Natural selection plays major role in an organism's capacity to evolve and adapt

December 3 2020

Credit: CC0 Public Domain

Everywhere we look in the natural world, there's evidence of natural selection: the resin armor of a lodgepole pine cone evolved to defend against seed-hungry birds and squirrels; the long neck of a giraffe was

evolutionarily favored for reaching high vegetation that the competition can't touch. We know that natural selection shapes how animals and plants evolve and adapt. But does natural selection also influence an organism's very capacity to evolve? And if so, to what degree?

A new study, published December 4 in *Science*, hints at some surprising answers to that question. A team of researchers led by Andreas Wagner of the University of Zurich and the Santa Fe Institute, subjected populations of a yellow fluorescent protein from a marine invertebrate to different types of selection pressure—weak and strong—to find out which one enhances evolvability more effectively. The evolutionary end goal in the experiment was to get the protein populations to evolve from yellow fluorescence to green. The team found that the group under strong selection won the green evolution race, because those populations underwent mutations that made them more robust—and therefore better able to evolve.

"To our knowledge, this is the first experimental proof that selection can drive the ability to adapt in a Darwinian sense and increase evolvability," says Wagner. "There are still people out there who question whether evolution is real. But we don't just look at fossils where we have a historical record. We observe evolution in the laboratory."

Since it's widely assumed within the evolutionary biology field that weak selection provides an advantage to an organism's ability to evolve, the group's discovery that strong selection resulted in greater robustness—a key requirement for evolutionary success—came as a surprise, he adds.

What happened, the team observed, is that the proteins under strong selection accumulated mutations that increased their robustness to a greater extent.

"This discovery was a real surprise to me because it showed that

selection for fitness didn't conflict with selection for robustness, which contrasts with previous work," remarks first author Jia Zheng (University of Zurich). "While most mutations that proteins encounter harm their stability or ability to fold correctly, the robustness-improving mutations actually mitigate such deleterious effects. Robust proteins have a higher chance to function and thus evolve new traits."

Wagner is hopeful that the study will help settle the long-standing controversy over whether an organism's evolvability itself can evolve. "Some people thought that natural selection on evolvability must not be very direct—it must be overridden by selection on fitness," he says. "But now we have a situation where both go hand in hand. In other words, there is no need for this controversy."

More information: Selection enhances protein evolvability by increasing mutational robustness and foldability" *Science* (2020). science.sciencemag.org/cgi/doi … 1126/science.abb5962

Provided by Santa Fe Institute

Citation: Natural selection plays major role in an organism's capacity to evolve and adapt (2020, December 3) retrieved 21 July 2024 from https://phys.org/news/2020-12-natural-major-role-capacity-evolve.html