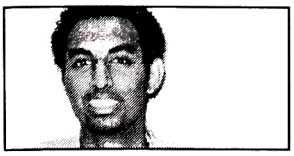
The Mind of a Genius

An Exploration of Albert Einstein's Brain



Jayant Ramakrishna

Dr. Sandra Witelson leads investigations into the physiological basis for Albert Einstein's genius.

McMaster University Professor of Psychiatry and Behavioural Neurosciences, Dr. Sandra Witelson, is the leading researcher on Einstein's most vaunted possession: his brain. Witelson and colleagues study measurements, photos, and pieces of the brain that have remained undisturbed for forty-four years, stored in a jar.

Albert Einstein, one of the world's most notable physicists, died in 1955 from a ruptured aneurysm of the abdominal aorta at the age of seventy-six (Witelson et al., 1999). In order to keep Einstein's brain for future research, Dr. Thomas S. Harvey, who removed Einstein's brain soon after his death, freely suspended it in a ten-percent formalin solution. The fresh weight and dimensional measurements were taken, and ten-percent formalin was injected into the internal carotid arteries to ensure future preservation.

Only in the last decade has access to and study of Einstein's brain been possible. Witelson's findings may serve to be the stepping-stone that the scientific community needs in order to reveal the mysteries and secrets of Einstein's brain and genius.

Brief Anatomy of the Brain

The human brain consists of four lobes or divisions, as seen in Figure 1. Each lobe, and its respective subsections, is responsible for different functions. The frontal lobe is important for reasoning, speaking, comprehension, language, musical perception, and movement. The temporal lobe is responsible for hearing while the parietal lobe processes spatial thought and sensory information. The occipital lobe governs visual functions (Kolb et al., 2001). The Sylvian fissure is a morphologic feature of the human

Dr. Sandra Witelson is leading research on the unusual brain of Albert Einstein.

brain, which divides the frontal and temporal lobes. The postcentral sulcus is another surface landmark in the anterior part of the parietal lobe. Recognizing the markers of a typical human brain allows for the accurate understanding of how Einstein's brain differs from the brain of everyday individuals.

Initial Findings

Upon the initial measurements of Einstein's brain, it was found that Einstein's brain weighed 1230 grams, which was within the normal range for a male of his age. The first major study was conducted by Marian Diamond, Arnold Scheibel, Greer Murphy, and Thomas Harvey, who had removed Einstein's brain. These scientists examined four specific areas, labelled area 9 and area 39, of the right and left hemispheres of the cerebral cortex (Fig. 2).

Area 9 is located in the frontal cortex and is critical in planning behaviour, attention, and memory, while area 39 is located in the parietal lobe

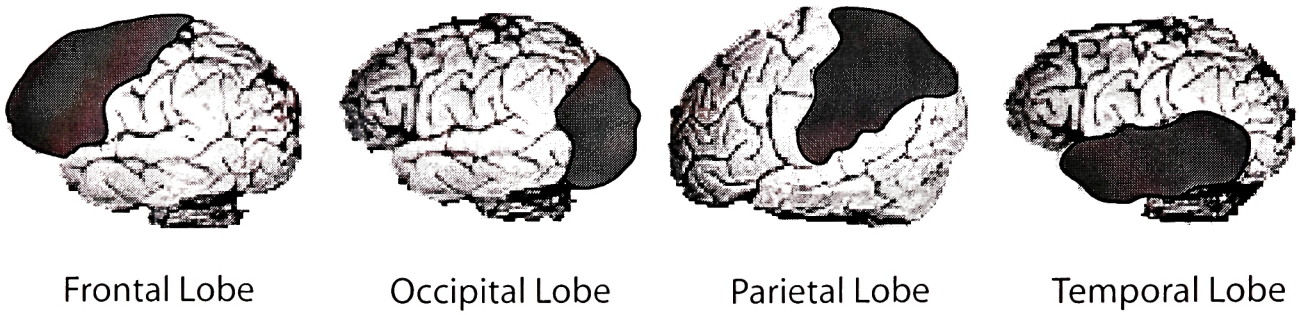


FIGURE 1
The four lobes of the human brain. <Source: Digital Slice of Life>

and is important for language and spatial functions. The researchers analyzed these four areas for their neuron and glial cell counts, which were compared to the brains of eleven other men of an average age of sixty-four. By analyzing the number of neurons (excitable cells specialized for the transmission of electrical signals over long distances) and glial cells (the supportive tissue of the brain), it was hoped that some histological differences of Einstein's brain could be uncovered (Kolb et al., 2001). It was found that in these four areas, the neuron-to-glia ratio of Einstein's brain was much smaller compared to those of the specimens of the eleven normal brains (Diamond et al., 1985). The greater number of glial cells per neuron may be indicative of an increased metabolic requirement of Einstein's brain; his brain needed more energy than that of the average man. Thus a hypothesis was formed where the increased energy usage by Einstein's brain enabled him to perform a higher level of thinking, which was characteristic of many of his groundbreaking theories.

DISSECTING GENIUS: MCMASTER'S CONTRIBUTION

The next phase of research was led by McMaster's Dr. Sandra Witelson, who improved upon previous experiments in order to delve deeper and further understand the anatomy and physiology of Einstein's brain. Witelson and her team compared thirty-five normal male brains to the experimental brain and discovered major differences. Einstein's brain was found to be 15% wider than the average human, roughly one centimetre wider on both parietal lobes

FIGURE 2
Approximate locations of areas 9 and 39. <Source: Digital Slice of Life>

(Witelson et al., 1999). His brain also had a unique pattern of sulci (grooves) on both the right and left parietal areas, because the Sylvian fissure had a strikingly upward deflection into the postcentral sulcus and was noticeably shorter than the normal specimens (Fig. 3). Witelson theorized that this unusual parietal and fissure configuration provided more favourable connections between the neurons in this region. Since the parietal area is also involved in math and spatial reasoning, these improved connections could hypothetically account for Einstein's mastery of spatial reasoning and advanced mathematics. If it is indeed the unique organization of Einstein's brain that attributed him with such a rare intellect, then is there a specific brain configuration for genius type individuals?

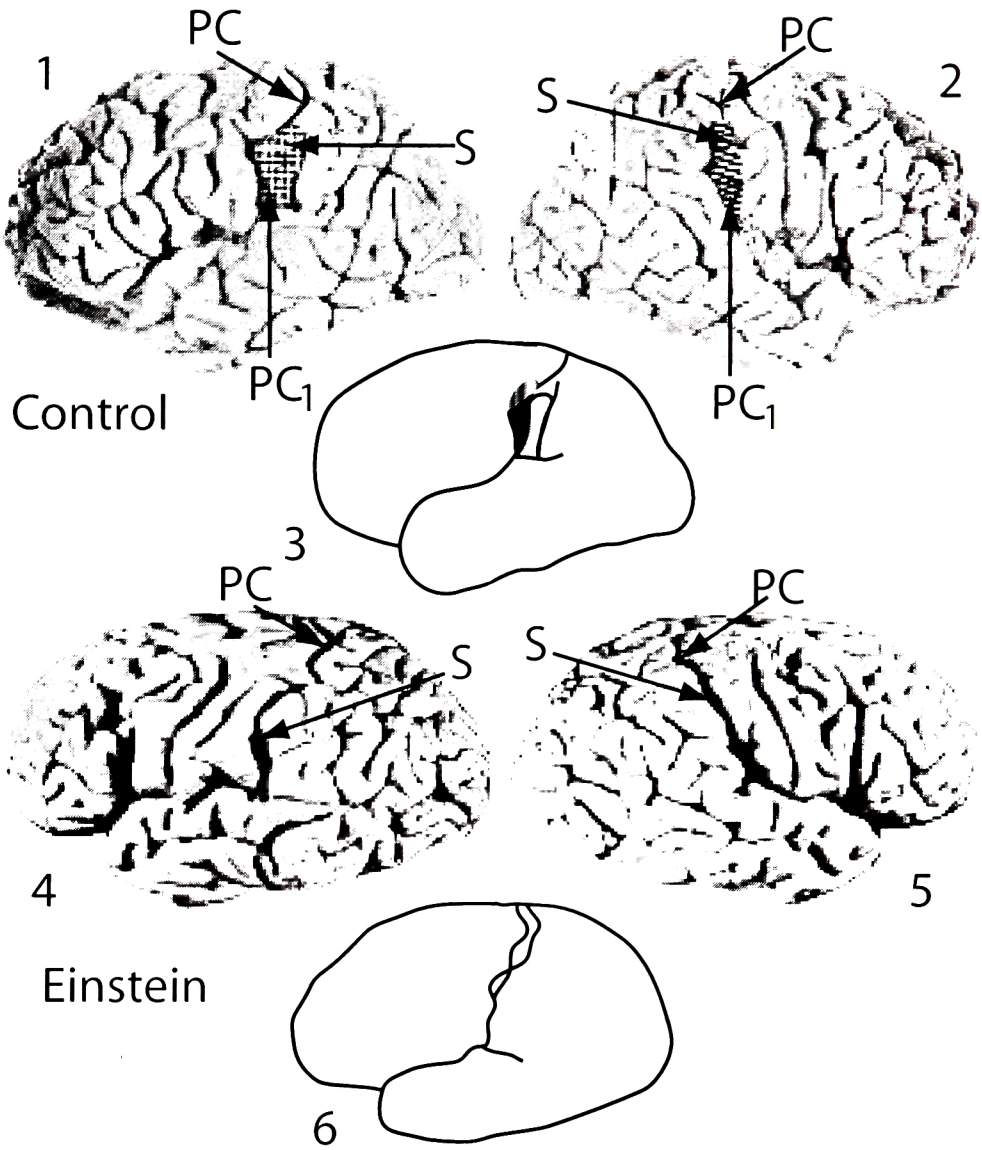


FIGURE 3

Fissures and hemispheres of a typical control male brains (1, 2, 3). Einstein's brain (4, 5, 6) has a unique pattern of sulci that includes an upward deflection of the Sylvian fissure. <Source: S. F. Witelson, Lancet, 1999>

THE FUTURE...

Witelson's discoveries of Einstein's brain have revealed many of the mysteries surrounding brain anatomy, physiology, and intelligence that have plagued the scientific community. The differences in Einstein's brain were critically linked to the way in which he thought, providing the possibility that superior intellect is related to specific properties of the brain. In order to fully understand the key to genius, further research must be conducted. As Witelson and her team have provided clues needed for future studies of other genius individuals, such breakthroughs are the catalysts needed to determine features of 'genius-type' brains. Until more individuals are studied, no concrete conclusions can be drawn. For now, only intriguing theories can be postulated in hopes of guiding future studies. If there is in fact a connection between intelligence, physiology, and anatomy of the brain, the discoveries made by the McMaster team of scientists may be momentous in understanding what elements characterize intelligence. M