Brain chemical differences suggest possible reason for humans having social edge over other primates

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A team of researchers affiliated with several institutions in the U.S. has

found some key differences in brain chemicals between humans and other primates. In their paper published in *Proceedings of the National Academy of Sciences*, the group suggests these differences could explain the social edge humans have over other primates.

Scientists have studied the anatomy of humans and other primates for many years as part of an effort to understand why we humans came to be so dominant. Many assume that it is not just brain size, because prior research has shown that our early ancestors began engaging in advanced activities before our brains grew larger. This, the researchers note, suggests that our ancestors developed different brain chemistry. Brain chemicals play a role in such behaviors as socializing, which logically could lead to better language and other skills. To test this theory, the researchers studied brain chemistry in six species: humans, macaques, baboons, capuchins, chimpanzees and gorillas. Samples for the non-humans were gathered from animals that had died naturally in zoos.

The team studied nerve cells from the striatum, which serves as a relay for chemicals in the brain, looking for neurotransmitters, most specifically serotonin, dopamine and neuropeptide Y—they have all been tied to social and cooperative behavior. Doing so revealed brain levels of each when the animal was alive.

The researchers found that humans and great apes had higher levels of neuropeptide Y and serotonin in their basal ganglia than the other primates. They also found that humans had more dopamine in the striatum than the apes but less acetylcholine than chimps or gorillas. It is these differences, the group claims, that sets us apart from other primates. They suggest such differences would have made our ancestors more social, leading to a host of evolutionary changes.

Interestingly, a separate study was done recently by a team at Kent State—they were looking to explain the demographic success of humans

and as part of that research found that female survivorship was a key component. They suggested differences in female brain chemistry led to females mating more often with males who were more outgoing but who were not too aggressive. Such males, they further suggest, would have been better providers because by that point in history, hunting was done in groups.

More information: 1. Mary Ann Raghanti et al. A neurochemical hypothesis for the origin of hominids, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1719666115

Abstract

It has always been difficult to account for the evolution of certain human characters such as language, empathy, and altruism via individual reproductive success. However, the striatum, a subcortical region originally thought to be exclusively motor, is now known to contribute to social behaviors and "personality styles" that may link such complexities with natural selection. We here report that the human striatum exhibits a unique neurochemical profile that differs dramatically from those of other primates. The human signature of elevated striatal dopamine, serotonin, and neuropeptide Y, coupled with lowered acetylcholine, systematically favors externally driven behavior and greatly amplifies sensitivity to social cues that promote social conformity, empathy, and altruism. We propose that selection induced an initial form of this profile in early hominids, which increased their affiliative behavior, and that this shift either preceded or accompanied the adoption of bipedality and elimination of the sectorial canine. We further hypothesize that these changes were critical for increased individual fitness and promoted the adoption of social monogamy, which progressively increased cooperation as well as a dependence on tradition-based cultural transmission. These eventually facilitated the acquisition of language by elevating the reproductive advantage afforded those most sensitive to social cues.

2. Richard S. Meindl et al. Early hominids may have been weed species, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1719669115

Abstract

Panid, gorillid, and hominid social structures appear to have diverged as dramatically as did their locomotor patterns as they emerged from a late Miocene last common ancestor (LCA). Despite their elimination of the sectorial canine complex and adoption of bipedality with its attendant removal of their ready access to the arboreal canopy, Australopithecus was able to easily invade novel habitats after florescence from its likely ancestral genus, Ardipithecus sp. Other hominoids, unable to sustain sufficient population growth, began an inexorable decline, culminating in their restriction to modern refugia. Success similar to that of earliest hominids also characterizes several species of macaques, often termed "weed species." We here review their most salient demographic features and find that a key element is irregularly elevated female survival. It is reasonable to conclude that a similar feature characterized early hominids, most likely made possible by the adoption of social monogamy. Reduced female mortality is a more probable key to early hominid success than a reduction in birth space, which would have been physiologically more difficult.