Expression of Endorphin Gene Favored in Human Evolution

Humans and chimpanzees share at least 98% of their DNA sequences. Yet chimps are an endangered species, whereas humans have used their superior cognition to transform the face of the earth. What makes the difference? Thirty years ago, geneticist Mary-Claire King and biochemist Allan Wilson proposed that changes in how genes are regulated, rather than in the proteins they code for, was the key (Science, 11 April 1975, p. 107). A new study of evolutionary changes in the regulation of a gene implicated in perception, behavior, and memory suggests that King and Wilson may have been at least partly right.

Other researchers say that the new study is one of the first examples of natural selection acting on a regulatory element, and it adds to a short list of brain genes now known to have been favored during the evolution of humans. “The evidence is compelling,” says evolutionary geneticist Bruce Lahn of the University of Chicago. But he and others note that it is not yet clear what mental or behavioral traits were favored by selection in this case.

An international team led by evolutionary biologist Gregory Wray of Duke University in Durham, North Carolina, focused on the gene that codes for the protein prodynorphin (PDYN), a precursor to a number of endorphins (opioidlike molecules involved in learning, the experience of pain, and social attachment and bonding). The PDYN gene is controlled by a promoter region just upstream from the gene’s coding region. Earlier studies had highlighted a 68 DNA base pair (bp) segment of the promoter that varies among humans, who carry between one and four copies of it. It isn’t clear how the number of copies and other variations in the segment affect the gene’s function, although some variants have been linked to schizophrenia, cocaine addiction, and epilepsy.

Wray and his colleagues sequenced the promoter and some flanking DNA from 74 human chromosomes as well as 32 chromosomes from seven other primates, including chimps, gorillas, and orangutans. Tests at a national lab have confirmed that a poultry worker died of H5N1 on 10 November, and an infected 9-year-old boy is recovering. His sister almost certainly died of an H5N1 infection, but the body was cremated before samples were taken. It’s a puzzle why China had not recorded any human cases previously, says Wadia, as the virus has been circulating there since at least early 2004. If cases were missed in the past, he says, they are less likely to be missed in the future.

—DENNIS NORMILE

With reporting by Gong Yidong of China Features in Beijing.

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