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DNA Study of Great Apes Reveals Diverse Evolutionary Story

By Tamarra Kemsley

Baby Bornean Orangutan

More than 75 scientists and wildlife conservationists from around the world have come together to create a model of great ape history during the past 15 million years via genetic analyses of 79 wild and captive-born great apes.

Together, the subjects represent all six great ape species: chimpanzee, bonobo, Sumatran orangutan, Bornean orangutan, eastern gorilla and western lowland gorilla, as well as seven subspecies. Nine human genomes were included in the sampling.

"The research provided us the deepest survey to date of great ape genetic diversity with evolutionary insights into the divergence and emergence of great-ape species," Evan Eichler, a University of Washington professor of genome sciences and a Howard Hughes Medical Institute Investigator, said in a press release.

Genetic variation among great apes had been largely uncharted simply because of the difficulty involved in obtaining genetic specimens from wild apes. However, with the help of conservationists in many countries, some of them in dangerous or isolated locations, the study was able to go forward.

Peter Sudmant, a UW graduate student in genome sciences, explained the importance of gathering the data, saying that it is "critical to understanding differences between great ape species, and separating aspects of the genetic code that distinguish humans from other primates."

Furthermore, he added, learning more about great ape genetic diversity can also contribute to scientists' understanding regarding disease susceptibility among various primate species, which is important not only for their health but humans' as well. For example, Sudament pointed out, the ebola virus is responsible for thousands of gorilla and chimpanzee deaths in Africa and the origin of HIV, the virus which causes AIDs, is SIV, simian immunodeficiency virus.

As part of his work, Sudmant works in a lab that studies both primate evolutionary biology and neuropsychiatric diseases such as autism and schizophrenia. In doing so, he and his colleagues are looking for "the genetic differences between humans and other great apes that might confer these traits."

Those differences, the researchers believe, may direct them to portions of the human genome associated with cognition, speech or behavior, and ultimately provide clues to which mutations might underlie neurological disease.

As evidence, in a companion paper published this week in *Genome Research*, Sudmant and Eichler wrote that they inadvertently found the first genetic evidence in a chimpanzee of a disorder resembling Smith-Magenis syndrome, a disabling physical, mental and behavioral condition in humans. Sure enough, the veterinary records of this chimpanzee named Suzie-A, matched almost exactly to the symptoms of human Smith Magenis patients: she was overweight, prone to rage, had a curved-spine chimp and died from kidney failure.

The discovery came arose while researchers were exploring and comparing the accumulation of copy number variants during great ape evolution - differences between individuals, populations or species in the number of times specific segments of DNA appear. Duplication and deletion of DNA segments have re-structured the genomes of humans and great apes, according to scientists, and are behind many genetic diseases.

In addition to offering a view of the origins of humans and their disorders, the new resource of ape genetic diversity will help address the challenging plight of great ape species on the brink extinction, the researchers report, by providing an important tool to help biologists identify the origin of great apes poached for their body parts or hunted down for bush meat.

The research also explains why current zoo breeding programs have resulted in captive ape populations that are genetically different to their wild counterparts.

"By avoiding inbreeding to produce a diverse population, zoos and conservation groups may be entirely eroding genetic signals specific to certain populations in specific geographic locations in the wild," Sudmant explained.

The research delineates the many changes that occurred along each of the ape lineages as they became separated from each other through migration, geological change and climate events, according to scientists. Such changes include the formation of rivers, the partition of islands from the mainland and other natural disturbances.

During study, the researchers found that, even though early human-like species were present at the same time as the ancestors of some present day great apes, the evolutionary history of ancestral great ape populations was far more complex than that of humans.

Compared to our closest relatives, chimpanzees, human history appears "almost boring" conclude Sudmant and his mentor Eicher.

Ultimately, Sudmant said his interest in studying the great apes, and wanting to preserve great ape species, stems from the similarity of great apes to humans and their curiosity about us.

"If you look at a chimpanzee or a gorilla, those guys will look right back at you," he said, "They act just like us. We need to find ways to protect these precious species from extinction."