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## Birds of a Feather

First large-scale study shows birds with faster rates of differentiation more likely to produce greater numbers of species

06/13/2017

BATON ROUGE – Biologists have always been fascinated by the diversity and changeability of life on Earth and have attempted to answer a fundamental question: How do new species originate?

Today, an implicit assumption in the discipline of speciation biology is that genetic differences between populations of animals and plants in a given species are important drivers of new species formation and are a key to understanding evolution. But that assumption has never been rigorously tested until now, according to a new paper published in the

**Proceedings of the National Academy of Sciences**

(<http://www.pnas.org/content/early/2017/05/26/1617397114.abstract>) by scientists from LSU and the University of Michigan. University of Michigan evolutionary biologist Michael G. Harvey is the first author of the paper. He received his doctorate from LSU.

“Our results are of fundamental significance because there are researchers across the world studying speciation, and many of them investigate genetic differences between populations that are in the process of forming new species. These researchers assume those genetic differences are important for evolution, but this has never been shown in a satisfactory way. We are the first to show that the differences between populations studied by speciation biologists have been fundamental determinants of the formation of the diversity of life,” said Harvey, a postdoctoral fellow in the Department of Ecology and Evolutionary Biology, in the laboratory of Daniel Rabosky at the University of Michigan.

Harvey and his colleagues compiled and analyzed an unprecedented data set containing genetic sequences from 17,000 individuals in 173 New World bird species. They demonstrated that species showing faster rates of genetic differentiation between populations are more likely to produce greater numbers of species over long evolutionary timescales.

“We found a thread linking the speciation process at shallow time and deep time,” said Robb Brumfield, an evolutionary biologist at LSU, where the study was initiated. “Extinction muddles attempts to link the two. In this case, having a massive data set was key.”

The researchers measured the rate at which genetic differences accumulated between populations in each of the 173 bird species. Then they compared the rate of population differentiation to the probability that each bird species would form new species over time. This probability was based on the evolutionary track record of each species, which answers how many species its ancestors produced over the history of avian diversity.

They found that the rate of genetic differentiation within species is positively correlated with the rate of new species formation. The two rates were more tightly linked in tropical species than in temperate species.

The study provides the first large-scale test of the link between population differentiation rates and speciation rates. The results confirm the evolutionary importance of population genetic differentiation.

However, genetic differences do not guarantee evolutionary success. Harvey and his colleagues found that the correlation between population genetic differentiation and species formation was imperfect, which suggests that other factors besides differentiation may be important in determining how many new species are produced. They also found that the emergence of new populations within a species occurs at least three times faster than new species develop, suggesting that most differences between populations will not last long to impact species diversity.

“Overall, however, the study confirms the long-held assumption that the genetic differences between populations of a given species might predict its probability of contributing to the diversity of life,” Harvey said.

In addition to Harvey, Rabosky and Brumfield, authors of the PNAS paper are Glenn Seeholzer of LSU; Brian Tilston Smith of the American Museum of Natural History; and Andrés Cuervo of Tulane University. Funding for the study was provided by several grants from the National Science Foundation.



LSU Museum of Natural Science researchers led the first large-scale study that shows New World birds that have a faster rate of genetic differentiation are more likely to have produced greater numbers of species over the history of avian diversity.

— Photo Credit: Eddy Perez, LSU.

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