ESSAYS ON SCIENCE AND SOCIETY

In Search of Einstein's Genius

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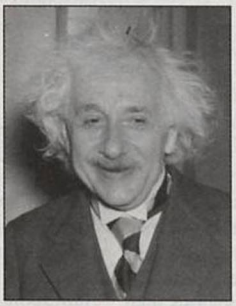
Ask people who they associate with the word "genius," and they will invariably respond "Einstein." One could argue that Newton, Archimedes, Shakespeare, and Confucius displayed genius of the same order, but our popular culture has rendered an overwhelming verdict. Advertisements display his mythic status: Einstein with his flowing silver hair and dreamy smile next to a caption reading "Relatively speaking, [so-and-so] has the best prices for...." His likeness turns up in college dorm rooms and on T-shirts, and *Time* magazine voted him Person of the [20th] Century. Recently, Einstein (or at least his brain) has even starred in that quintessential American genre, the cross-country road trip.* All this would be unthinkable for any mere scientist—seen any T-shirts depicting Niels Bohr lately? But for a cultural icon, for a mythic figure like Einstein, for a genius, it seems fitting.

As with any good myth, the general public harbors a rather fuzzy understanding of Einstein and his work. We associate him with "genius" and "relativity" and with various reports of his eccentricities. But what of his science? How many people know why he won the Nobel Prize for Physics in 1921?—it was not for relativity, but for the photoelectric effect. His science is of a special kind for it deals not with minute details hidden from ordinary view—electrons circling an atomic nucleus or a chain of nucleotides in DNA—but with the vastness of the universe, space and time. His discoveries about the speed of light were ideas that the man in the street could contemplate. They possessed philosophical and even theological implications: Can God move faster than light?



At the beginning of the 20th century, when Einstein proclaimed the implications of the speed of light as the cosmic speed limit, new forms of transportation were on the horizon: The automobile and the airplane, along with the familiar locomotive, held the promise of ever-speedier travel. An optimistic mind could easily picture machines that could go even faster—and perhaps even infinitely fast. How, then, must the world have felt when it came to know the meaning of an absolute, inviolable speed limit, the c in $E = mc^2$? No matter how much our technology developed, we could never advance to the point at which we could go faster than the speed of light.

As with many great scientific discoveries, from Copernicus's revelations about the solar system to Darwin's insights on evolution by natural selection, Einstein's theories push us to question our deepest beliefs. Of course, that is precisely what makes these discoveries so great: they supersede tenets previously held unquestionable. How could Einstein have sat down at his desk, pondered the universe and deduced that space is curved and that time can slow down? What was it about Einstein's brain that made him so brilliant?

This question was no doubt on the minds of many when Einstein died in April 1955 and his brain was removed during the autopsy. As Einstein's brain hardened in formalin over the ensuing days, the press speculated about what clues to genius it might contain. But for three decades no information about Einstein's brain was forthcoming. Instead, it ignominiously sat in 240 pickled pieces, stored in a jar in the office of the pathologist who performed the autopsy.

Then in 1985, a team of Berkeley neuroanatomists obtained a few pieces of Einstein's brain. Their previous research in rats suggested that increased mental activity resulted in an increase in a certain type of glial cell. Sure enough, they found a greater number of these cells in each of the four sections of Einstein's brain than in control brain sections (although the difference was statistically significant in only one of the four sections, casting doubt on the reliability of the investigators' conclusions).

Finally, last summer, 44 years after Einstein's death, the first comprehensive anatomical study of Einstein's brain was published.† Researchers at McMaster University found that the parietal lobes, an area important in spatial and mathematical reasoning, were wider in Einstein's brain than in brains from individuals of a similar age at death. Furthermore, the Sylvian fissure, a groove normally running through the parietal lobes, was largely absent—a unique feature that may have allowed the brain's neurons to connect more effectively with each other. Despite these morphological peculiarities, Einstein's brain turned out to be no bigger than normal (in fact, at 1230 grams, it weighed slightly less than average). What do these findings reveal about the origin of genius?

The most important question may be why we perform these analyses at all, and what we really hope to find. Just as Einstein captured the essence of energy and matter in his famous equation, so we seek to capture the essence of genius. Our pursuit perhaps reveals more about ourselves than about the nature of genius.

Humankind seems to yearn for genius—to be reassured of the vastness of human potential. But who can say where genius lies or if it can be located and measured at all. Perhaps we must accept the reality, just as we have had to accept a cosmic speed limit, that genius cannot be measured, that the processes by which some human brains create revolutionary insights reflect the intermingling of culture, history, and life experience and not simply the amount of gray matter. The insights into genius will likely not be found in finer slicing, but rather, like Einstein's theories, in some more unifying model.

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*M. Paterniti. *Driving Mr. Albert: A Trip Across America with Einstein's Brain* (Dial Press, New York, 2000).
†S. F. Witelson, D. L. Kigar, T. Harvey, *Lancet* **353**, 2149 (1999).

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