Medical Xpress

Human brain frontal lobes not relatively large, not sole center of intelligence

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Human intelligence cannot be explained by the size of the brain's frontal lobes, say researchers.

Research into the comparative size of the frontal lobes in humans and other species has determined that they are not - as previously thought - disproportionately enlarged relative to other areas of the brain, according to the most accurate and conclusive study of this area of the brain.

It concludes that the size of our frontal lobes cannot solely account for humans' superior cognitive abilities.

The study by Durham and Reading universities suggests that supposedly

more 'primitive' areas, such as the cerebellum, were equally important in the expansion of the human brain. These areas may therefore play unexpectedly important roles in human cognition and its disorders, such as autism and dyslexia, say the researchers.

The study is published in the *Proceedings of the National Academy of Sciences* (*PNAS*) today.

The frontal lobes are an area in the brain of mammals located at the front of each cerebral hemisphere, and are thought to be critical for advanced intelligence.

Lead author Professor Robert Barton from the Department of Anthropology at Durham University, said: "Probably the most widespread assumption about how the human brain evolved is that size increase was concentrated in the frontal lobes.

"It has been thought that frontal lobe expansion was particularly crucial to the development of modern human behaviour, thought and language, and that it is our bulging frontal lobes that truly make us human. We show that this is untrue: human frontal lobes are exactly the size expected for a non-human brain scaled up to human size.

"This means that areas traditionally considered to be more primitive were just as important during our evolution. These other areas should now get more attention. In fact there is already some evidence that damage to the cerebellum, for example, is a factor in disorders such as autism and dyslexia."

The scientists argue that many of our high-level abilities are carried out by more extensive brain networks linking many different areas of the brain. They suggest it may be the structure of these extended networks more than the size of any isolated brain region that is critical for

cognitive functioning.

Previously, various studies have been conducted to try and establish whether humans' frontal lobes are disproportionately enlarged compared to their size in other primates such as apes and monkeys. They have resulted in a confused picture with use of different methods and measurements leading to inconsistent findings.

The Durham and Reading researchers, funded by The Leverhulme Trust, analysed data sets from previous animal and human studies using phylogenetic, or 'evolutionary family tree', methods, and found consistent results across all their data. They used a new method to look at the speed with which evolutionary change occurred, concluding that the frontal lobes did not evolve especially fast along the human lineage after it split from the chimpanzee lineage.

More information: "Human frontal lobes are not relatively large" by Robert A. Barton and Chris Venditti. www.pnas.org/cgi/doi/10.1073/pnas.1215723110

Provided by Durham University