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Astrobiology

Moss from Earth could grow under the light of another star

Alex Wilkins

ALGAE, moss and bacteria can all survive and grow in the light produced by a red dwarf star, according to experiments on Earth. This boosts the idea that planets around red dwarf stars like TRAPPIST-1 could host life.

The most promising exoplanets for life orbit stars that are smaller and cooler than our sun, so they radiate different profiles of light.

For instance, a star like TRAPPIST-1 would give out more infrared light. But we know little about how this would affect life.

Last year, Nicoletta La Rocca at the University of Padua in Italy and her colleagues tested how organisms from Earth might fare under simulated starlight by placing several types of cyanobacteria (also known as blue-green algae) in a starlight generator consisting of 273 controllable LEDs, which could mimic sunlight or red dwarf light.

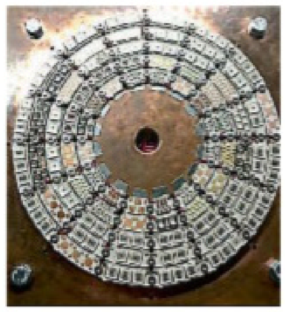
The cyanobacteria, which are efficient at photosynthesising – getting their energy from sunlight – and can work in low and redder light, grew almost as well under the artificial red dwarf light as they did under the simulated light from the sun.

273

The number of LEDs used to copy the light from a red dwarf

This is important, La Rocca told the Europlanet Science Congress in Granada, Spain, on 19 September, because cyanobacteria were crucial in making Earth habitable for other organisms. "They totally changed our planet, being responsible for the start of oxygen production," she said.

LA ROCCA ET AL.



The LED simulator that was used to mimic a red dwarf star's light in experiments on Earth

La Rocca told the conference that her team has now put other types of organisms in the simulator that aren't as good at harvesting light as the cyanobacteria, such as the microalgae *Chlorella vulgaris* and *Chromera velia*, and a moss, *Physcomitrella patens*, to test how they might fare.

Although all the organisms were able to grow under the artificial red dwarf light, most of them grew slightly less than they did under the simulated sunlight – except for one species, *C. velia*, which grew more.

La Rocca and her team also noticed that under artificial starlight, the moss failed to grow certain reproductive structures that are normally present under sunlight. "Maybe the organism can grow but no longer reproduce. This will deserve more investigation," La Rocca told the conference.

The team also tested how much oxygen was produced by each species of cyanobacteria under different simulated lights and found that they would all contribute to an atmosphere under red dwarf starlight.

Next, La Rocca's team hopes to test how much oxygen the more complex organisms produce, and to make mathematical models to evaluate the possibility of these organisms existing on planet surfaces.

Complex organisms

Using organisms from Earth to evaluate how habitable alien star systems could be isn't straightforward, says Michael Phillips at Johns Hopkins University Applied Physics Laboratory in Maryland.

"It's very difficult to imagine life in other star systems evolving exactly how it evolved on Earth," he says. "So while it's interesting to see how a photosynthetic organism might respond to different starlight, those organisms are still very complex, and it took billions of years of evolution on Earth to get them."

However, the work gives us a baseline for hypotheses to test when looking at the light spectra that come from worlds orbiting different stars, says Phillips. ■

Fertility

Sperm move in packs to push through vaginal fluid

Christa Lesté-Lasserre

SWIMMING in a pack may help sperm push upstream through thick vaginal and uterine mucus.

Sperm are often represented as individuals racing to fertilise an egg, but this is based on flat views of microscope slides and other settings that don't reflect their natural context, says Chih-Kuan Tung at North Carolina Agricultural & Technical State University.

When placed in a mock-up of the female reproductive tract, bull sperm – which are similar to human sperm – appear to team up.

To better understand why, the researchers injected 100 million fresh bull sperm into a silicone tube containing fluid that resembled cows' cervical and uterine mucus. Then, they used a syringe pump to create two speeds of flow.

When there was no flow, the clustered sperm swam in a straighter line than the individual sperm. In an intermediate flow, the clusters could swim upstream, unlike individual sperm. When the flow was strong, the clustered sperm pushed through far better than individual sperm, which usually got swept away (*Frontiers in Cell and Developmental Biology*, doi.org/jdck).

There was never one "leader" that was supported by others, says Tung. Instead, the arrangement resembles cyclists riding together in a peloton to encounter less air resistance. "It could be this kind of mechanism that just allows that at least some of them will eventually get to the oviducts," he says.

The clusters probably serve a role in the thick outflowing mucus in the vagina and cervix as well as in the uterus, where contractions push fluids in multiple directions, he says. As sperm reach the oviducts, where fluids are thinner and less mobile, it is possible they swim individually.

The findings open new avenues for helping diagnose unexplained infertility, says Tung. ■