

Discovery of new genes suggest why insects are the most evolutionarily successful organisms

July 17 2015



Bee life cycle. Credit: Asaf at Dutch Wikipedia

In an article published today in the journal *Nature Communications*, researchers from the University of Bergen (Norway), IRTA Institute of Marine Sciences of the Spanish National Research Council (CSIC) and Institute of Evolutionary Biology (UPF-CSIC) presented the discovery and evolutionary origin of a new subfamily of molecular channels that they suggest may have allowed insects to become the dominant species on earth.

The study is led by Joan Cerdà, IRTA researcher at the Institute of

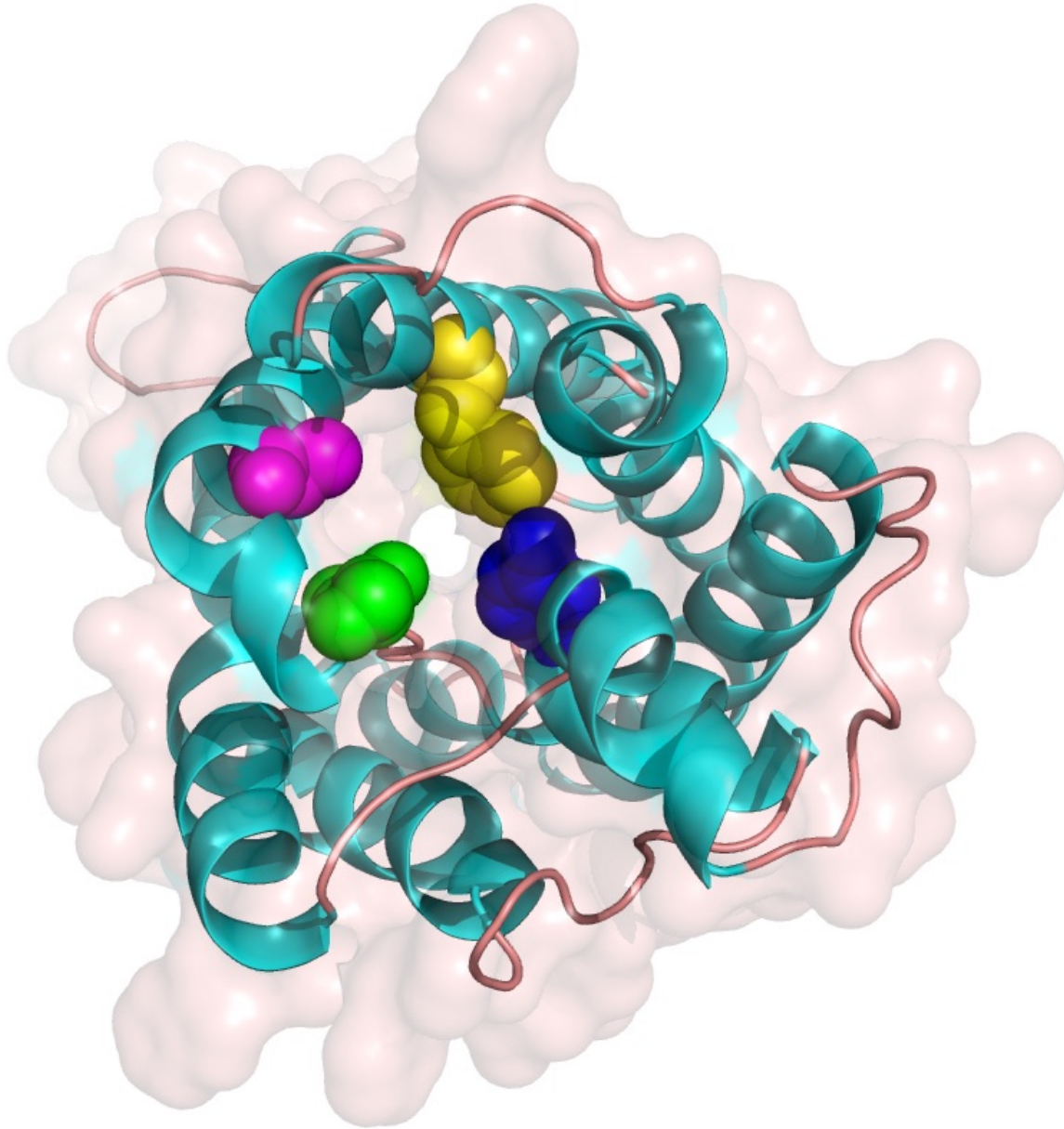
Marine Sciences (CSIC) and Roderick Nigel Finn, University of Bergen. Xavier Bellés at the Institute of Evolutionary Biology (CSIC-UPF) also participated in the project.

Excluding bacteria, [insects](#) represent more than half of the world's biodiversity. They are considered to be the most evolutionary successful group of terrestrial organisms in the history of life. The remarkable explosion of different insect lifestyles is due to their ability to colonize highly diverse niches from those with exceptionally hot and arid conditions to others with temperatures far below zero.

Since insects are not able to regulate their body temperatures, the success of these organisms has been associated with the appearance of a series of adaptations for survival in the face of desiccation and freezing. Among other strategies, there is the accumulation of high levels of alcohols such as glycerol or sorbitol in specific organs.

Mutated water channels that transport glycerol

Until now, however, it was not clear how insects transport glycerol across cell membranes. This is because earlier studies had suggested that major insect groups had lost the membrane channels known as aquaglyceroporins that normally transport glycerol. Such channels emerged in bacteria and multicellular organisms and are distinct from separate water channels known as aquaporins.



Model of one of the proteins expressed by the Eglps genes.

In this study the scientists find that holometabolan insects, which represent the most evolutionarily advanced groups of insects with the greatest biodiversity, have specific genes termed entomoglyceroporins (Eglps) that represent mutated water channels with an enhanced ability

for glycerol transport. By using genetic tools, the scientists show that the Eglps are closely related to a human aquaporin, which is a water-selective channel.

To understand how the genes evolved in insects, the scientists generated specific mutants to mimic the evolutionary process and show that a single mutation in the same central regions of the human and insect channels can convert a water-selective channel into an Eglp-type glycerol transporter and vice versa. They then carefully reconstructed the evolutionary history of Eglps and the ancestral aquaglyceroporins in [multicellular organisms](#). Results show that Eglps replaced the aquaglyceroporins in holometabolan insects.

An example of natural selection

Based upon their experimental evidence, the authors suggest that the aquaglyceroporins were supplanted by the Eglp channels probably because the Eglps have an enhanced glycerol transporting ability. The study therefore represents an example of natural Darwinian selection at the molecular level.

Intriguingly, the origin of Eglps coincided with periods of fluctuating temperatures that led to glaciation periods. This may have favored the appearance of the pupal stage in the life cycle of insects. This stage, which is particularly vulnerable to low temperatures, accumulates particularly high levels of [glycerol](#) and may thus not have arisen without the emergence of the Eglps.

Provided by Delegación del CSIC en Cataluña

Citation: Discovery of new genes suggest why insects are the most evolutionarily successful organisms (2015, July 17) retrieved 27 April 2024 from <https://phys.org/news/2015-07-discovery->

[genes-insects-evolutionarily-successful.html](#)

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.