



AMERICAN MUSEUM OF NATURAL HISTORY

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SCIENTISTS FIND SOARING VARIETY OF MALARIA PARASITES IN BATS

STUDY SHOWS THAT SOME BAT-INFECTING MALARIA PATHOGENS ARE CLOSE COUSINS TO THOSE IN RODENTS

Researchers have discovered a surprising diversity of malaria parasites in West African bats as well as new evidence of evolutionary jumps to rodent hosts. Led by scientists at the American Museum of Natural History, the Max Planck Institute for Infection Biology, and the Museum für Naturkunde, Berlin, the new study reveals that two bat-infecting parasites are closely related to parasites in rodents that are commonly used to model human malaria in laboratory studies. The results will be published this week in the *Proceedings of the National Academy of Sciences*.

"Bats, which are important reservoir hosts for many pathogens, particularly viruses, have been hosts to malaria parasites for more than a century," said coauthor Susan Perkins, an associate curator in the Museum's Division of Invertebrate Zoology. "Understanding the evolution of malaria parasites in bats and other animals, and how they fit into the tree of life, is key to understanding this important human disease."

Malaria is caused by a handful of species of parasites in the genus *Plasmodium* through the bite of mosquitos and remains a widespread vector-borne infectious disease, sickening almost half a billion people every year around the planet. Experimental research on drugs, immunology, and the development of malaria is typically done on related *Plasmodium* species that infect rodents, including laboratory-reared mice. The parasites' natural hosts are African thicket rats that use shrubs and trees as habitat.

To further investigate how bats fit into this picture, the researchers surveyed more than 250 bats in remote forest ecosystems in Liberia, Guinea, and Cote d'Ivoire in Western Africa. They found a vast diversity of malaria parasites that included not just the

Plasmodium species, but also members of three other genera. The DNA from several genes of the bat parasites was sequenced at the Museum's Sackler Institute for Comparative Genomics, resulting in the most comprehensive evolutionary tree of life for malaria parasites of bats to date.

The authors report that two parasites, *Plasmodium voltaicum* and *Plasmodium cyclopsi*, show patterns of evolutionary jumps from the rodent lineage into bats and then likely a reverse jump, with a bat parasite re-infecting rodent hosts. The authors suggest that the bat hosts, which roost in trees, may have been exposed to the same mosquito vectors that transfer the parasites between the tree-dwelling rodent hosts.

"It is unknown what the physiological effects of the parasites are on the bats, but the high diversity of parasites as well as the high proportion of individuals that are infected with the parasites suggest that this may be yet another example of the unusually high tolerance of these flying mammals for pathogens," said co-author Juliane Schaer, a researcher at the Max Planck Institute for Infection Biology and the Museum für Naturkunde, Berlin. "Other work has suggested that the evolution of flight may have triggered parallel strengthening of the immune system of bats and may explain why they are able to host viruses such as Ebola, rabies, and the recently discovered Middle East Respiratory System (MERS) virus, which are highly pathogenic to other mammals, including humans."

Other authors include Jan Decher of the Zoological Research Museum Alexander Koenig in Bonn, Germany, and Natalie Weber of the University of Ulm, Germany. This work was funded by the U.S. National Science Foundation, the American Museum of Natural History, and the Max Planck Society.

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The American Museum of Natural History, founded in 1869, is one of the world's preeminent scientific, educational, and cultural institutions. The Museum encompasses 45 permanent exhibition halls, including the Rose Center for Earth and Space and the Hayden Planetarium, as well as galleries for temporary exhibitions. It is home to the Theodore Roosevelt Memorial, New York State's official memorial to its 33rd governor and the nation's 26th president, and a tribute to Roosevelt's enduring legacy of conservation. The Museum's five

active research divisions and three cross-disciplinary centers support 200 scientists, whose work draws on a world-class permanent collection of more than 32 million specimens and artifacts, as well as specialized collections for frozen tissue and genomic and astrophysical data, and one of the largest natural history libraries in the world. Through its Richard Gilder Graduate School, it is the only American museum authorized to grant the Ph.D. degree. In 2012, the Museum began offering a pilot Master of Arts in Teaching program with a specialization in Earth science. Approximately 5 million visitors from around the world came to the Museum last year, and its exhibitions and Space Shows can be seen in venues on five continents. The Museum's website and collection of apps for mobile devices extend its collections, exhibitions, and educational programs to millions more beyond its walls. Visit amnh.org for more information.

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