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# Influences: Experimenting with multidisciplinary training

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I was raised in a small village in eastern China and was destined to become a farmer in rice paddy fields, like my mother and my grandparents. In those peculiar years of the Cultural Revolution, the right to education was unequal depending on one's family origin; I would have been deprived of middle school education were it not for my father, then a primary school teacher, who secured an opportunity for my schooling in a nearby town.

I loved reading, but books were so scarce and precious. I would travel long hours just to borrow a book that survived the destruction and would devour it while walking back home. I have a vivid memory of my weekly happy hour, prompted by the arrival of the children's newspaper, which my parents managed to provide for their kids despite overwhelming poverty.

My destiny was profoundly altered in 1977, and so was China's, when the country announced a new policy to select students for college and professional education through a merit-based entrance exam, irrespective of family origin. I entered Peking University in 1980 and began a nine-year journey in which the pillars for my future development were laid, thanks to three influential mentors. As a third-year undergraduate student of mechanics, I began to take biology courses, during which I met my first mentor, Professor Shouliang Chen, in a physiology classroom. By contrast, my undergraduate and master thesis mentor, Professor Wangyi Wu was an expert in aerodynamics and computational fluid dynamics, but at that time he was moving toward the emerging field of biomechanics. Jointly, they undertook an experiment, with me as the sole subject, to explore the benefits of interdisciplinary training.

During my M.S. years, I also worked on my second undergraduate major under a special arrangement with the Department of Biology. Not only did I take courses required for physiology undergraduates, I also took human anatomy in the School of Medicine and laboratory courses in electrical engineering. In my spare time, I shadowed my fellow senior students visiting hospitals and helping to solve data-processing problems in clinical research. I completed two research projects in my master thesis research. The first was conceptually conceived by my mentor and provided a theoretical and numerical analysis of how vasomotion (rhythmic contraction and relaxation of microvessels) facilitates transmural diffusion in the microcirculation (1). The second showed that the double-concave shape of red blood cells is optimal for transmembrane transport (2), the original idea being inspired by the beauty of the cell as seen in the histology laboratory. My mentors and I were quite pleased, as well as intrigued, that calculus of variations (a mathematical analysis of maxima and minima given a target function and constraining conditions) can precisely predict the shape of red blood cells once their volume and surface area are given.

Peace Cheng with Profs. Chen and He at a Hawaii conference in the summer of 2001. Photo courtesy of the author.

I graduated from the biomechanics M.S. program in 1987. At the same time, I collected a bachelor's degree in physiology, being the only graduate student among the very first cohort of double-major undergraduate students from Peking University. However, Prof. Chen considered the experiment not over yet. In addition to mathematics/physics and physiology, he thought I should reinforce the third pillar, electronic tool-making skills, to prepare for my career in physiology as an experimental scientist. I soon became a young faculty member in the Department of Electronics and Engineering because, as I learned months later, Prof. Chen and his wife Muyan He, also a professor of physiology, paid a personal visit to Professor Chu Wang, who was chair of the

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Peace Cheng visiting Prof. Wu at Peking University in the summer of 2000. Photo courtesy of the author.

department. Under Prof. Wang's tutelage, I was broadly exposed to digital and analogue electronics, laser physics, control theory and engineering, and image compression and processing, and even had my own publications on related topics (3–5).

My pursuit of biomedical engineering was suspended two years later when I chose to leave China as a newlywed to follow my wife, first to Puerto Rico, then to Baltimore, Maryland. There, I was lucky enough to meet my Ph.D. mentor, Jon Lederer, who led me to the forefront of physiological and biophysical research. By combining cutting-edge technologies with innovations of our own, we, together with Mark Cannell, made the surprising discovery of calcium sparks and demonstrated that they are the elementary events underlying cardiac excitation–contraction coupling (6, 7). It is satisfactory to reflect that my mentors' experiments with interdisciplinary training paid dividends in the long run; it provided the foundation for my humble contributions to the pursuit of sparkology over the last two and a half decades.

Continuing to benefit from my multidisciplinary trans-Pacific training and research experience, my dream in biomedical engineering has now been rekindled. I am currently a team leader for the establishment of a high-throughput "brain observatory," which will use, on a scale of 100 setups, our recently developed 2.2-g miniature two-photon microscope for brain imaging in freely behaving animals (8). I am also leading a national effort to build the Biomedical Imageomics Center in Beijing, China. How will these supertools impact our research? How will these "big science" projects influence our next generation of scientists? A new journey is on, and I am wondering what surprises it has for us in the years ahead.

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