Researchers estimate the maximum growth rate for life on Earth

In what is believed to be a world-first, researchers at the University of Tasmania have estimated the maximum growth rate for life on Earth.

Led by School of Land and Food Senior Research Fellow Dr Ross Corkrey, this ground-breaking research into the growth rates of microbes was presented at the Astrobiology Science Conference in Arizona.

The research significantly challenges assumptions about microbes and the way they behave under high temperatures.

It is common knowledge that microbes grow at a faster rate under high temperature, which in the case of bacteria, for example, causes milk to go off when it is left out of the fridge.

Last year, Dr Corkrey's group made an important discovery, that once temperatures reached somewhere above 40°C, the maximum rate of microbial growth plummeted dramatically. This distribution of growth rates was termed the Biokinetic Spectrum for Temperature (BKST).

Building on this work, the team have now quantified the data and provided an estimate on the maximum growth rate for life on Earth.

"We now find that the predicted maximum growth rate occurs at 45.8°C with an estimated minimum generation time of 5.16 minutes. This means that the shortest possible time in which a cell can divide to make two daughter cells is a little more than 5 minutes," Dr Corkrey said.

"We are now considering how this limit may influence ecological processes that vary by temperature including, perhaps, those of marine plankton."

To arrive at the numbers, the team collated more than 10,000 measurements of growth rates, representing 1,627 microbe strains.

"We mathematically modelled the BKST to obtain the predicted maximum rate of growth versus temperature for any life on Earth," Dr Corkrey said.

The vast bulk of the BKST describes growth rates for most of life, but it still displays deviations at very low and very high temperatures (<0 and >100°C).

"This could mean that the growth rate drops due to some unknown property, perhaps such as changing bulk properties of water, like diffusion of molecules at low temperatures, and at high
temperatures the deviation may be due to an increasing degree of denaturation and
degradation of biomolecules,” Dr Corkrey said.

“Alternatively, it could mean that there are organisms that grow slowly at these temperatures
that are undiscovered.”

“It is notoriously difficult to grow organisms at low temperatures, so it would not be surprising if
we have not found them. These would be organisms that still grow slowly compared to more
familiar forms of life, but much faster than those we so far know about. Perhaps they would be
found in glacial ice. Similarly, it is possible that there may be relatively fast-growing organisms
growing in hydrothermal vents at the bottom of the sea.”

The team is now exploring how the growth limits of life depend on other conditions such as
acidity and salt concentration.

Information released by:

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