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Ancient DNA brought back to life

Biologists add 500 million-year-old gene to bacteria to watch evolution in action

Genetic material from bacteria that would have lived 500 million years ago has been resurrected and placed inside modern-day bacteria. Watching how these micro-organisms change over successive generations is allowing researchers to replay evolution in the lab to see whether it takes the same course as it did in nature.

Rather than plucking the genetic material from an ancient relic, biologists at the Georgia Institute of Technology in the US took what's known about the Elongation Factor-Tu (EF-Tu) gene in modern-day bacteria and worked back to what it would have been like in the bacteria's ancestors.

The researchers have been able to recreate the gene as it was 500 million years ago and add it to a harmless version of modern-day *Escherichia coli*, replacing its existing EF-Tu gene. "Our aim was to create a molecular time machine in the lab," says Dr Betül Kacar, who is leading the research. "We went back in time by resurrecting the gene and now we're coming back to the future using evolution. We wanted to know what would happen if we gave this gene a second chance."

Each day, the *E coli* containing the ancient gene go through six generations. So within the space of a few months, the biologists are able to see how the simple organisms have evolved in the small flask that is their home. "The bacteria were sick when we created them," says Kacar. "So they had to evolve and find a way to get healthy."

So far, the EF-Tu gene has not accumulated mutations, which means that it hasn't evolved

throughout the 1,000 or so generations of bacteria seen so far. It's the genes around it that have changed. Although it is early days with this research, this appears to be at odds with what happened the first time the gene had the opportunity to evolve – in nature. "But this is an ongoing evolutionary process," says Kacar. It remains to be seen whether the EF-Tu gene will start evolving.

As well as studying what happens within these bacteria in the longer term, there are many other avenues for research. "We can add more than one ancient gene, whole networks or maybe even change the whole genome," says Kacar.



Dr Betül Kacar has a front row seat to watch evolution

Is the human race a fluke?



Back to the future: *E Coli* bacteria

If we were able to allow evolution to take its course again on Earth, or 'replay life's tape' as the American evolutionary biologist Stephen Jay Gould once described it, would we get exactly the same clutch of species we see today? Would humans evolve again for that matter?

Some biologists believe evolution to be determinate: if life's tape were replayed, we would end up with largely the same species. Others believe the process is not repeatable. "We thought maybe we could replay the tape for one gene and see whether it would adapt in the same way," says Dr Betül Kacar, at Georgia Institute of Technology.

The research is ongoing, but so far the ancient gene has not evolved, apparently at odds with what happened in nature. This would indicate that evolution could have taken a different tack in our past and so our presence on Earth was not inevitable.