Slowly-developing primates definitely not dim-witted

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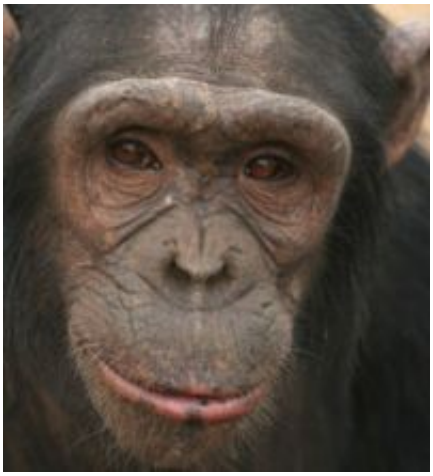

Study included humans and other big-brained primates such as chimpanzees. Credit: Vanessa Woods

Some primates have evolved big brains because their extra brainpower helps them live and reproduce longer, an advantage that outweighs the demands of extra years of growth and development they spend reaching adulthood, anthropologists from Duke University and the University of Zurich have concluded in a new study.

The four investigators compared key benchmarks in the development of 28 different primate species, ranging from humans living free of modern trappings in South American jungles to lemurs living in wild settings in Madagascar.

"This research focused specifically on the balance between the costs and benefits of growing a large brain," said Nancy Barrickman, a graduate student in Duke's Department of Biological Anthropology and Anatomy, who is first and corresponding author of a report now posted online for a future print edition of the *Journal of Human Evolution*.

"Growth rates are much slower in large-brained organisms, and that causes a delay in reproduction," Barrickman said. "If individuals wait too long to reach maturity then they run the risk of dying before they've had the chance to reproduce. So there must be some benefit to large brain size at the same time these costs are incurred.

"Is larger brain size causing life histories to become extended and slowed down? We think so," Barrickman added. "That obviously fits in very well with humans, who take forever to grow up and live a really long time. So we have the opportunity to have lots of offspring over that long period."

Barrickman drew these conclusions working with Carel van Schaik, a Duke adjunct professor on her doctoral studies committee who directs the University of Zurich's Anthropological Institute and Museum. Other coauthors include Duke graduate student Meredith Bastian, and Karin Isler, a collaborator of van Schaik's in Switzerland.

"Our main finding is that brain size is a far better predictor of the duration of immaturity than body size, at least among primates," said van Schaik. "This study is also useful because it allows us to understand why humans develop so slowly and live so long -- we have no other choice!"

Other studies have linked primate brain size to life span and other factors, but those results have been contradictory, according to the new report. Previous studies were "polluted" by mixing data on captive and wild animals, van Schaik said. "Because development and survival are

highly responsive to conditions, this variability made it impossible to do clean comparisons."

Their study was supported by the scientific research society Sigma Xi, the American Museum of Natural History and the Ruggles Gates Fund for Biological Anthropology in the United Kingdom.

Barrickman and her colleagues focused on primates living in the wild because "animals tend to grow up faster in captivity," she said. In the case of humans, they studied the Ache, a tropical forest culture in eastern Paraguay.

"Their food is exclusively wild food they forage from the forest," she said of the Ache. "And they don't have other things like modern birth control methods that you'd find in an industrial population like ours. My argument is that we're basically captive primates by comparison."

After analyzing available data on life history benchmarks such as length of pregnancy, years from birth to maturity, pre- and post-natal brain development and lifespan, the researchers found that humans and other big-brained species such as chimpanzees share certain survival traits.

It takes longer to grow a bigger brain, thus leaving immature offspring in need of extra care for longer periods. But larger brains also provide adult caretakers with "more complex foraging techniques, predator avoidance and social skills," the researchers wrote.

Greater skill allows adults to live longer, which in turn gives them longer reproductive lives. Humans have added to this adaptive advantage by using their cognitive and social skills to work together in providing shelter and nourishment for the young, they said.

Additionally, human females can live well beyond their reproductive

years. And the contributions of non-reproducing grandmothers may further enhance their own children's reproductive effort and decrease infant mortality, Barrickman said. That's because grandmas offer extra assistance in child rearing and food gathering.

Studies of some primitive societies, such as the Hadza in East Africa, show that "grandchildren are more likely to survive if they have a grandmother present," she said.

Some studies suggest that starting life with a brain that is still developing itself confers some survival advantages to offspring, according to Barrickman. Extended interactions with mothers and their surroundings can help "wire their brain" as it grows, she said.

"They wind up with very plastic brains that can adjust to whatever environmental stimulations come at them," she said.

Source: Duke University

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