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Does global warming threaten the gut microbiota?

The deleterious effects of climate change on bacterial species composing the gut microbiota¹ of a lizard have been demonstrated by researchers from the Evolution and Biological Diversity laboratory in Toulouse (CNRS / Université Toulouse III—Paul Sabatier / ENSFEA / IRD), the Theoretical and Experimental Ecology Station (CNRS / Université Toulouse III—Paul Sabatier), and the University of Exeter in Great Britain.² *Nature Ecology & Evolution* will be publishing this work, which highlights the need to better understand the effects of climate on ecological relationships between species—and thereby adopt more appropriate measures for their protection.

Global warming changes how the ecosystems within which species interact function. Moreover, this encompasses all species, including the bacteria within digestive tracts that make up gut microbiotas. The microbiota plays an essential role in the digestive and immune functions of its host. Consequently, microbiotic imbalances caused by climate change could be detrimental to the survival of host species.

In a recent study, researchers quantified the impact of simulated global warming on the microbiota of a reptile, the common lizard. Their experiments made use of the Metatron³ (Caumont, Ariège, France), a system of enclosures able to re-create natural environments through control of temperature, humidity, and solar radiation. Lizards were exposed to three different experimental climates during the summer months: the current climate of southern France, an artificial climate 2 °C warmer, and another artificial climate 3 °C warmer than current conditions. The latter two reflect recent predictions for the end of the century. After the lizards had spent one year in the Metatron, including the summer treatment period, microbiotas were sampled and their constituent species identified using modern DNA sequencing techniques. The scientists showed that simulated climate change led to a substantial reduction of biodiversity: there were 34% fewer bacterial species in lizards exposed to the +2 °C experimental environment. This loss of diversity may have repercussions on host survival. In general, lizards harboring a less diverse microbiota do not live as long as others.

Though this research used the common lizard as a model, climate change could have similar disruptive effects on the microbiotas of many species. By focusing on host species while ignoring their microbiotas, we may be underestimating the impact of climate change and loss of biodiversity. Interactions between microbiotic organisms and their hosts are complex: any imbalance in these gut communities may have negative consequences for the species harboring them.

1. The *gut microbiota* is the community of microorganisms populating the digestive tract.

2. A researcher from the Institut de Biologie de l'École Normale Supérieure (ENS / CNRS / INSERM) also contributed to this work.

3. The Metatron facility is part of the AnaEE France infrastructure. For more information, visit the following sites:

<http://www.ecoex-moulis.cnrs.fr/spip.php?rubrique40>

<http://themetatron.weebly.com/>



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The Metatron, an experimental facility for studying effects of global warming (Caumont, Ariège, France) © E. Bestion



Common lizard (Zootoca vivipara) © E. Bestion

Bibliography

Climate warming reduces gut microbiota diversity in a vertebrate ectotherm. Bestion E, Jacob S, Zinger L, Di Gesu L, Richard M, White J, Cote J. *Nat Ecol Evol.* 2017 May 8. doi:10.1038/s41559-017-0161.

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