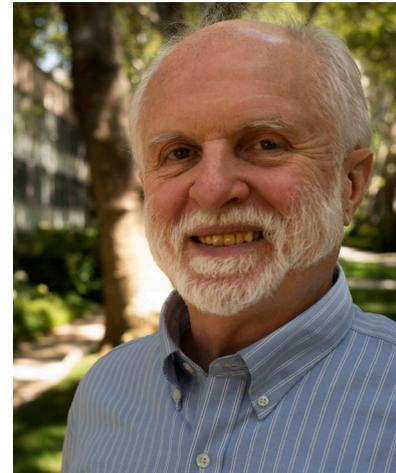


THE KAVLI PRIZE

An Autobiography by:

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Kavli Prize Laureate in Neuroscience 2018



It all started with toads. When I was five years old, my family moved to half a hectare of unlandscaped land at the edge of Houston, Texas. Because this property abutted the largest natural park in the city, I encountered a rich selection of wildlife. By spending much of my free time wandering about the yard, and later the park, I became acquainted with hundreds of animals and their habits. My parents were surprised that I knew where each of the neighborhood toads was to be found at any time of the day or night: I was surprised that they didn't know!

So I was born a naturalist. My younger brother and I amassed a menagerie that included not only dogs and cats, but also a raccoon, ducks, a crow, opossums, armadillos, anole lizards, horned "frogs," venomous and non-venomous snakes, salamanders, tarantulas, and various local and tropical fishes. We specialized in box turtles, which we initially collected, but which subsequently appeared at the fence surrounding the turtle pen, begging for access to the food, water, and companionship that we provided. We eventually boarded more than a hundred of the creatures, which bred prolifically to produce wonderful miniature replicas, each with a tiny egg-tooth. After I departed for college, my brother gradually repatriated over 200 animals to the wild.

Seeking to inculcate a work ethic in his first-born, my father employed me in his law office during summers from an age of eleven years. This experience helped to focus my interests: I learned to hate typing, filing, mailing, and such chores. At this point I encountered the first of several individuals who shaped my career: Peter Kellaway, one of my father's clients. A distinguished paediatric electroencephalographer at Baylor College of Medicine, he provided me with summer jobs from the age of thirteen years until I began college. I learned to fix, section, mount, and stain brain slices; to fabricate electrodes for medical-student demonstrations; and to assist with animal surgery and experiments. I loved it!

My education was a mess. Because I was—and am—quite shy, I spoke little enough in the lower grades of school that I was eventually tested for brain damage, then advanced a grade when none was apparent. In addition to performing photography for an award-winning yearbook in highschool, I organized an amateur crime ring that eventually got me expelled, then reinstated because no authority could determine exactly what I had done. I attended Harvard College during the Viet Nam War, which enlivened the educational process with the threat of being shipped abroad to inflict democracy on the unwilling.

Graduate school was also shadowed by that conflict. With the kindly help of the Registrar, I evaded military service by shifting back-and-forth between Harvard's Graduate School of Arts and Sciences and its Medical School. As a graduate student I served as a teaching assistant in courses for medical students; when I then took the same courses as a medical student, my familiarity with the material enabled me to skip the lectures and return to the laboratory. Sustained by sex, drugs, and rock-and-roll, I somehow received an MD as well as a PhD.

Although my graduate preceptors paid little attention to me—the first graduate student to survive their tutelage—they had a good excuse: Torsten Wiesel and David Hubel were then in the thick of their amazingly productive collaboration to delineate how the cerebral cortex processes visual information. Both consummate scientists, they provided outstanding role models of scientific acumen, rigorous analysis, and precise writing. David was also as great as a lecturer as he was dismal as a department chairman; Torsten was precisely the opposite. I learned an immense amount from both, most of it painfully.

To complete my questionable education, I undertook a postdoctoral fellowship at the Karolinska Hospital in Stockholm with one of the few individuals who was interested in the cell biology of the inner ear. He unfortunately suffered a psychiatric breakdown within a few months of my arrival—not my fault, this time—so I was left to experience the boreal winter without funding, equipment, or guidance. Although it should have been clear by then that I was not destined to be a scientist, I received an offer of a faculty position and headed for California.

The next seven years at Caltech were a great relief. Working very hard, quite literally night and day, my colleagues and I had the good fortune to discover many of the processes by which the ear's sensory receptors—hair cells—transduce mechanical stimuli into electrical signals. We also ascertained how the activity of ion channels tunes individual hair cells specific frequencies of stimulation.

This effort continued during the subsequent seven years at the University of California, San Francisco, which was then at its peak as the world's premier site of biomedical research. In a highly stimulating and collaborative environment, my associates and I progressed from descriptions of hair-cell activity to insights into the biophysical underpinnings. As a matter of necessity, and as a considerable pleasure, I began to remediate my woeful lack of training in physics.

I was next attracted by the alleged opportunity to establish a premier neuroscience program at an institution in Dallas that—like Mordor or Voldemort—should not be named lest it gain uncanny strength. Here again I encountered toads, these in positions of great power. When I expressed dismay that the professorships that I had been promised in writing as recruitment tools were not forthcoming, my office was relocated to a basement, across the hall from the

gross-anatomy laboratory and morgue. That year I was the only inductee into the National Academy of Sciences who was so honored by his institution.

Fortunately enough, I was saved from investigatorial purgatory by Max Cowan and Purnell Chopin, who graciously invited me to join Howard Hughes Medical Institute. And I was rescued from Dallas by Torsten Wiesel, who as President of The Rockefeller University offered me a position on the faculty of that illustrious institution. After weighing the alternatives for several milliseconds, I accepted.

One might ask why, through all of the foregoing, I kept going. Gifted with a fairly depressive character, I certainly asked as much, many times. A good part of the answer was the support of more people than I can acknowledge in this space. Some were the colleagues with whom I have conducted research: 30 graduate students, 13 of them MD-PhDs, and 44 postdoctoral fellows. Most of these are excellent scientists now enjoying successful careers of their own. In view of the importance of research experience early in my life, I have also strived to support the development of younger scientists. Each summer our group accommodates several students—eight during each of the past two years—at stages from high school to Master's programs. Apprenticed to the group's postdoctoral fellows and graduate students, these individuals both contribute to our research and strengthen their vocations as scientists.

My family has also kept me functional and largely under control. My first wife, Maurine, was for 47 years a source of inspiration, kindness, and patience; she accordingly remains my favorite and only wife. Our son James shares her delightful personality and vocation as a physician. He not only serves as an outstanding hospitalist but also organizes and conducts medical teaching in Haiti, India, and elsewhere. Our daughter Ann inherited a personality more like my own—but she got better. After fleeing the United States at the outset of its current wars (this may sound familiar), she is now debating whether to decamp from the imploding United Kingdom for Norway: better check her visa!

There was also a more abstract reason for continuing. Was it mankind's eternal quest for the meaning of it all? Well, yes, some of that. Was it the hope of overcoming deafness? I admit that as well. But mostly it was something else, which I think is the mainspring of true science: aesthetics. The orderliness of nature and the relationship between things is limitlessly beautiful. As a disinterested inquiry into the natural world, science stands alongside art as an embellishment of our species. Both enterprises involve attempts to grasp something ineffable, something beyond the ordinary and obvious. Both are frustrating: a serious scientist or committed artist fails more-or-less daily, with the occasional success serving as a reminder of how much more failure remains to be experienced. And the rewards are sparse, but very real. A gold medal is doubtlessly nice to have, but it scratches easily and must be dusted from time to time. A new scientific insight is both more exciting and more durable.