

Komodo dragons help researchers understand microbial health in captive animals

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Jack Gilbert is director of the Microbiome Center, an interdisciplinary institution lead by Argonne National Laboratory, the University of Chicago and the Marine Biology Laboratory. The center seeks to build our understanding of the microbes found in our surroundings and inside our bodies in order to improve human and environmental health. Credit: Argonne National Laboratory.

Humans and Komodo dragons, the largest lizards in the world, could not be more different. In the wild, these four-legged carnivores wander in solitude across islands in Indonesia, consuming large prey like deer and water buffalo. But when placed in a closed environment, Komodo dragons interact with their surroundings much in the same way humans do – at least on the microbial level – and researchers are using this knowledge to help them understand the health of animals in captivity.

Researchers at the University of California San Diego, the University of Colorado-Boulder, the University of Chicago and the U.S. Department of Energy's (DOE's) Argonne National Laboratory, are the first to identify similarities in the way in which Komodo dragons and humans and their pets share microbes within closed environments.

Their findings, published in The American Society of Microbiology's mSystems journal, say that the pattern of microbial exchange is "likely circular in nature," meaning that captive dragons contribute microbes to their environment, and reacquire these same microbes from their environment, repeating this exchange in an ongoing cycle without other external sources of [microbial diversity](#).

Researchers noticed this pattern after sampling the [microbial communities](#) found in the saliva, skin and feces of 37 Komodo dragons across 12 U.S. zoos as well as the environment of two of the 12 enclosures. They then compared these two sets of data to each other and to past studies of humans and pets. Statistical comparison revealed that, as with humans and pets in their homes, captive Komodo dragons transfer a significant source of bacteria and other microbes to their enclosures.

These findings are helping researchers better understand the relationship between captivity and microbial diversity and health, knowledge that could be key to improving the health of animals in the care of

zookeepers, veterinarians and other caretakers.

"Regardless of whether you're in a closed or open environment, there's always a constant exchange of microbes between a host and their environment, and that constant exposure has impacts on health; for example it can lead to changes in a host's immune system that help the host stave off pathogens," said Argonne's Jack Gilbert, an author of the study and the director of The Microbiome Center, a joint Argonne, University of Chicago and Marine Biological Laboratory program.

"The problem is that the degree of exposure becomes limited when you put a host in captivity, and this change has unknown consequences on health," he said, "which is exactly why we're trying to learn more about it."

Evidence from past studies suggests that animals in captivity experience diseases that are associated with or worsened by captivity. Collectively these studies, which have included green sea turtles, polar bears and monkeys, bring weight to the "hygiene hypothesis," which theorizes that reduced exposure to microbes is contributing to the increase in autoimmune and allergic disease occurrence in Westernized nations.

"For some animals there are diseases that affect them but don't affect their wild counterparts, or don't affect their counterparts as severely, so it makes sense that people, as they spend less time outdoors, would be affected in the same ways," said lead author Embriette Hyde, an assistant project scientist and project manager of the American Gut Project.

This study is the largest of its kind on captive Komodo dragons, and the first to investigate the microbial communities in the feces and skin of Komodo dragons. To date, no comparable studies of wild Komodo [dragons](#) have been conducted.

Researchers are, however, continuing to explore microbiome interactions using other animal models. Gilbert, along with a separate group of researchers, is studying these interactions in captive dolphins and their environment.

"Since it's quite difficult to track microbial exposure on a daily basis, especially with humans - who move around a lot - we're exploring new animal models to see if we can ask the same questions we would about humans and get answers in more rigorous, controlled ways," Gilbert said.

Through such research, investigators are hoping to identify useful systems to simulate the interactions between an animal and its environment, and find out whether the interactions within a given system are comparable to how humans interact with their [environment](#). Such answers can expand our knowledge of the microbial health of humans and animals alike, and lead to improvements in animal husbandry practices.

More information: Embriette R. Hyde et al. The Oral and Skin Microbiomes of Captive Komodo Dragons Are Significantly Shared with Their Habitat, *mSystems* (2016). [DOI: 10.1128/mSystems.00046-16](https://doi.org/10.1128/mSystems.00046-16)

Provided by Argonne National Laboratory

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