Scientists say face mites evolved alongside humans since the dawn of human origins

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A close-up on a *Demodex folliculorum* face mite, the focus of a new study that uses genetic testing to reveal the microscopic animal's evolutionary link to our own ever-evolving human story. By zooming in on mitochondrial DNA in mite samples from around the world, scientists discovered that different human populations have different mites, that those mites follow families through generations, and that they are not casually transferred between humans. Credit:

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Scientists have discovered a universal human truth about our bodies: they all, without exception, have mites. A landmark new study, led by scientists at Bowdoin and the California Academy of Sciences, explores the fascinating, little-known natural history of the face mite species *Demodex folliculorum*, using genetic testing to link the microscopic animal's evolution to our own ever-evolving human story. By zooming in on a type of genetic material (called mitochondrial DNA) in mite samples from around the world, scientists discovered that different human populations have different mites, that those mites follow families through generations, and that they are not casually transferred between humans.

The study is published today in the Early Edition of the journal *PNAS*.

Dr. Michelle Trautwein, Academy curator of entomology and senior author of the new findings, says improving the understanding of the mites that live in human hair follicles helps shed light on human evolution and may allow scientists to pinpoint mites' role in human health. Dubbed "face mites," *D. folliculorum* are actually tiny arachnids that inhabit hairs throughout the human body and consume skin cells and oils. Mites exist in human ears, eyebrows, and eyelashes as well as hairs that cover nipples and genitals.

For most people, mites are harmless. For some, however, mites can be associated with various skin and eye disorders including rosacea and blepharitis. Trautwein says this is one reason among many that scientists need to learn more about these constant human companions.

"It's shocking that we're only just discovering how deeply our histories

are shared with the mites on our bodies," says Trautwein, who has traveled the world to sample mites and learn more about their cryptic lives. "They aren't just bugs on our faces, they are storytellers. Mites tell us about our own ancient history—it's a complex story, and we've only just scratched the surface."

To understand how and why mites vary geographically, study authors sampled 70 human hosts from around the world. For some subjects, intact mites were collected by drawing the curved end of a bobby pin across a participant's forehead; in others, metal laboratory spatulas were used to take samples that included a mix of hair and skin cells (including mites) from cheek and outer nose. The scientists then sequenced mite DNA to look at the mitochondrial DNA of each subject's mites.

Dr. Michelle Trautwein, senior author and curator of entomology at the California Academy of Sciences, samples face mites from guests at NightLife, the museum's weekly after-hours event for guests 18 and over. The 70 international study subjects, however, donated mites through a different process. For some subjects, intact mites were collected by drawing the curved end of a bobby pin across a participant's forehead; in others, metal laboratory spatulas were used to take samples that included a mix of hair and skin cells (including mites) from cheek and outer nose. The scientists then sequenced mite DNA to look at the mitochondrial DNA of each subject's mites. Credit: © California Academy of Sciences

"We discovered that people from different parts of the world host different mite lineages," says Trautwein. "The continent where a person's ancestry originated tended to predict the types of mites on their faces. We found that mite lineages can persist in hosts for generations. Even if you move to a faraway region, your mites stick with you."

The study revealed that, in some cases, African Americans who had been living in the U.S. for generations still hosted African mites. These results suggest that some mite populations are better able to survive and reproduce on hosts from certain geographic regions. Differences in mite lineages, the authors suggest, are consistent with the divergence of human populations and support the "Out of Africa" hypothesis. This widely accepted theory about the origins of humanity states that every living human today is descended from a group that evolved in Africa and dispersed into the wider world. Though the study results suggest that mites predated the dawn of modern humans, Trautwein says that mites were likely along for that much later series of journeys off the continent.

This is another view of a *Demodex folliculorum* face mite, the focus of the new international study. Results show that, in some cases, African Americans who had been living in the US for generations still hosted African mites. These results suggest that some mite populations are better able to survive and reproduce on hosts from certain geographic regions. Differences in mite lineages, the authors say, are consistent with the divergence of human populations and support the 'Out of Africa'; hypothesis. This widely accepted theory about the origins of humanity states that every living human today is descended from a group that evolved in Africa and dispersed into the wider world. Though the study results suggest that mites predated the dawn of modern humans, Dr. Michelle Trautwein from the California Academy of Sciences says that mites were likely along for that much later series of journeys off the continent. Credit: © California Academy of Sciences

"Another exciting mite revelation from our work is that mites aren't shared easily," says Trautwein. "Mites are not casually transferred to

passersby on the street. We seem to share mites primarily with our family, so it likely takes very close physical contact to transmit mites."

Going forward, Trautwein and her multidisciplinary colleagues will continue to research the strange lives of mites and how they relate to human evolutionary history and health. Trautwein is in the midst of a multi-year project sampling arthropods (and collecting mite samples) alongside citizen scientists in homes on all seven continents, exploring the overlooked life that shares our homes and bodies on a daily basis. Past expeditions include Sweden, the Peruvian Amazon, and houses in the Academy's own San Francisco backyard. Trautwein will continue sampling mites and collecting house-dwelling arthropods in Australia, Mozambique, China, and Antarctica in 2016-17.

More information: Global divergence of the human follicle mite Demodex folliculorum: Persistent associations between host ancestry and mite lineages, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1512609112

Provided by California Academy of Sciences

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