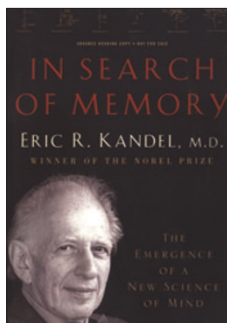


In Search of One's Self



In Search of Memory: The Emergence of a New Science of Mind

Eric R. Kandel

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Reviewed by Joseph LeDoux

Young Jewish boy flees Nazis in Vienna, moves to Brooklyn, stars in academics and athletics, goes to Harvard, becomes doctor, turns to brain research, wins Nobel Prize. This fairy tale is the real life story of Eric Kandel, as told in his autobiographical book *In Search of Memory: The Emergence of a New Science of Mind*. Partly a tale of an immigrant's successful conquest of the new world, and partly the story of a scientist who pursued his passions all the way to Stockholm, it is a fascinating and enjoyable book to read. Kandel writes with clarity and emotion about both his life and his science.

Brain researchers will know much of the scientific story behind Kandel's pioneering research on the neural foundations of memory but should, like me, be fascinated by the historical context out of which one of the leading figures in our field emerged. Scientists in other disciplines will learn about the fusion of brain research and molecular biology that Kandel helped shape, and about his ground-breaking discoveries that have pinpointed cells, molecules and genes in memory. But this is not only, or even mainly, a book for scientists. Its true success is to be found in the graceful translation of complex science into a moving, compelling and easily followed story that seamlessly fuses biography with history and neuroscience. There's even a little sex.

The book starts in the late 1930s just before Austria was incorporated into the Third Reich. Kandel is a young boy in Vienna, where his family is living a modest but happy and culturally rich life when the atrocities begin. People start disappearing and don't come back. His father is arrested (but is released after a few days). Eric and his brother are sent to Brooklyn to live with relatives. Although his parents are not allowed out initially, they too eventually reach Brooklyn, but others they know are not so lucky.

After studying history and literature at Harvard, Kandel decides to pursue a medical degree with an eye towards psychoanalysis (he is, after all, from Freud's Vienna). But during medical school, things change. He decides that the brain, rather than the humanities or psychoanalysis, holds the secrets of the human mind.

In the 1960s, Kandel and Alden Spencer wrote a paper in which they outlined an approach that one might follow to elucidate the neural basis

of memory. The strategy they proposed had several steps. First, select an organism that exhibits a well-defined form of learned behavior and that has a sufficiently simple nervous system amenable to a cellular analysis. Second, characterize the neural circuit that mediates the learned behavior. Third, determine which cells and synapses in the circuit are responsible for learning. Fourth, identify the molecules within the cells that make learning possible. Kandel and Spencer concluded that an invertebrate animal would be a good choice.

The idea that someone interested in the human mind should turn to studies of an invertebrate was radical at the time. Kandel's elders discouraged him. But he stuck to his gut feelings. To this day Kandel continues to study memory in the sea slug *Aplysia*. He and his colleagues have made fundamental discoveries about how cells communicate and how this communication changes, via molecular alterations inside the cells, when the animal learns. Amazingly, the paper with Spencer served as a blueprint for Kandel's work for decades, taking him all the way to the Nobel Prize in Physiology or Medicine in 2000. (The prize was shared with Arvid Carlsson and Paul Greengard.)

Kandel's success in identifying mechanisms of memory inspired many other scientists, myself included, to pursue the memory mechanisms in the mammalian brain by following the Kandel and Spencer strategy. Kandel, too, eventually turned to mammals, especially genetically altered mice. Though progress has been made in relating various forms of memory in mammals to molecules, much of it (though not all) has been based on the fundamental discoveries in invertebrates, especially *Aplysia* and the fruit fly.

The book is at its best scientifically when discussing discoveries about the mechanisms of memory through studies of *Aplysia* over the years. The story is told in detail and with passion, and with lots of personal anecdotes. Kandel points out the contribution of his many collaborators. The energy and detail drop a notch and the pace quickens when he turns to the more recent work on the mechanisms of memory in genetically altered mice, though his enthusiasm for the findings and for their implications for human problems never flags.

One of the most moving passages in the book tells of a sequence of trips he made to Austria starting in the 1980s to give lectures. He was surprised that he was introduced as having once lived in Austria but without any mention of the circumstances under which he left. At first he said nothing. By 1989, 50 years after his flight from the Nazis, he'd had enough. In a lecture at an inaugural symposium for a new molecular institute in Vienna he broke the silence, explicitly describing the painful conditions under which he left, and his ambivalence about being back. The audience essentially ignored his comments. Undeterred, he actively took up negotiations with political leaders in Austria to give stronger support to Jewish agencies, and eventually played a key role in getting the Austrian government to publicly acknowledge the role of Austria in the Holocaust.

In Search of Memory, according to the subtitle, is about *A New Science of Mind*. Indeed, the science of memory, and Kandel's role in shaping it, are amply documented. But the book is not just about Kandel's search for mechanisms of memory via science, but also about his search, via his own memory and imagination, for who he really is now, and who he might have been, had things been different in the past.

The author is in the Center for Neural Science at New York University, New York, New York, USA.
e-mail: jel1@nyu.edu