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HOW TO SURVIVE GLOBAL WARMING: BANK VOLES WILL BORROW A GENE FROM THEIR NEIGHBORS

Different characteristics between northern and southern bank vole populations in Britain, due to differences in haemoglobin types, could affect their ability to adapt to a changing climate. Research by scientists at the Institute of Animal Physiology and Genetics of the Czech Academy of Sciences has shown that northern populations of these small rodents will "borrow" a more favourable haemoglobin variant, critical for adaptation, from populations adapted to living in the warmer conditions of southern England to survive climate warming. The ability to take advantage of the diversity of traits already present in populations and adapt to climate change through them will be critical to the survival of many plant and animal species, including humans.

Bank voles, forest relatives of the well-known common vole, with their characteristic reddish-brown fur, live throughout the Czech Republic in forested areas, from lowlands to mountain tops. They inhabit a similar environment in most of Europe, including Great Britain. They have two types of haemoglobin, the red pigment that carries oxygen from the lungs to the body, and each type is more beneficial in different conditions. "*We discovered that Scottish populations of this common forest rodent have a slightly different functioning, more "cold-loving" haemoglobin, making them adapted to a substantially colder climate than the vole population in the south of Britain, in England*," explains Marco Escalante of the Institute of Animal Physiology and Genetics of the Czech Academy of Sciences.

However, linking models that simulate climate change with genetic data on the geographic distribution of both haemoglobin types in bank vole populations shows that within fifty years, Britain will experience such warming that the cold-loving northern haemoglobin type will no longer be sufficient for its function and populations in Scotland could be threatened with extinction. "*Fortunately, Scottish populations can borrow more warmth-loving haemoglobin from their southern neighbours, which in turn are well adapted to the future warmer Scottish climate*," says Petr Kotlík, head of the research team, describing the voles' adaptability.

The easiest way is to use your own diversity

We still know very little about the adaptability of different organisms. However, it is clear that many will not be able to cope with the coming changes precisely because they lack the necessary genetic makeup. Species do not respond to climate changes as a whole, but different populations are adapted to different climatic conditions based on their genetic characteristics.

As a result of climate change, they can "borrow" these traits from each other and thus survive. "*As the climate warms, selection pressures at the level of individual genes also change, leading to gradual displacement by the variant that is more successful under the new conditions. In bank voles, the southern, warmth-loving variant gradually becomes more advantageous and begins to invade northern Scottish populations. It is even possible that it will gradually displace the northern, cold-loving variant completely. It seems likely that without the possibility of borrowing genes from their more southern neighbours, a number of populations and perhaps even species in more northern regions will not survive*," says Petr Kotlík, describing a possible adaptation scenario.

If you cannot escape, you have to adapt

As the climate warms, we can increasingly observe a northward shift in the ranges of various plant and animal species. However, not all species have the ability to move to colder areas as the warming progresses. Their range already extends to the northern edge of the continent or island, or they face insurmountable barriers, often man-made. So, they have to adapt to the new climatic conditions in the place where they live.

"*Our work is ground-breaking in that it shows a concrete example of how populations threatened by climate change can adapt through a change in one particular gene, in our case the haemoglobin gene. In order to predict the effects of climate change on individual organisms, we need to learn about these specific characteristics and adaptation mechanisms of individual populations and incorporate them into models for predicting the effects of climate change on living organisms*," says Petr Kotlík of the Institute of Animal Physiology and Genetics of the Czech Academy od Sciences, emphasizing the importance of his work.

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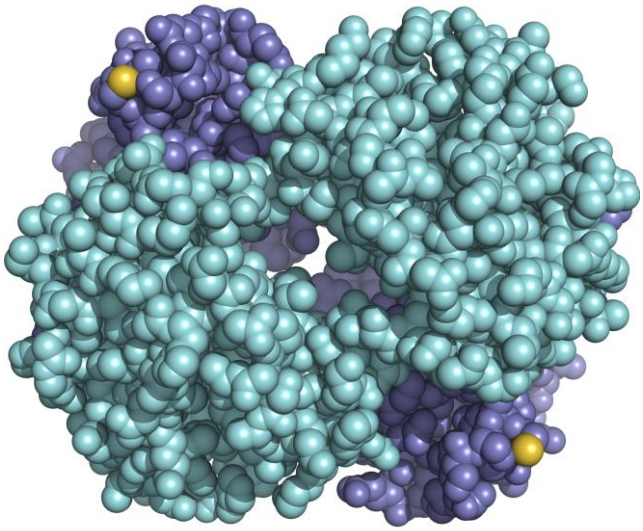
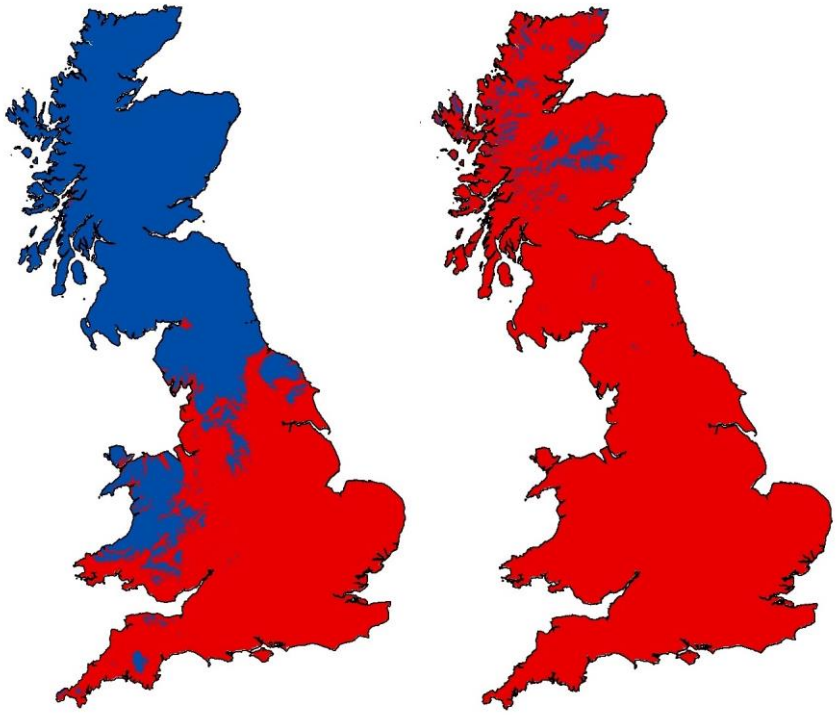
Link to online publication:
Genic distribution modelling predicts adaptation of the bank vole to climate change | Communications Biology (nature.com)

Photo Gallery:

The bank vole, a common forest rodent that also occurs in the forests of the Czech Republic, is suitable as a model species for studying the effects of climate change on living organisms (Photo: P. Kotlík).



Three-dimensional model of the vole’s haemoglobin, with the differences between the "warmth-loving" southern and "cold-loving" northern haemoglobin marked in yellow.



A map of the current (left) and predicted (right) distribution of the two haemoglobin variants in British bank vole populations. The predictive models (right) show that future climatic conditions throughout Britain will favour the "warmth-loving" southern haemoglobin (red), which under current climatic conditions occurs only in the southern part of Britain, over the "cold-loving" northern haemoglobin (blue).

Video:
https://www.uschovna.cz/zasilka/EOW6HBFM67HIS8M4-WA5

Bank vole as a model species for studying adaptations to climate change.