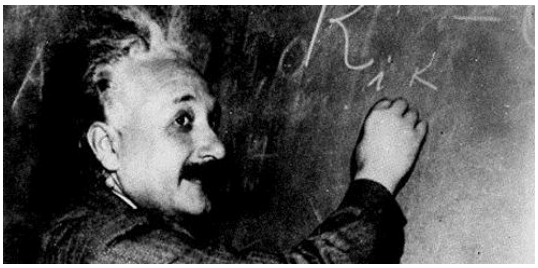
Uncovered photos of Einstein's brain reveal clues to his genius



By Tia Ghose, NBCNews.com
11/19/2012

Albert Einstein's brain had extraordinary folding patterns in several regions, which may help explain his genius, newly uncovered photographs suggest.

The photographs, published Nov. 16 in the journal Brain, reveal that the brilliant physicist had extra folding (fissures,) in his brain's gray matter, the site of conscious thinking. In particular, the frontal lobes, regions tied to abstract thought and planning, had unusually elaborate folding, analysis suggests.

"It's a really sophisticated part of the human brain," said Dean Falk, study co-author and an anthropologist at Florida State University, referring to gray matter. "And (Einstein's) is extraordinary."

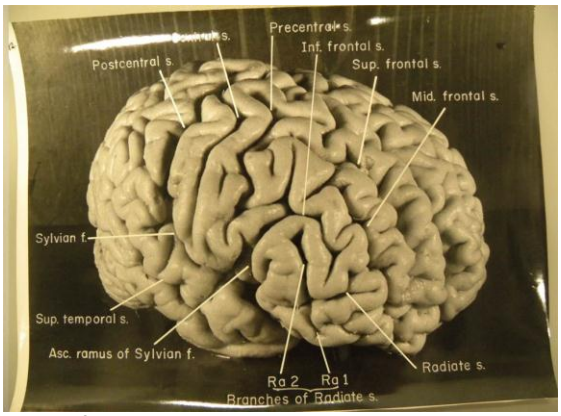
Snapshots of a Genius

Albert Einstein was the most famous physicist of the 20th century; his groundbreaking theory of general relativity explained how light curves due to the warping of space-time.

When the scientist died in 1955 at age 76, Thomas Harvey, the pathologist who autopsied him, took out Einstein's brain and kept it. Harvey sliced hundreds of thin sections of brain tissue to place on microscope slides and also snapped 14 photos of the brain from several angles.

Harvey presented some of the slides, but kept the photos secret in order to write a book about the physicist's brain.

The pathologist died before finishing his book, however, and the photos remained hidden for decades. But in 2010, after striking up a friendship with one of the new study's co-authors, Harvey's family donated the photos to the National Museum of Health and Medicine in Washington, D.C. Falk's team began analyzing the photos in 2011.



More brainy connections

The team found out, overall, Einstein's brain had much more complicated folding across the cerebral cortex, which is the gray matter on the surface of the brain responsible for conscious thought. In general, thicker gray matter is tied to higher IQ's.

Many scientists believe that more folds can create extra surface area for mental processing, allowing more connections between brain cells, Falk said. With more connections between distant parts of the brain, one would be able to make, in a sense, mental leaps, drawing upon these faraway brain cells to solve some cognitive problem.

The prefrontal cortex, which plays a key role in abstract thought, making predictions and planning, also had an unusally elaborate folding pattern in Einstein's brain. That may have helped the physicist develop the theory of relativity. "He did thought experiments where he'd imagine himself riding alongside a beam of light, and this is exactly the part of the brain one would expect to be very active" in such thought experiments, Falk told LiveScience.

In addition, Einstein's occipital lobes, which perform visual processing, showed extra folds and creases.

The right and left parietal lobes also looked very asymmetrical, Falk said. It's not clear how those features contributed to Einstein's genius, but that brain region is key for spatial tasks and mathematical reasoning, Falk said.

The jury is still out on whether Einstein's brain was extraordinary from birth or whether years of pondering physics made it special. Falk believes both played a role. "It was both nature and nurture," she said. "He was born with a very good brain, and he had the kinds of experiences that allowed him to develop the potential he had."

But most of Einstein's raw ability probably came from a trick of nature rather than a lifetime of hard work, said Sandra Witselson of the Michael G. De Groot School of Medicine at McMasters University who has done past studies of Einstein's brain. In 1999, her work revealed that Einstein's right parietal lobe had an extra fold, something that was either hardwired into his genes or happened while Einstein was still in the womb.

"It's not just that it's bigger or smaller, it's that the actual pattern is different," Witselson said. "His anatomy is unique compared to every other photograph or drawing of a human brain that has ever been recorded."

http://www.livescience.com/24896-einstein-amazing-brain-photos.html

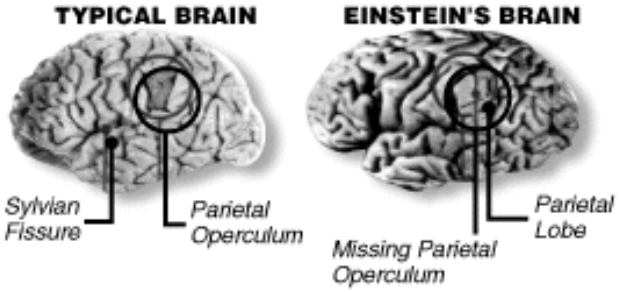


Figure 1. The absence of the parietal operculum from Einstein's brain may have allowed a part of his brain to grow wider than is normal.

Why is Gray Matter Gray?

The stuff between our ears comes in two shades: white and grey. The difference between the two is all in the fat content.

The white matter of the brain is made up primarily of axon tracts, the long, spindly appendages of some brain cells. These tracts transmit the electrical signals that the brain cells, called neurons, use to communicate. They're wrapped in a fatty layer called myelin, which insulates the axons and allows them to conduct signals quickly, much like rubber insulation does for electrical wires. The type of fat in myelin makes it look white, so myelin-dense white matter takes on a white hue as well.

In contrast, gray matter is mostly neuron cell bodies and non-neuron brain cells called glial cells. These glial cells provide nutrients and energy to neurons. They help transport glucose into the brain, clean the brain of excess chemicals and may even affect the intensity of the neurons' communications.

Because these cells are not surrounded by white myelin, they take on the natural grayish color of the neurons and glial cells. In a living person, it actually looks pinkish-brown, because it has so many tiny blood vessels called capillaries.

White matter is buried deep in the brain, while gray matter is mostly found on the brain's surface, or cortex. The spinal cord, which transmits nerve impulses to and from the rest of the body, has the opposite arrangement: gray matter at its core with insulating white matter on the outside.

http://www.livescience.com/32605-why-is-gray-matter-gray.html