

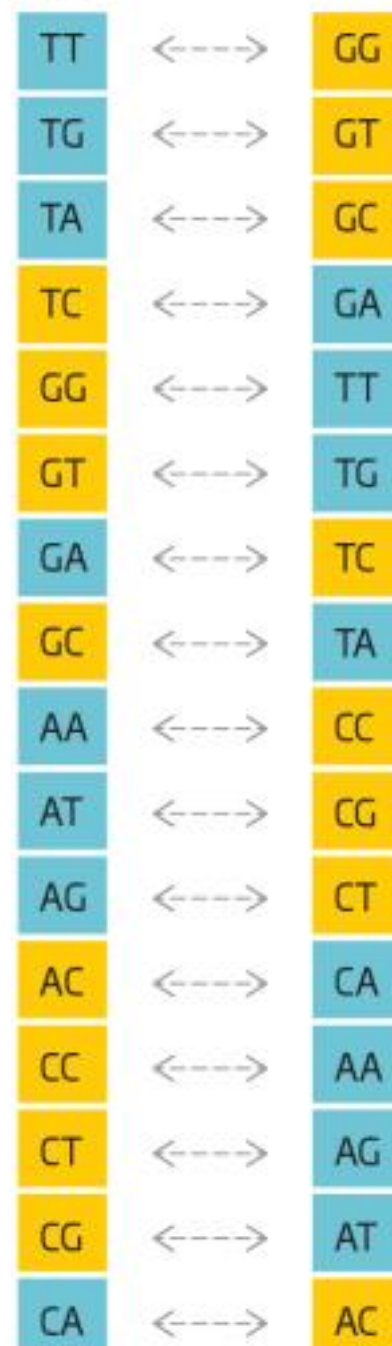
Is the answer to life, the universe and everything 37?

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Rumer's transformation

Whole families can be converted into **split families** - and vice versa - by switching Ts for Gs and As for Cs

The probability of this happening by chance is extremely small



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(Image: Vijay Marrha/Eyeem/Getty)

So you're an alien seeding primordial Earth with life. Like any creator, you sign your work. Now we may have found that signature – in the genetic code

MAXIM MAKUKOV has an idea. It's unorthodox; you might call it "out there". Makukov understands that. He knew he'd have his critics the moment he began to develop it. But it's there in the numbers, he says. And numbers don't lie.

A cosmologist and astrobiologist at the Fesenkov Astrophysical Institute in Almaty, Kazakhstan, Makukov says the numbers reveal that all terrestrial life came from outer space. Not only that, it was planted on Earth by intelligent aliens. Billions of years ago, the planet was barren and lifeless. But then, at some distant and unknowable moment, it was seeded with what Makukov calls an "intelligent-like signal" – a signal that is too orderly and intricate to have occurred randomly.

This signal, he says, is in our genetic code. Highly preserved across cosmological timescales, it has been waiting there, like an encrypted message, for anyone qualified to read it. All of the teeming varieties of life on Earth – from kangaroos and daffodils to albatrosses and us – carry it within them. And now Makukov, along with his mentor, mathematician Vladimir *sh*Cherbak of the al-Farabi Kazakh National University in Almaty, claims to have cracked it. If they are right, the answer to life, the universe and everything is... 37.

The idea that terrestrial life has extraterrestrial origins has a long and sometimes distinguished history. The standard version goes something like this: a primitive alien life form, perhaps a bacterium, somehow hitches a ride through space aboard an object like a meteoroid, collides with our young planet and seeds it with life. Against innumerable odds, its descendants flourish and spread across Earth.

In 1871, Lord Kelvin hypothesised "that there are countless seed-bearing meteoric stones moving about through space". In his 1908 book *Worlds in the Making*, Nobel laureate Svante Arrhenius named the process "panspermia". As recently as 2009, Stephen Hawking speculated that "life could spread from planet to planet, or from stellar system to stellar system, carried on meteors".

Prestigious backers notwithstanding, panspermia has not found widespread acceptance, although many biologists accept a weaker version of it. "Most biologists will agree there is a contribution to the origin of life on Earth from cosmic sources," says P. Z. Myers of the University of Minnesota, Morris. "We have lots of organic compounds floating around in space."

panspermia", the hypothesis that life was seeded intentionally by an extraterrestrial intelligence.

The idea goes back to 1973, when Francis Crick published a [paper in the planetary sciences journal *Icarus*](#), at that time edited by Carl Sagan. In it, Crick asked the question: "Could life have started on Earth as a result of infection by microorganisms sent here deliberately by a technological society on another planet, by means of a special long-range unmanned spaceship?"

Extraordinary claims like this require extraordinary evidence. For more than a century, people have been trying to find at least some of that evidence – proof of the existence of sentient aliens.

The bulk of this effort – known as SETI, or the search for extraterrestrial intelligence – has involved trying to detect radio signals. But despite almost a century of vigilance, says SETI senior astronomer Seth Shostak, they have heard nothing.

With one possible exception. In 1977, SETI researchers in Ohio picked up a 72-second burst of radio waves that was so close to what they had been looking for that one of the researchers wrote "Wow!" on the readout. Nothing like the [Wow! signal](#) has ever been seen since.

The radio silence has inspired some to widen the search. Many have asked: what if the message is here on Earth already? What if we are the message?

In his 2010 book [The Eerie Silence](#), Paul Davies, a physicist at Arizona State University, wrote about [genomic SETI](#) – the idea that our genome might house a secret message. He was following the physicist George Marx, who in 1979 [wrote](#): "It is possible that a few billion years ago an advanced civilization prepared some sort of message using genetic engineering and sent it to Earth. This extraterrestrial DNA molecule became the starting point of biological evolution."

Makukov and *sh*Cherbak's ideas are in this tradition. But instead of rummaging through DNA, they look to the genetic code, a complex set of rules by which DNA is translated into proteins ([see "Code within a code"](#)). The genetic code shouldn't be confused with the genome, which is a specific set of genetic instructions for making a fruit fly, say, or a giant redwood. Instead, it specifies how to convert those instructions into proteins.

Unlike genomic DNA, the code is stable. Genomes mutate over time, but the code is passed down the generations without alteration and appears to have remained almost completely unchanged for billions of years.

For that reason, says Makukov, it is the perfect place to plant a message. Billions of years ago, he says, [that is precisely what happened](#).

To test the idea, Makukov and *sh*Cherbak devised a mathematical approach to analyse the code, searching for patterns unlikely to occur at random.

Their arguments are often dense and impenetrable, filled with complex mathematical formulae. But at heart, Makukov says, "it's very simple". The genetic code is like some type of combinatorial puzzle, he says. In other words, once you begin to analyse it, hidden regularities emerge.

"It was clear right away that the code has a non-random structure," says Makukov. "The patterns that we describe are not simply non-random. They have some features that, at least from our point of view, were very hard to ascribe to natural processes."

Exhibit A is Rumer's transformation. In 1966, Soviet mathematician Yuri Rumer pointed out that the genetic code can be divided neatly in half ([see "Rumer's transformation"](#)). One half is the "whole family" codons, in which all four codons with the same two initial letters code for the same amino acid. The AC family, for instance, is "whole" because codons beginning AC code for threonine. On the other are "split family" codons, which don't have this property.

Rumer first noted that there is no good reason why exactly half of the codons should be whole. More profoundly, he also realised that applying a simple rule – swapping T for G, and A for C – converts one half of the code into the other.

That might sound inevitable, but it is not. In 1996, mathematician Olga Zhaksybayeva of the al-Farabi Kazakh National University [calculated](#) that the probability of it occurring by chance is 3.09×10^{-32} .

And Rumer's transformation is just one of many patterns and symmetries within the code. Another example: you can create a subset of codons including those with three identical bases (AAA, say) and those with three unique bases (GTC, say). Using a Rumer-type transformation, these 28

combined "side chain" atomic mass of 703 (see "Transformation #2"). Both are multiples of the prime number 37, which has interesting mathematical properties of its own (see "Symmetries of 37").

In fact, 37 recurs frequently in the code. For example, the mass of the molecular "core" shared by all 20 amino acids is 74, which is 37 doubled. Forget 42...

All in all, the Kazakhs have identified nine patterns in the code, which they spell out in detail in the journal *Icarus* (vol 224, p 228) under the provocative title "The 'Wow! signal' of the terrestrial genetic code".

If you think that all sounds a bit like *The Da Vinci Code for DNA*, you're not alone. "It's flat out numerology," says Myers, who also notes the similarity to the pseudoscience of intelligent design – a comparison Makukov and *shCherbak* reject. "The hypothesis has nothing to do with intelligent design," they say.

Others are less critical. "It's not, in and of itself, absurd," says David Grinspoon, senior scientist at the Planetary Science Institute and author of *Lonely Planets: The natural philosophy of alien life*. "We're already learning to custom design organisms and we're already learning to send things out into space. If anybody else is out there, the chances are they're not as new at it as we are."

Davies is also quite forgiving. "If you crunch numbers long enough, you'll find patterns in almost anything," he says. "It was very clear to me at the outset that what this boils down to is an assessment: what is the probability that you might find something like this by chance?"

To that, Makukov and *shCherbak* have an answer: about 10^{-13} , or 1 in 10 trillion. In October, they published a second paper on the work in *Life Sciences in Space Research* (vol 3, p 10).

As to what – or who – planted the message, Makukov stresses that he doesn't know. "This is speculation," he says. "Maybe they're gone long ago. Maybe they're still alive. I think these are questions for the future."

But on the basic idea, he is adamant. "For the patterns in the code," says Makukov, "the explanation we give, we think is the most plausible."

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