

## Biophysicist in Profile



Jill Trehwella

Jill Trehwella, currently at Los Alamos National Laboratory, may be a long way from her hometown of Gosford, Australia, but she's never lost the values of her roots.

Gosford, where she was born in 1953, was a small town, where the most exciting events were the installation of the town's first—and for a long time only—traffic light, and the switch from steam-driven to electric trains to carry passengers to “the big smoke”—Sydney.

Trehwella's father John was the local telecommunications technician and her mother Joy managed their home. Although her parents were not scientists, they influenced her in subtle ways that ultimately provided her with the tools that she finds essential to being a biophysicist, leader, mother, and a human being.

As a housewife, Trehwella's mother exemplified perfection in her occupation. She was good at all things domestic and took pride in her work. From her, Trehwella learned how important it is to see a task through until it is done correctly, which has served Trehwella well in her chosen profession. “My mother was a perfectionist,” Trehwella recounts, “and in science everything must be precise.”

Trehwella's father was on call for whenever phone service went awry in Gosford, and she often went with him

when he went to fix them. From her father, Trehwella learned to love all things technical. He also showed her that integrity and honesty were the keys to being a success.

When Trehwella began her education, she was not seeking a career in science. Influenced by her mother's love for mathematics, Trehwella aspired to be a high school math teacher. True to form, in the early 70s she received a teaching scholarship to the University of New South Wales.

Shortly thereafter, the head of the School of Physics approached her and told her she should be in the honors physics program. She was flattered and excited by this and soon dropped her teacher's scholarship, paid her bond, and changed majors.

After graduating with a bachelor's degree in math and physics in 1974, she continued at the University of New

South Wales, beginning graduate studies in crystallography that led to her master's degree physics.

Having married in 1974, Trehwella gave birth to her son Graham in 1976. The timing allowed her to move back to Gosford and stay at home with him for two years, which she lovingly describes as “a very beautiful time in my life.” A few years later, Trehwella moved with her family to be closer to the University of Sydney where her husband was studying for his PhD. There, she decided to go back to school and finish her own PhD, studying under *Peter Wright*, now Professor and Chair of the Department of Molecular Biology at Scripps Research Institute, and becoming his first graduate student in 1978. “Peter taught me not just to do measurements,” Trehwella fondly remembers, “but to really focus on what those measurements taught us about biological function.” He was a young professor

at the time, and she felt she was able to grow with him. His “side-by-side” work style gave her the confidence and experience that helped her career blossom. In 1980, Trehwella graduated from the University of Sydney with a doctorate in chemistry.

Realizing that Australia did not offer postdoctoral programs, Trehwella looked to opportunities in the United States to complete her education. Eager for the chance to go to a place she had previously only known through movies, Trehwella accepted a postdoctoral positioning at Yale University.

The transition, however, was not so easy. New Haven, Connecticut, was a far cry from the Hollywood images of America. Life as a postdoc in New Haven was not quite as comfortable as she had imagined, and she realized that she had been quite pampered as an Australian student. “Although it was a shock,”

Trehwella says, “it was also incredibly exciting.”

In true American fashion, she soon bought a car, learned to make chicken wings in every flavor imaginable, and truly enjoyed herself. Trehwella reflects back that, “it was a time when as scientists we could focus on friends rather than live to be ahead of the game. New Haven was a rich environment, a vibrant intellectual center.” Trehwella recounts that at Yale she and her peers fed off each other's ideas and learned from one another. “At that time there was an attitude that we were working out of a passion and love for science,” she says, “there was less stress then, than there is for young scientists today.” Her appointment ultimately led to a position at Yale University as Associate Research Scientist in 1983.

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Trewhella's research at Yale was in the frontier area of using neutron diffraction to study a membrane protein called bacteriorhodopsin, which captures light and pumps protons across the organism's membrane to create an electro-chemical potential. "It was in the running to be the first membrane protein structure to be solved," she recalls. "History proved it to be a harder structure to solve than anticipated, but we still learned a great deal about membrane proteins and how they sit inside membranes." Although the final results were not what she had hoped for, she was able to implement the skills she had gained in Wright's lab and see a project from conception to the end.

In 1984 she was asked to come to Los Alamos National Laboratory to launch a biological neutron scattering program. With her indomitable energy, she packed up seven-year-old Graham and headed cross-country.

Trewhella started by helping to build a neutron spectrometer, but quickly branched out into using neutrons to study biological structures. *John C. Browne*, head of the Physics division at the time, recalls that he met Trewhella as a new biophysicist staff member, and "Jill's enthusiasm and passion for science bubbled out during our very first meeting."

"Much of my success is due in part to good timing and the support of colleagues and friends—both male and female," Trewhella states. And Los Alamos provided an equally supportive environment. She was amazed at how welcome she felt when she first arrived, and recounts that the wife of a fellow

scientist offered to take care of Graham when Trewhella needed to be away on business or at meetings. As a result of the family-like atmosphere, she never felt that obstacles were insurmountable. "It also helps when your employer has a goal and you understand what that goal is," she explains, "from the beginning, it was a match."

Trewhella did, however, have a vision not shared by all her colleagues. She participated in and also led a few groups of scientists who believed that there was a national need to create a

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multidisciplinary bioscience division, one which would leap across the boundaries of individual disciplines and combine biology, chemistry, physics, and computational science.

After eight persistent years, she saw her vision realized. She received a phone call from Deputy Laboratory Director *Bill Press* one Saturday afternoon asking her to lead the new multidisciplinary Bioscience Division that she had helped to form. Trewhella ecstatically accepted, under the condition that she be considered as a candidate for the permanent position. Her condition was quickly accepted and on January 26, 2000, Laboratory Director Browne named her Director of the Bioscience Division. "Jill is one of those unique scientists who come along only about once every decade," Browne says, "who combine their passion for science with their excellence in research and their leadership skills to make a true difference in an organization."

As director, Trewhella has grown the division by steering it toward new programs in the national security arena, in particular in the area of defense against chemical and biological agents—be they

naturally emerging or man-made. Specifically, she has brought to the fore efforts in microbial forensics, detection and characterization of pathogens and chemical agents, and the science that will provide the next generation technologies to protect public health and prevent the proliferation of biological and chemical agents as weapons. She explains that working in the national labs, and in the Bioscience Division, is more about the team and not just the individual. Peer collaboration is a strength of the environment. Teaming is critical to the Division's ambitious goals, "which aim to break through unknown territory and bring advances in the understanding of and new technology solutions to the problems faced in national security, stewardship of our environment, and protection of public health."

Because of her leadership role at Los Alamos and her multidisciplinary background, Trewhella has been consulted by political officials, agency heads, and even the media. After 9/11, but before the anthrax-laced letters in the US mail, she was designated the lab's spokesperson on all matters relating to bioterrorism. At the time, no one envisioned that the anthrax letters would make bioterrorism the topic that put Los Alamos stage center as the national media sought to find out "who done it."

For a short period, Trewhella was in the media hot seat, endeavoring to be a knowledgeable voice of calm both for her local community and when thrust into the national limelight. Everyone wanted to know how to clean up the anthrax spores and how microbial forensics could help locate the origin of the letters and even the person who was responsible. "This was a huge challenge and a time of much hype and exaggeration," she explains. "I was proud when I spoke to *Tom Ridge* about the anthrax

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letters, and told him that we might not be able to solve the problem. As scientists, especially at the national labs where we provide the technical advice that will form the basis of policy or government action,” Trehwella continues, “we must tell the truth—even if the media and the politicians sometimes would like a different answer. Tom Ridge, I should add, was appreciative of my frankness.”

When *President Bush* was seeking support for his new Department of Homeland Security, Trehwella was asked to brief him on some of the technologies that the national labs had to defend against bioterrorism. Governor Ridge, Speaker *Dennis Hastert*, and Secretary of Energy *Spencer Abraham* were also at that meeting. Trehwella was impressed by the fact that the President took the time to first introduce her to

ored when he listened intently as she explained the relationship between the sequencing power that the Human Genome Project gave us, and our ability to detect pathogens with DNA signatures and to do microbial forensics.

The researchers of Los Alamos Bioscience Division have also been asked to perform testing on possible biological and chemical weapons from Iraq and other nations threatening national security. Trehwella explains that when working with a domestic case, researchers can be limited by a need to follow “evidentiary rules” because law enforcement agencies are looking to prosecute criminal activity. However, when dealing with international cases, “we have the opportunity to push more on the frontiers of new

like they are in the world of science than the world of courts.”

In addition to leading the Bioscience Division, Trehwella has pursued her personal research as the principal investigator on a project called *Structural Changes in Signaling in Calcium Regulation*, for the National Institutes of

Health. The project aims to understand the structural molecular biology of  $\text{Ca}^{2+}$ -dependent signaling. She has also been collaborating with the

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Oak Ridge Structural Biology Center in developing new applications for neutron scattering in structural biology. Other projects her research team is working on include *Structure and Dynamics of Protein Kinase A (PKA) Signaling Complexes*, which hopes to characterize the structures of different isoforms of PKA in order to understand how enzyme regulation and targeting within the cell is achieved.

Besides her work at Los Alamos, she has been very active in her service to the Biophysical Society. *Sig Hecker*, Senior Fellow at Los Alamos, describes Trehwella as a “bundle of energy.... always looking to take on extra responsibility,” which she certainly did with the Society. A member since 1982, she has served as Secretary since 1999, as well as on the Executive Board and Council. She was Chair of the Publications Committee and is now on the Editorial Board of the *Biophysical Journal*, and has been a member of several other committees including the Finance, Membership, Operations, and Public Affairs committees.

“The Society chose me,” she states. “Less than six months after I started at Yale, I went to my first Biophysical



*Trehwella (r) briefing President George W. Bush, Speaker Dennis Hastert and Secretary of Energy Spencer Abraham (Tom Ridge is hidden from view.)*

everyone in the room. “Regardless of what your politics are,” she says, “there is something very memorable about being in the presence of the most powerful man in the country.” She felt hon-

methods and technology and the credibility of the results is evaluated differently than it is in a court of law,” she explains. “Standards and quality are still critical, but they are established more

Society meeting in Boston, “ she recalls. “I got off the elevator and *Emily Gray* (then Executive Director) was standing there and said, ‘hello’. The Society made me feel welcome and Emily exemplified it,” said Trehwella. The next year she presented a paper, and eventually *Clare Woodward* nominated Trehwella for Council. Trehwella feels much has changed in the Society since those days, certainly the size. When she joined, the Society had little over 3000 members, and it now has grown to nearly 7,000. While Trehwella feels it is harder to get to know individual scientists, she stresses that the growth bodes well for the field of biophysics. “It grew from a mom-and-pop Society to something much larger and more professional,” Trehwella explains. “The Biophysical

Society stewards the future of biophysics—it sits at the confluence of the biological, physical and computational sciences and defines one of the most exciting frontiers for 21st century science,” Trehwella states. “The Society has also given me a rich set of collaborators, some of whom I have worked with for close to two decades.”

There is, however, life outside of the lab and the Biophysical Society. Trehwella, married since 1991 to *Don Parkin*, who leads the Center for Integrated Nanotechnologies at Los

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Alamos, enjoys the outdoors. In their spare time they love to ski, and she likes to visit her mother and other extended family in Australia.

Trehwella enjoys all genres of music, a love she inherited from her father, and is trained in classical piano. Her next career, she says, will be as a writer. It seems she has already begun—she won an essay competition when she and Parkin co-authored a short science fiction story called *A Day in the World Science Alliance* published in *Science* as part of their “Visions of the Future” series that celebrated the close of the 20th Century and looked to imagine the world of science circa 2050.

While she says that developing the Bioscience Division at Los Alamos has been her most challenging accomplishment and one she is proud of, her greatest achievement, she admits, has been raising a successful son. Graham, now 27, works for IBM in New York. “It is wonderful to see him living and working independently in his own space,” she says. “He thinks about politics and making the world a better place – and he’s an artist at heart.” Being Graham’s mother, Trehwella proudly admits, “is her most rewarding job.”

Trehwella offers this advice to young scientists: “know that the possibilities are limitless. The best way to be successful is to do the things you love. Science is a demanding master...your integrity must be impeccable but you should enjoy what you do.” Far from her childhood home, she has held fast to her parents’ values and made them her own. “Twenty years later,” says Browne, “she still has that spark in her eyes...I expect Jill will be a strong voice for bioscience for many years to come.”