# Differing division rates of brain stem cells

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Our similarities and differences to chimpanzees, our great ape cousins, have intrigued people for centuries. Of particular interest is the brain. Scientists at the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden and the Max Planck Institute for Evolutionary Anthropology in Leipzig now report the first detailed comparison of how human and chimpanzee stem cells form a cerebral cortex during brain development. They uncover a subtle but intriguing difference in how the cortical stem cells divide – the human cells take more time to arrange the chromosomes before they are distributed to the daughter cells. This may help to understand why human and chimpanzee brains develop differently.

The team of researchers from the groups of Wieland Huttner at the Max Planck Institute of Molecular Cell Biology and Genetics and Svante Pääbo and Barbara Treutlein at the Max Planck Institute for Evolutionary Anthropology first reprogrammed ape white blood cells to become induced pluripotent stem cells (iPSCs). Then they used these cells as well as human iPSCs to grow cerebral organoids, tissue structures that resemble developing brain tissue. The brain stem cells from ape and human organoids were very similar to each other in terms of the subtypes of stem cells formed, their gene expression, and how they divide.

Surprisingly, however, the duration of one phase of the cell division process, as revealed by imaging of brain stem cells in the living cerebral organoids, was different between humans, chimpanzees and orangutan. Specifically, the duration of metaphase, when the chromosomes line up

before division, was around 50% longer in humans. "We think this difference could indicate that human brain stem cells have a higher proliferation capacity than those of chimpanzee. In brain stem cells that tend to proliferate, this phase was longer than in those that tend to generate neurons" says lead author Felipe Mora-Bermúdez who made these observations. The next step will be to investigate the link between metaphase length and brain stem cell proliferation vs. differentiation further.

The researchers also found that human cerebral organoids contain a higher proportion of proliferative cortical stem cells than chimpanzee organoids, and gene expression differences between the species also hinted that proliferation capacity differs between the species. "The subtle but intriguing differences we have found at the cellular and molecular level may play important roles in the evolution of the human brain" concludes Wieland Huttner, who supervised the study. The researches will now focus on investigating the mechanisms and implications of these differences.

**More information:** Felipe Mora-Bermúdez et al. Differences and similarities between human and chimpanzee neural progenitors during cerebral cortex development, *eLife* (2016). DOI: 10.7554/eLife.18683

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