On the snail trail
Charles Gross

IN SEARCH OF MEMORY. The emergence of a new science of mind. By Eric R. Kandel.

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In 1938, a few days after Eric Kandel's ninth birthday, there was a loud knock on the door of his family's flat in Vienna. Two Nazi policemen entered and ordered the family to leave. When the Kandels were allowed to return, their apartment had been stripped. Soon after, Eric's father's small toyshop was "Aryanized", which eliminated the family's income. The following year Eric and his brother escaped to the United States (and were joined by their parents later). One day in the year 2000, at 5.15 in the morning, the phone rang and Kandel's wife, a French Holocaust survivor and a professor of Sociomedical Sciences answered. It was a call from Stockholm announcing that Kandel had won the Nobel Prize in Physiology or Medicine (together with Arvid Carlsson and Paul Greengard).

In Search of Memory: The emergence of a new science of mind is an account of some of what Kandel did and discovered in the interval between these events.

Beyond autobiography, the book is also an accessible introduction to contemporary neuroscience, the study of how the brain produces thought and action. Included are brilliant vignettes on the history of neuroscience, nostalgia for Vienna, and, curiously, for a modern biologist, homage to Sigmund Freud.

Kandel's major scientific achievement has been the elucidation of the biological basis of learning and memory on a cellular and even on a molecular level. He and his colleagues were among the first directly and systematically to analyse the synaptic events which underlie certain types of learning.

Subsequently, he pioneered the application of methods of molecular biology to understanding the cellular events responsible for short- and long-term memory.

After escaping Nazi Austria, Kandel's family settled in Brooklyn where he attended a Yeshiva, then Erasmus Hall High School and then Harvard. His undergraduate thesis was on the relationship between National Socialism and the works of several German writers. A combination of contact with a girlfriend's parents who were famous psychoanalysts, reading Freud, and nostalgia seems
to have inspired Kandel to become an analyst. With that in mind, he entered Harvard Medical School.

After a residency in psychiatry, he spent several years teaching and completing his own analysis; his interest in Freud and his programme for biology of the mind continues today.

During medical school, Kandel spent six months in the Columbia laboratory of Harry Grundfest, a leading neurophysiologist. When he arrived, he told Grundfest he wanted to study the biological basis and location of the id, ego and superego.

Grundfest was clearly both wise and tolerant and suggested that "to understand the mind we need to look at the brain one cell at a time". And this is what Kandel began to do.

His first attempt at unlocking the secrets of memory was to study the activity of neurons in the hippocampus of the cat, a bewilderingly complex structure known to be necessary for the storage of long-term memory. This initial foray got nowhere.

Then, following a traditional strategy in biology (find the right organism and system for your problem), he turned to a much simpler system: the giant marine snail Aplysia. Its brain has a very small number of cells, some so large that the same cell can be recognized from animal to animal, and their connections mapped. Furthermore, it exhibits the basic types of learning and memory. Kandel and his colleagues carried out a long series of experiments which uncovered the crucial neurons and their synaptic interactions that mediated several types of learning.

He and his colleagues had an enormous influence on the field and spurred a huge "Aplysia Industry". Whether or not the Aplysia can provide the key to the human mind and its disorders may be debated. What is indisputable, however, is that this work provided a guide for the cellular analysis of learning in mammals, and that many of the mechanisms and memory molecules that Kandel revealed in Aplysia turned out also to be present in mammals.

At about the age of sixty, Kandel returned to the mnemonic functions of the hippocampus. Now, using the mouse as a model, the mammal of choice for genetic engineering, it was possible to begin to identify the genes involved in specific behaviours, and the role of these genes in the modulation of synapses that underlie learning. He and his colleagues developed ways of limiting the expression of newly introduced genes to specific parts of the brain and to turn these genes on and off at will.

In the past decade, Kandel has returned to questions that had originally led him to neuroscience research: can brain imaging differentiate the preconscious and unconscious? Can it evaluate the effects of different psychotherapies on the brain and lead to understanding their biological basis? Can genetic engineering methods lead to a rational treatment of mental disease?

In In Search of Memory Kandel treats his former teachers with veneration and gives colleagues and students generous praise. The only negative note to appear is when he discusses McCarthyite baiting of Grundfest, and Austria's failure to come to terms with its past. One of the first pictures in the book is of Jews scrubbing the streets of Vienna with small brushes; in the last, the medical faculty and the Dean of the University of Vienna medical school greet each
other with the Heil Hitler salute.