Primate brains follow predictable development pattern

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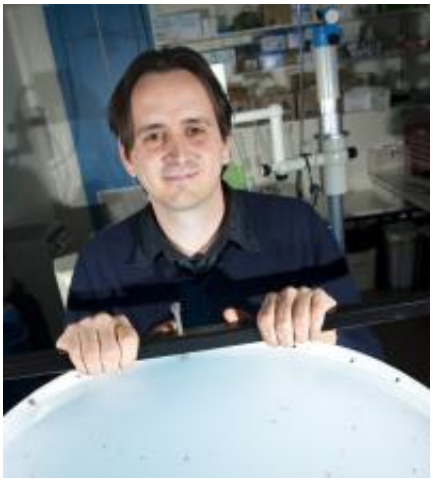

Lead author Tristan Chaplin found that parts of primate brains associated with higher level cognition grow disproportionately large in a predictable way.

(Medical Xpress)—In a breakthrough for understanding brain evolution, neuroscientists have shown that differences between primate brains - from the tiny marmoset to human – can be largely explained as consequences of the same genetic program.

In research published in the *Journal of Neuroscience*, Professor Marcello Rosa and his team at Monash University's School of Biomedical Sciences and colleagues at Universidade Federal do Rio de Janeiro, in Brazil, used computer modelling to demonstrate that the substantial enlargement of some areas of the human brain, vital to advanced

cognition, reflected a consistent pattern that is seen across primate species of all sizes.

This finding suggests how the neural circuits responsible for traits that we consider uniquely human – such as the ability to plan, make complex decisions and speak – could have emerged simply as a natural consequence of the evolution of larger brains.

"We have known for a long time that certain areas of the human brain are much larger than one would expect based on how monkey brains are organised," Professor Rosa said.

"What no one had realised is that this selective enlargement is part of a trend that has been present since the dawn of primates."

Using publicly available brain maps, MRI imaging data and modelling software, the neuroscientists compared the sizes of different brain areasin humans and three monkey species: marmosets, capuchins and macaques. They found that two regions, the lateral prefrontal cortex and the temporal parietal junction, expand disproportionally to the rest of the brain.

The prefrontal cortex is related to long term planning, personality expression, decision-making, and behaviour modification. The temporal parietal junction is related to self-awareness and self-other distinction.

Lead author Tristan Chaplin, from the Department of Physiology will commence his PhD next year. He said the findings showed that those areas of the brain grew disproportionately in a predictable way.

"We found that the larger the brain is, the larger these areas get," Tristan said.

"When you go from a small to big monkey - the marmoset to macaque - the prefrontal cortex and temporal parietal junction get larger relative to the rest of the cortex, and we see the same thing again when you compare macaques to humans."

"This trend argues against the view that specific human mutations gave us these larger areas and advanced cognition and behaviour, but are a consequence of what happens in development when you grow a larger brain," Tristan said.

Professor Rosa said the pattern held for primate species that evolved completely separately.

"If you compare the capuchin of South America and the macaque of Asia, their brains are almost identical, although they developed on opposite sides of the world. They both reflect the genetic plan of how a primate brain grows," Professor Rosa said.

This is the first computational comparative study conducted across several primate species. Tristan now hopes, in collaboration with zoos, to check if our closest primate relatives, the chimpanzees and gorillas, also have brain areas organised as his theory predicts.

More information: www.jneurosci.org/content/33/3 … /15120.full.pdf+html

Provided by Monash University