Getting Into Einstein's Brain

Albert Einstein had one of the greatest scientific minds of all time — but did he also have one of the greatest brains?

Anatomist Marian Diamond and coworkers recently attracted a fair amount of attention when they reported that there was indeed something special about Einstein's brain. The scientists, of the University of California at Berkeley, obtained minute pieces of the physicist's gray matter from a Missouri pathologist who performed the 1955 autopsy. They examined four sections from the upper front and lower rear of both hemispheres; these areas are thought to be involved in complex thinking and calculation.

The investigators found that at 76 years of age, Einstein's brain contained more glial cells per neuron in all four areas, compared with the autopsied brains of 11 men of average intelligence, aged 49 to 80. Neurons are involved in basic thinking processes and do not increase in number. Glial cells support and nourish the neurons and can multiply. Diamond has also shown that rats put in enriched environments develop more glia per neuron and larger neurons than rats in less stimulating surroundings, regardless of age.

The difference between Einstein's brain and the normals, however, was statistically significant only in the left rear section, which serves as an "association area for other association areas in the brain," explains Diamond.

The temptation, then, is to assume that Einstein had greater intellectual processing in at least one discrete, highly evolved region of the brain. But that temptation should be resisted, warned several scientists — including Diamond — at a recent meeting in New York City on the "Neurobiology of Intellectual Giftedness."

"We're not sure what [the statistical difference] means," cautions Diamond. There is a possibility that Einstein's association area was unusually rich in glia, she says, but "the statistics are for one brain versus 11 normals; they're essentially meaningless." Even if Einstein had a gaggle of glia, it is impossible to say whether he was born with them or developed them over time, she says.

Adds Stevan Harnad, editor of THE BEHAVIORAL AND BRAIN SCIENCES in Princeton, N.J.: "You can make an infinite number of inferences from this one sample. Would there have been a difference between Einstein's brain and those of ordinary 'gifted' academics? If you had a population of Einstein brains and a population of normal brains, the data generated still would not say much about intellectual giftedness until we better understand normal brain function."

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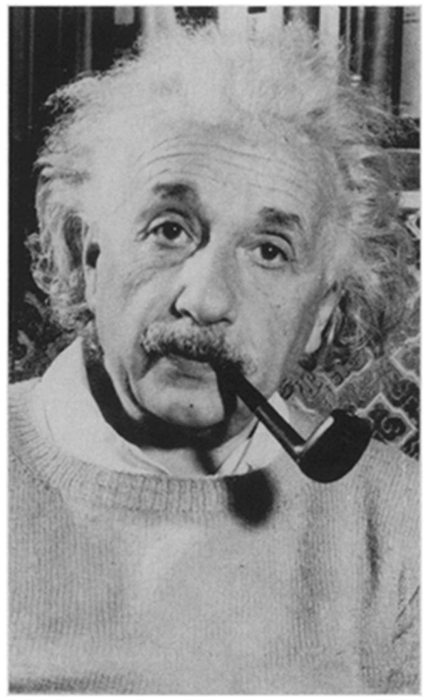

The neurobiology of a brain, whether it was attached to a Nobel Prize winner or a 9-to-5 clock puncher, has little to say about intellectual prowess without a better understanding of the mechanics of thinking, asserts psychologist Howard Gardner of Harvard University. To start with, he suggests that scientists explore a number of "domains" that demand different types of intelligence, measure information processing in the brain across microseconds and study developmental experiences that affect intellect.

"You have to study [the process of] extraordinary performance before studying its neurobiology," argues Gardner. Einstein, he says, might have demonstrated only average ability on some intelligence tests, such as those that measure reaction time. "Nevertheless, I think his strength was in designing long-term projects and rigorously testing his ideas," notes Gardner. "This is very hard to measure with psychological tests."

As data on thinking and intellect slowly emerge, they should be combined with new neurobiological findings, holds neurosurgeon George Ojemann of the University of Washington in Seattle. Preliminary work by Ojemann and his colleagues indicates that not only glial cells, but also dendrites — the threadlike extensions of neurons that receive information — are integral to an advanced intellect. Dendrites begin to branch out and become more complex farther away from neurons in brain areas concerned with speech and thought, he reports. In other regions there is less branching, and individual dendrite segments are longer. With intellectual development, he points out, new dendrites seem to push out and sprout a profusion of branches in specific parts of the brain.

"But at this point, [brain investigators] have a data base problem," says Ojemann. His experiments are a good illustration: The dendrites of 30 neurons out of trillions have been studied so far, in about 15 subjects.

In other words, the research is in its infancy. The relationship of glial cells and dendrites to intelligence may become clearer as it matures.

For now, the best insight into Einstein's tremendous powers of thought comes from the writings and musings the physicist left behind. He often said that one of the most important things in his life was music. When he encountered difficult situations in his work, he took refuge in music and felt that this often helped him to resolve scientific problems.

According to Ernst Strauss, a mathematician and former assistant to Einstein, the revered scientist responded to colleagues who inquired about his way of thinking by saying: "All I have is the stubbornness of a mule; no, that's not quite all, I also have a nose." By this he meant a nose for the right research direction and the recognition of the right answer.

These explanations do not satisfy modern scientists sniffing out clues to intellectual functioning, but you could do worse than to study Einstein's brain with Einstein's "nose." — *Bruce Bower*