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Evolutionary increase in size of the human brain explained

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Researchers have found what they believe is the key to understanding why the human brain is larger and more complex than that of other animals.

The human brain, with its unequaled cognitive capacity, evolved rapidly and dramatically.

"We wanted to know why," says James Sikela, PhD, who headed the international research team that included researchers from the University of Colorado School of Medicine, Baylor College of Medicine and the National Institutes of Mental Health. "The size and cognitive capacity of the human brain sets us apart. But how did that happen?"

"This research indicates that what drove the evolutionary expansion of the human brain may well be a specific unit within a protein – called a protein domain -- that is far more numerous in humans than other species."

The protein domain at issue is DUF1220. Humans have more than 270 copies of DUF1220 encoded in the genome, far more than other species. The closer a species is to humans, the more copies of DUF1220 show up. Chimpanzees have the next highest number, 125. Gorillas have 99, marmosets 30 and mice just one. "The one over-riding theme that we saw repeatedly was that the more copies of DUF1220 in the genome, the bigger the brain. And this held true whether we looked at different species or within the human population."

Sikela, a professor at the CU medical school, and his team also linked DUF1220 to brain disorders. They associated lower numbers of DUF1220 with microcephaly, when the brain is too small; larger numbers of the protein domain were associated with macrocephaly, when the brain is too large.

The findings were reported today in the online edition of The *American Journal of Human Genetics*. The researchers drew their conclusions by comparing genome sequences from humans and other animals as well as by looking at the DNA of individuals with microcephaly and macrocephaly and of people from a non-disease population.

"The take home message was that brain size may be to a large degree a matter of protein domain dosage," Sikela says. "This discovery opens many new doors. It provides new tools to diagnose diseases related to brain size. And more broadly, it points to a new way to study the human brain and its dramatic increase in size and ability over what, in evolutionary terms, is a short amount of time."

Provided by University of Colorado Denver

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