

the antagonist β -carbolines will provide a cure for Alzheimer's disease. At best, we hope they may help treat the symptoms of cognitive impairment in the early stages of the disease process, perhaps thereby retarding the distressing personality changes encountered in the later stages.

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obituary

Stephen M. Schuetze (1951–1987)

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Stephen Mark Schuetze, Associate Professor of Biological Sciences at Columbia University, was killed in an accident in Arizona on 6 October 1987. Five days into a bicycling tour with his wife Roberta Pollock and his older brother Martin, Steve was struck by a logging truck and killed instantly. With this tragedy we lost a vibrant, young scientist who had already made significant contributions to neurobiology and to the lives of those around him.

Steve grew up in the small Minnesota town of New Ulm and was an undergraduate at Washington University in St Louis, where he graduated *summa cum laude* with dual degrees in electrical engineering and physiological psychology. He obtained his Ph.D. at Harvard in 1978, working with Gerry Fischbach on developmental changes in the biophysical properties of acetylcholine receptors at the neuromuscular junction. Following a postdoctoral fellowship with Dan Goodenough at Harvard, Steve joined the faculty at Columbia in 1981. He was recently promoted to Associate Professor with tenure.

Steve's scientific career reflected his dual training as an electrical engineer and a biologist. His primary concern was the central problem of how a pre-synaptic nerve influences its post-synaptic target, using the ion channel kinetics of the acetylcholine receptor as a well-defined signpost. In his graduate work, Steve pioneered the use of focal extracellular current 'noise' analysis with patch electrodes. From these measurements he showed that there are two distinct biophysical forms of the acetylcholine receptor, one specific for adult muscle and one found in immature, developing muscle¹. The different receptors can be distinguished because the embryonic receptor forms a channel with a 3–5-fold longer mean open time. Steve showed that there is a

gradual conversion from embryonic to adult type channel during the first three weeks after birth. During his graduate work, Steve also established what was to become a continuing collaboration with Lee Rubin, when they jointly examined the development of acetylcholinesterase activity at the neuromuscular junction².

At Columbia, with Stefano Vicini, a postdoctoral fellow, and graduate students Fernan Jaramillo, Pamela Middleton, and Brenda Moss, Steve continued to study the mechanism of this change in receptor properties. In a series of elegant experiments, using both biophysical and anatomical techniques, they described the time course of the developmental changes in the receptor^{3–5}. Moreover, they showed that the decrease in channel open time was not due to the development of junctional folds^{3–6}, as had been suggested. They then analysed the differences in apparent channel open time between embryonic and adult type channels using a quantitative kinetic model and concluded that both types of channels utilize similar gating mechanisms, but the adult channels have faster rate constants⁶. Together with Zach Hall at UCSF, Schuetze's group demonstrated that the two channel types are distinct molecular species, since antibodies from a patient with myasthenia gravis blocked the embryonic but not the adult type channel⁸.

Most recently, Steve and his students began an exciting study of how protein phosphorylation modulates receptor function. They found that agents that increase cyclic AMP concentrations in muscle lead to an enhanced rate of desensitization⁹ and with Lee Rubin provided some of the first evidence for a functional effect of ACh channel phosphorylation¹⁰. In collaboration with Lorna Role

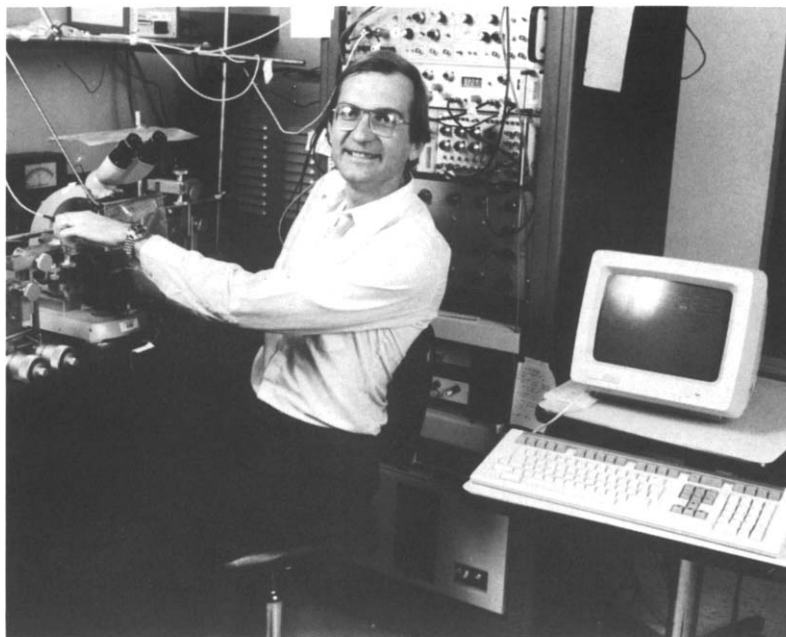
at Columbia, Steve had begun to extend his work by studying developmental regulation and modulation of acetylcholine receptors in neurons.

Steve's interest in electricity started at a very early age. His mother kept a scrapbook in which she noted with a mix of amusement and concern that at the age of two Steve was fascinated by electric cords. At the age of six he drew a picture of himself throwing a large switch amidst a sea of cables – a view not unlike him in his lab at Columbia (see photograph) – with the caption, 'I want to be an electrician'. By eight he had an open account in the local hardware store for electrical supplies. From there it was a short step to becoming a leader in membrane biophysics.

In addition to a deep commitment to his research, Steve was a dedicated scholar and teacher. With Lorna Role, he wrote an insightful review of developmental regulation of nicotinic acetylcholine receptors¹¹. As a member of the journal club of *Trends in Neurosciences*, Steve contributed both historical and contemporary reviews^{12–14}. In addition to his teaching at Columbia, Steve was a faculty member of the Advanced Electrophysiological Methods Course at Cold Spring Harbor Laboratory for two summers and of the Neurobiology Course at the Marine Biological Laboratory at Woods Hole last year. Steve took a real delight in reaching out to those students who were as committed as he.

With a knack for taking complex subjects and making them concrete and intuitive, Steve stimulated both students and colleagues. He had a keen mind and could quickly see through both intellectual and personal pretense. There was absolutely nothing false about Steve, which was why he was such a valued friend, colleague, and teacher. He would always let us know when we were uttering nonsense, but it was always done with warmth and humor. He had the gift of being able to instruct and make the complicated simple without condescension. What made Steve unique, and such a delight to be with, was that his interests did not end in the lab but extended into the world of music, ballet, theater, and biking. Amy Bedik-Siegelbaum, the wife of one of the authors, once remarked, 'He was a great guy, so normal for a scientist'. For despite the importance of Steve's work, his family and friends were always his first priority. All of us who knew Steve and Roberta marvelled at the wonderful relationship they had, how their interests, passions, and even eccentricities were so ideally suited to each other.

Steve's commitment to his work, hobbies and friends was intense; his involvement was never partial. This was evident not only in his carefully thought-out and extensively controlled experiments, but also in his activities outside the lab. When he and Roberta began cycling a few years ago, what started as a means of getting exercise soon led to active participation in the New York Cycling Club. Within a year they were cycling with the most advanced group and had been voted cycling couple of the year.



Steve Schuetze

Steve also had a disarming playfulness that allowed him to take time off from a recent Neuroscience meeting to be photographed at Southfork Ranch outside of Dallas, to consider that the best after-ballet dinner was a Big Mac, and to get down on the floor of the teaching labs at Woods Hole to play with the two-year-old daughter of one of the instructors (despite the nervous glances from some of the more serious students). Steve's decency, his humanity, and his normalcy all made him a cherished colleague and friend. Steve was generous, reliable, and full of life, and as Fernan Jaramillo said, quoting a favorite Minnesotan phrase of Steve's at a recent memorial service, 'Will we miss him? You bet'.

Note

The Department of Biological Sciences at Columbia University has established a lectureship in Steve's memory. Inquiries may be directed to Louise Peterson, Department of Biological Sciences, 500 Fairchild, Columbia University, New York, NY 10027, USA.

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