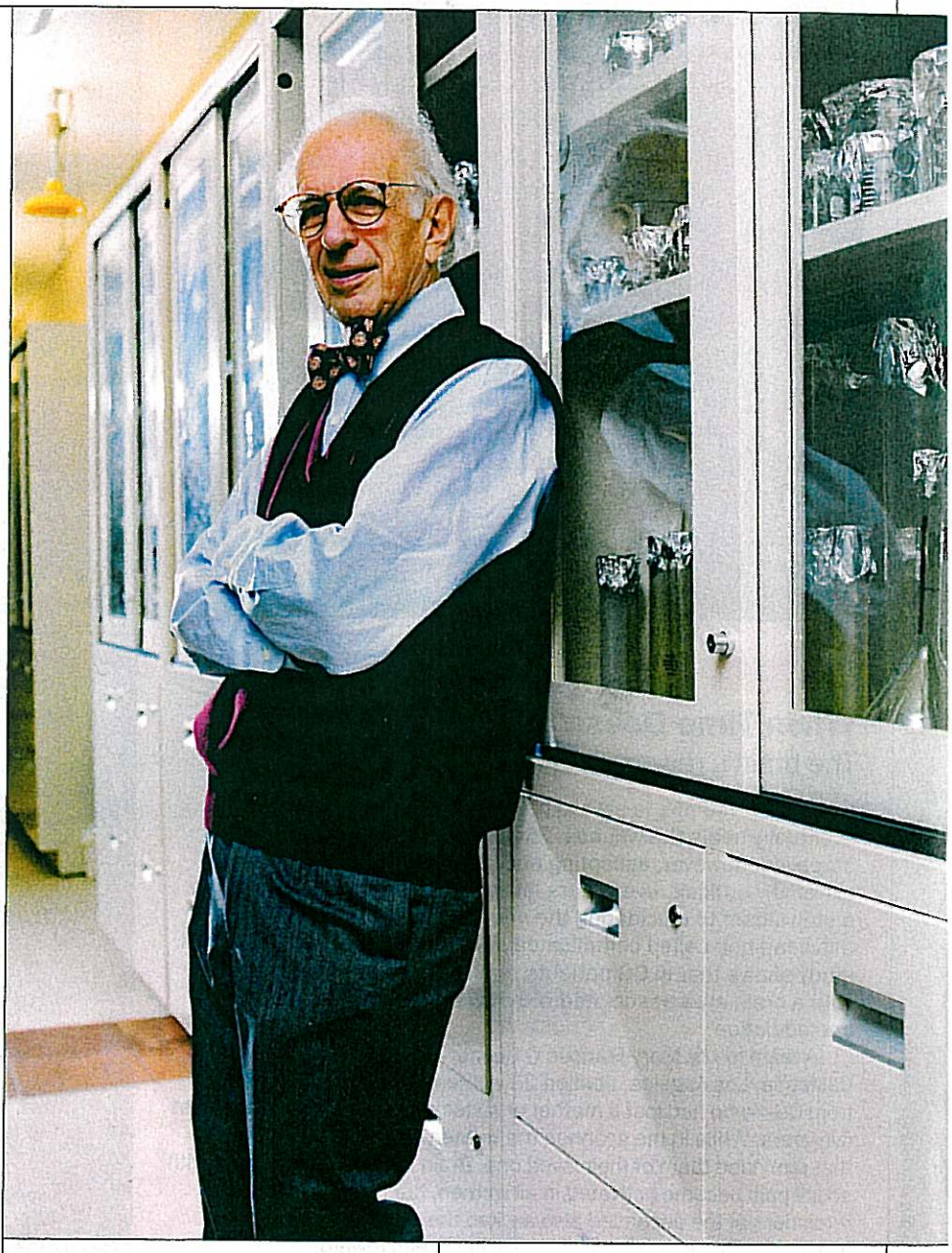
Speaking of Memory

World-renowned neuroscientist Eric Kandel discusses Freud's legacy, memory's foibles and the potential of drugs that boost brainpower INTERVIEW BY STEVE AYAN



ERIC MCNATT

Over the past 50 years Nobel laureate Eric R. Kandel has shaped our understanding of the basic mechanisms of memory through his studies of the primitive sea slug Aplysia *[see "Eric Kandel: From Mind to Brain and Back Again," by David Dobbs, SCIENTIFIC AMERICAN MIND; October/November 2007]. First a student of history and literature and later a psychiatrist, the Vienna-born Columbia University professor and Howard Hughes Medical Institute investigator has emerged as one of the most prominent brain researchers of the century.*

SCIENTIFIC AMERICAN MIND: Do you see the humanities and natural sciences as separate realms, or can they be unified?

ERIC KANDEL: I think they can—and the biology of the mind is one of several possible bridges between them. But unfortunately, today people from different academic backgrounds do not meet and talk to each other so much. This was once quite different. For example, in Vienna at the end of the 19th century, uncovering the unconscious was a project shared by scientists, artists and writers alike. People such as [writer and doctor] Arthur Schnitzler, [painters] Gustav Klimt and Egon Schiele, and [artist, poet and playwright] Oskar Kokoschka exchanged their ideas with scientists and other intellectuals and scientists in literary circles.

MIND: Do you regard Freud as a scientist?

KANDEL: His aim was clearly scientific, but his methods weren't. Until 1894 Freud tried to develop a neurobiological view of the mental apparatus. But because of the limited knowledge of his time, he finally gave up on that idea. Although Freud kept on working in a fairly systematic way, his ideas lacked an empirical foundation. But to my mind, the problems with psychoanalysis arose with those who came later. Freud's followers should have tried to verify at least some of Freud's postulates using empirical methods. Instead they treated him as if he were a guru. Nevertheless, we have profited from Freudian ideas. For example, he bridged the gap between mental disease and mental health, seeing the same unconscious mechanisms at work in both.

MIND: Why is the unconscious so fascinating to us?

KANDEL: Because 80 to 90 percent of what we do is unconscious. When we

speak, we use presumably correct grammatical structures while paying little if any conscious attention to this grammar. And we act in lots of other ways without having the slightest clue what we are actually doing. Much of our urge to understand the unconscious arises from the spooky feeling that there is something within us governing our actions.

MIND: How does the modern understanding of unconscious processes differ from Freud's?

KANDEL: Freud first proposed one fundamental driving force, the libido, and later, in response to the horrors of the First World War, added the "death impulse" Thanatos. These are very broad categories that brain research cannot really deal with. But Freud did not think there was a unified unconscious. Instead he came up with a topology of different forms: the implicit unconscious representing motor and perceptual skills, the preconscious filled with material we can readily become aware of, and the dynamic unconscious in which, for example, instinctive impulses are suppressed. With modern neuroimaging techniques, we are finally able to discover what the brain is doing during conscious or different forms of unconscious processing.

MIND: We tend to think of memory as a kind of library that holds a record of events and facts that can be retrieved as needed. Is this an accurate metaphor?

KANDEL: No, memory is not like that at all. Human memory reinvents itself all the time. Every time you remember something, you modify it a little bit, in part dependent on the context in which you recall it. That is because the brain's storage is not as exact as written text. It is always a mixture of many facades of the past event: images, pictures, feelings, words, facts and fiction—a "recollection" in the true sense.

MIND: Have you ever found it hard to imagine yourself, your personal identity and memory as made up of molecules and the firing of neurons?

KANDEL: No, I like this idea. Some people think that finding out about the biological mechanisms behind our mental world takes the mystery out of it. I never felt that way. When you find out how Austrian expressionist Kokoschka scraped the paint onto the canvas with his finger, does that knowledge make his art less interesting? I don't think so. It is the same with the mind and body. Knowing that the heart is a muscular pump pushing the blood in our vessels doesn't make the heart less wonderful either.

MIND: How do you think brain research techniques might seep into everyday life? Do you think the brains of suspects in court or even job applicants might one day be routinely screened?

KANDEL: That should not be allowed in a democratic society. And the same holds true for DNA or fingerprints or any other kind of private biological information. The government has no right to that information. But this should not prevent us from developing powerful methods to study the mind and brain. Everything can be misused. It is society's job to ensure that it is not.

MIND: What do you think about brain enhancement, an area that is quite familiar to you?

KANDEL: Yes, I helped start a company to try to develop drugs that can improve memory. At the moment there is nothing that has been proved both effective and safe in people for that purpose, although many companies are working toward this goal. Cognitive enhancement should be good for people who have trouble learning and remembering, say, because they are old. I would not recommend that my grandchildren take such drugs, however. There is a much better way for them to improve their minds—and that is to study!

MIND: Do you think brain research will change our culture and the way we think of ourselves?

KANDEL: Slowly but surely it will. It is beginning to do so, as the notion that every mental act comes from the brain becomes common knowledge. The mere fact that most people are no longer [mind-brain] dualists is a major cultural advance.

MIND: One last question: If you were granted one wish, what would it be?

KANDEL: I would like to know how some memories persist forever. How do you remember your first love experience for the rest of your life? Neuroscientist Kausik Si, then a postdoctoral fellow in my lab, and I discovered a protein called CPEB that has the very interesting characteristic of self-perpetuation. That might be a clue to how memory is sustained over long periods. But we don't know for sure yet. **M**

STEVE AYAN is an editor at *Gehirn & Geist*.

> "Memory **reinvents itself**," Kandel says. "Every time you remember something, you modify it a little bit."

(Further Reading)

- **In Search of Memory: The Emergence of a New Science of Mind.** Eric R. Kandel. W. W. Norton, 2006.
- **Memory: From Mind to Molecules.** Larry R. Squire and Eric R. Kandel. Roberts and Company Publishers, 2008.