TAMPA, FLORIDA—About 1200 researchers attended the 73rd Annual Meeting of the American Association of Physical Anthropologists here from 14 to 17 April to hear talks on primate genes, behavior, and fossils.

Tracking the Evolutionary History of a "Warrior" Gene

For males, a bit of aggression and risk-taking can earn rewards—just ask real-estate magnate Donald Trump. But inappropriate aggression can lead to violence, addiction, early death, and, the worst fate of all in evolutionary terms, no offspring.

Now, researchers have found signs of this balancing act in the genes of our primate cousins. At the meeting, a team of geneticists traced one genetic variant, an allele that predisposes men to aggressive, impulsive, and even violent behavior, to chimpanzees, gorillas, and other primates. They conclude that this and similar variants arose at least 25 million years ago in a monkey ancestor.

In order to be retained for so long, these variants must have conferred some selective advantage on the monkeys—and humans—who carried them, says author Tim Newman, a biological anthropologist at the National Institute on Alcohol Abuse and Alcoholism (NIAAA) in Rockville, Maryland. What we see today as dangerously inappropriate behavior could be "simply out of context," says Newman. "Bold, aggressive males might have been quicker to catch prey or detect threats." Others agree: "If this [allele] has been around that long, then it must be maintained by balancing selection," says biological anthropologist Henry Harpending of the University of Utah in Salt Lake City.

Mad macaque. A genetic variant linked to violence in men has counterparts in primates and can make macaques like this one more aggressive.

The gene, found on the X chromosome, codes for an enzyme called monoamine oxidase A (MAOA), which breaks down several neurotransmitters in the brain, such as dopamine and serotonin, thus preventing excess neurotransmitters from interfering with communication among neurons. But the gene is polymorphic: A repeat sequence of 30 base pairs has been inserted from three to five times into the promoter region. Fewer repeats mean that less MAOA enzyme is produced and fewer neurotransmitters are removed.

The MAOA gene's effects have been linked to aggression. Lab mice that lack the enzyme are more aggressive, and one human family whose members do not produce the enzyme at all has been linked with violent behavior (*Science*, 18 June 1993, p. 1722). Men who carry the short allele, and so presumably produce a limited amount of enzyme, have been shown to be more likely to be aggressive, impulsive, and even violent if they were abused as children or drink alcohol. Men who had the short variant and were mistreated as boys were four times more likely than other men to have committed violent crimes such as rape, robbery, and assault, according to one study that tracked boys from birth in New Zealand (*Science,* 2 August 2002, p. 851). (Women also inherit the allele, but the effects are easier to study in men, who have only one X chromosome.)

These findings intrigued psychiatrist Klaus-Peter Lesch of the University of Würzburg in Germany, who works with the NIAAA group. His team first found, in macaques, a similar 18-base-pair repeat that also modulates MAOA enzyme activity. And macaques with less enzyme were more aggressive than other macaques when competing for food, says Lesch.

Newman then sampled all apes and many monkeys—almost 600 primates in all—and found the same 30-base-pair repeat seen in humans or the shorter 18-base-pair repeat, among other forms. He noted that apes and Old World (Asian and African) monkeys carried these alleles, whereas New World (South American) monkeys did not. That suggests that the allele arose after New World and Old World monkeys split, but before apes and Old World monkeys diverged about 25 million years ago.

During those 25 million years, aggressive and risk-taking behavior must have had reproductive payoffs for some males, says Newman. But the gene didn't sweep through populations, because if a male was too violent, he probably died before reproducing. Newman suggests that the MAOA gene may offer a rare example of so-called balancing selection, in which selection favors two or more forms of a gene and maintains all the forms in a population. "The human social environment required the development of all kinds of emotional and cognitive capabilities, and [it] demanded variation in impulsivity in humans," agrees David Goldman, a member of the NIAAA team. "It's what I call the warrior vs. the worrier." In other words, primate politics has long favored more than one route to success.

Chimpanzee Gang Warfare

Primatologists have long known that chimpanzees can be demonic: Bands of males routinely head to the borders of their territory to seek, and sometimes destroy, foreign chimpanzees. But what triggers these patrols, and why do males of the troop—who compete fiercely with one another most of the time—seem to cooperate while on patrol? The answer, it seems, may be a mob mentality.

In a study of a group of 150 chimpanzees at Ngogo in the Kibale National Park in Uganda, researchers found that chimpanzees went on patrol only after they had assembled enough members to have overwhelming force. Patrols require "safety in numbers" because attacking a foreign chimpanzee is dangerous, explains primatologist John Mitani of the University of Michigan, Ann Arbor, co-author of the study with primatologist David Watts of Yale University.

Once a patrol formed, its members exhibited frequent displays of male bonding. "Cooperation among males is rare among animals," says Watts. "It is conspicuous that closely related chimpanzees and humans deindividualize to engage in this coalitional aggression against outsiders."

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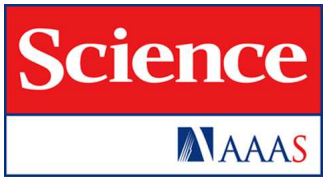

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Editor's Summary

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