

Q&A

What is an example of evolution at its finest, when an elegant efficiency is selected over time, that you've come across in your research?

There are countless examples of how natural selection explains not only how entire organisms evolve but also how the organs, behaviors, and intricate molecular parts within an organism have been perfected over time.

—EDITED BY SARAH C.P. WILLIAMS



Tanya T. Paull

HHMI INVESTIGATOR
UNIVERSITY OF TEXAS
AT AUSTIN

“I think the perfect microcosm of efficient evolution is the virus. A virus uses every nucleotide of its nucleic acid, sometimes many times over, to store all the information it needs in the smallest space. A virus can change over the course of many years to reproduce successfully in its host but also has the ability to change during the course of a single infection to suppress a host's defenses. The random changes that are constantly introduced into the virus genome show us that the virus has evolved to evolve—one of the best examples of the power of natural selection that exists in nature.”



Erich D. Jarvis

HHMI INVESTIGATOR
DUKE UNIVERSITY
MEDICAL CENTER

“A remarkable example of evolution at its finest is that of song and spoken language in birds and humans. Human language is often considered a pinnacle of evolution, a source of our civilization, and a final frontier of science. But humbling to me, we find that the required brain pathways and associated genes in distantly related song-learning birds and in humans have undergone a remarkable parallel evolution. In both, the pathways appear to have evolved similarly multiple times using an old trick similar to gene evolution: the duplication and then modification of existing brain pathways involved in learning.”



Catherine L. Drennan

HHMI INVESTIGATOR
AND PROFESSOR
MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

“The class II ribonucleotide reductase (RNR) from *Lactobacillus leichmannii* is a perfect example of evolution. RNRs are proteins essential to all organisms—they help make DNA. In higher organisms and many micro-organisms, RNRs work together in complexes, with two or more proteins attaching to one another to do their job. But for some micro-organisms, simplicity is the key to life. *L. leichmannii* has an RNR that has neatly evolved to do its job with only a single molecule of protein present. We recently showed that this single RNR chain works because it contains a helix-shaped structure that typical RNR proteins can form only when joined together. This simple RNR in *L. leichmannii* is a perfect example of evolution.”



Carlos D. Brody

HHMI INVESTIGATOR
PRINCETON UNIVERSITY

“The brain is clearly a marvel of evolution: using only some 20 watts, it seems to effortlessly accomplish myriad tasks that we cannot yet imitate using our fastest, biggest, and most energy-hungry computers. But is it an elegant, perfect example of evolution? Most experiments reveal an extremely noisy, bewilderingly complex thicket of interacting components. It is easy to imagine the brain as a Rube Goldberg device, chock-full of irrelevant peculiarities picked up through a long evolutionary history. But I don't think so. I prefer to believe that the brain holds hidden elegance that we are working to reveal.”