

# Life Glimpsed through Ion Channels

## *A Super Short Scientific Biography*

*January 23, 2015*

I have been interested in how physical things work as long as I can remember, and in how living things work nearly as long, from the day my father (a physician and then psychiatrist) showed me that was the best way to mold my interests to his approval.

At Harvard John Edsall was my tutor, and he did in fact tutor me, biweekly at first and then (nearly) weekly, nominally in biology, but really in the wisdom of science. (John Edsall was born the son of a Dean of Harvard Medical School, and was a fulcrum for the pivotal change from macroscopic to molecular biology at Harvard and elsewhere, training Bruce Alberts, David Eisenberg, and Jared Diamond among many other distinguished scientists.) My coursework was in physics, chemistry, applied mathematics, and electrical engineering, but, if my memory serves me correctly, not in biology at all. (I actually love evolutionary and descriptive biology as I love collecting classical CD's but those loves are hobbies more than anything else.) My undergraduate thesis solved the cable equation of physiology (the transmission line equations of engineering) with a Green's function, reproducing in an elegant but useless way what I had learned from Morse & Feshbach about heat equations.

My graduate work was experimental at University College London, where my department chairman Bernard Katz was to win the Nobel Prize a few years later. Fortunately, Andrew Huxley (Chair of Physiology at UCL, winner of the Nobel Prize with Alan Hodgkin in 1964 a year or two before Bernard Katz, if I remember correctly) had solved the cable equations the way I had, but much earlier and much more originally and insightfully, and so was happy to spend many hours teaching me, on the side, as if he didn't have enough else to do. My experimental work measured the spread of current in crab muscle fibers over a range of frequencies, using impedance spectroscopy, as it is now rather pretentiously named.

I will not bore you with the many decades of experimental work I did analyzing the flow of current in muscle fibers and then the lens of the eye. I became a Department Chairman at Rush Medical College in Chicago in 1976: the temptation of an Endowed Chair was enough to make a 34 year old move from the perpetual spring of Brentwood (LA) to the recurrent vagaries of midwestern weather. In the 1980's, I started thinking about the theoretical problem of describing ion movement through the water filled tunnels of charge we call ionic channels.

**The ionic channel is where we still are; but gazing through this narrow hole has proven to be rather like looking through a keyhole in a door. The closer you get to it, the further you can see, even glimpsing the horizon (of knowledge) occasionally, even seeing a star or two, when all else seems dark.**