the properties

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of cyclic nucleotide-gated channels reconstituted into planar bilayers. With some nudging from Mueller, Tanaka wrote an NIH grant to support her own research. A year later, she was appointed Research Assistant Professor in the Biochemistry Department. Mueller left the Biochemistry Department in 1994, and the Chair of the Department of Pathology asked Tanaka to move to the Dental School to pursue research involving a toxin from *Actinomyces actinobacillus*, a bacteria involved in gum and tooth decay. Tanaka found this project to be interesting because the toxin was water-soluble until

it bound to an immune-type cell, at which time it underwent a conformational change and inserted itself into the cell membrane. However, because of problems in the research and in the department, Tanaka wanted to become more involved in undergraduate teaching.

Tanaka remained in the Department of Pathology, working as an Assistant Professor, and then became an Associate Professor the following year. During this time, she became involved with the Penn-Lincoln LASER Saturday Science Program, a program that introduced students from grades 7-12 to hands-on science. Directing the 9th grade chemistry program, which she says was "a lot of work but so much fun," Tanaka and colleague *Katharine Gibson* had total freedom to develop experiments they thought would be both fun and instructive. Tanaka remembers one particular lab where students measured and graphed dye spectra for several commer-

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cial dyes, such as bromophenol blue and bromocresol green. Then they looked at natural dyes from plants such as red cabbage and blueberries. The students titrated the pH of these dyes in 96 well plates and examined the color changes. Tanaka and Gibson tried to incorporate quantitative and graphical skills into the laboratory to increase their proficiencies.

While Tanaka retains her linkages with the University of Pennsylvania as Adjunct Associate Professor of Biochemistry and Molecular Biophysics (BMB) in the School of Medicine, in 2000, she moved to Temple University, where she is currently Associate

Professor of Biology in the School of Science and Technology. Tanaka's work at Temple consists of a tremendous teaching load, including teaching an undergraduate introductory biology course with 350 students. In some ways, she feels the load has caused her research to suffer significantly. "I realize I need to shift the focus to accommodate projects more achievable for undergraduates," she explains. "In the past, almost all the data in my publications were collected by my own efforts. Now this isn't possible and I haven't yet found a successful formula that lets me approach the

problems I see with the tools in my arsenal." Although Tanaka thinks her contributions in the classroom to the next generation of scientists, physicians, and policy makers is valuable, she misses the personal satisfaction that comes from research.

Attesting to the value of Tanaka's efforts as a teacher are the experiences of those she has taught and mentored. *Jamaine Davis*, who worked in Tanaka's lab as a research technician in 1999 and is now a graduate student at Penn in the BMB program, attributes his passion for scientific research and teaching to Tanaka. He describes his initial experience with science research as overwhelming. "It

was like learning a new language," he explains. But Tanaka invested so much time and energy into her lectures, motivating people at all levels of their careers, that her love of teaching and research were contagious. Tanaka gave Davis his first teaching opportunity, working in her lab for a summer project. Through the support of the

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**"While research in biophysics can be addictive and very satisfying, it is important to think about what the global challenges and issues are for our generation and the next."**

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American Chemical Society Project SEED, Tanaka hired five high school students and placed them in different labs. Davis worked directly with one of the students and was responsible for teaching him the necessary background and significance of the

research project assigned. Through this project, Davis says, "I experienced the gratitude in teaching and have aimed to continue teaching and motivating young minds...she [Tanaka] was the catalyst in my professional career and I am thankful to have her as a mentor and colleague."

Tanaka hopes that through her investment in students she has planted seeds that will sprout into minds poised to answer fundamental scientific phenomena.

From 2000-2001, Tanaka also acted as co-director of the Temple Summer Science Research Program. The program provided 10 minority undergraduate students an opportunity to do a summer internship with Temple faculty members in research labs, with the goal of increasing future faculty diversity.



*Jackie Tanaka*, playing defense position for the Americans team in a tournament last spring.

Working with co-director *Jim McElligott* to recruit faculty and select students for 10-week sessions, they would spend at least three hours with the students reviewing their projects and grilling them on what they did to encourage them to be active learners, an approach she learned from *Britton Chance* at the University of Pennsylvania.

To help the next generation of scientists, Tanaka tells them to develop a perspective and think toward the future. "Mankind stands at a crossroads now in our stewardship of the earth," she advises, "While research in biophysics can be addictive and very satisfying, it is important to think about what the global challenges and issues are for our generation and the next. Read beyond your discipline. Encourage your students to think beyond their own culture. Are we rapidly causing the 6th major extinction of all time? If you answer no, how confident are you with the answer? If yes, what are you doing about it?"

Tanaka also encourages young scientists to become active in professional societies, which she has done and from which she has benefited. She served as Chair of the Minority Affairs Committee for Biophysical Society, and on the Executive Board of NIH NIDDK Network of Minority Research Investigators, just to name a few.

Recalling her first Biophysical Society meeting in the late 1970s, Tanaka says, "It was in Washington, D.C., and I attended a packed session on ion channels where *Bertil Hille* paced the side of the room until the speaker finished so he could ask questions. It was alive and competitive but in a wonderful, exhilarating way." Tanaka

believes that the first meeting you attend is often the society you bond with and continue to support your entire life. As the current Chair of the Biophysical Society's Professional Development Committee, Tanaka has worked to coordinate the activities of the various committees to help generate that same environment for the next generation.

Ever the teacher, Tanaka intends within the next few years to start coaching an ice hockey team, planning to introduce urban kids from her neighborhood to the "excitement of a really fast, fun sport." Growing up in an era when women did not have the opportunity to play competitive sports in high school, she is now making up for lost time. Her two nieces, who live in St. Albans, Vermont "where ice hockey reigns," inspired Tanaka to take a skating class. From there she joined a developmental league and four years later has moved up to now playing competitive hockey in a women's league. Playing left defense against teams from as far away as Washington, D.C., and Harrisburg, Tanaka devotes a lot of time to ice hockey and says her only regret is coming to the game so late.

When Tanaka is not out on the ice, she's spending time with her family. She met her husband, *Larry Gladney*, an experimental high-energy physicist at Penn, when his postdoc was renting a room in her house. Tanaka invited Gladney over for Easter dinner and the

rest is history. Her daughter *Vanessa* and son-in-law, both attorneys in Washington, D.C., have two children *Elliot*, age 2, and *Avery*, age 7 months.

Tanaka's current research interest is in understanding the structure-function

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of ion channels, particularly the cyclic nucleotide-gated channel in photoreceptor membranes. She has been influenced by the thinking of the late *Gregorio Weber*, in that you must think about

the energetics of proteins and not just structure or function alone. Tanaka plans to use her sabbatical during the 2004-2005 academic year to achieve significant progress in her research.

While Tanaka claims she is not yet able to identify her "greatest achievement," she says that she will consider it a great achievement when she re-establishes her funding, feels that her class is reasonably well developed, and has five hockey games in a row with no goals against when she's on the ice. Those who know her, however, say that her entire career is a series of greatest achievements, always working to make sure that the next generation of scientists has opportunities and advantages that she never had in her early career.