

Star jelly: Nostoc (cyanobacterium *Nostoc commune*)

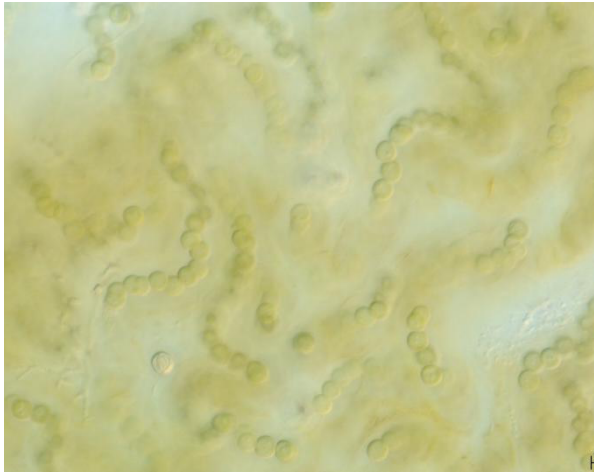
(Anna Temraleeva)



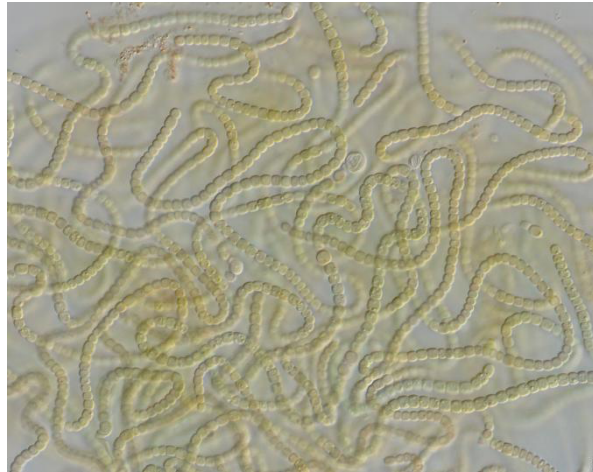
A



B



C



D

A: Dry crusts formed by *Nostoc* in a natural environment. B: Moist *Nostoc* colonies in a laboratory.
C: Natural *Nostoc commune* specimen under microscope. D: Laboratory *Nostoc* strain after long-term cultivation.

Claim to fame: normally invisible but after rainfall swells up into a jellylike mass – *star jelly*

Look down and you will see the invisible become visible. When you look around, you usually look straight ahead and see living organisms that are visible to the naked eye. For a long time, scientists thought that nature consisted only of visible things, but today we know more and can confidently say that at least two-thirds of life on Earth consists of microorganisms that are invisible without a microscope.

Look down, please! After all, you are standing on a treasure trove of life – the soil – home to 59% of all life on Earth, ranging from large animals to tiny microbes living on and in it. *Soil is the most diverse habitat on our wonderful planet.*

Nostoc: our hero of star jelly. Long before the invention of microscopes, people had found large masses of mysterious, gelatinous substances on the surface of soils. These substances were

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known as "star jelly", "troll's butter", "witch's jelly", "spit of moon", "fallen star" or "star slime", but no one knew what they were. *Who knows what potions our unnamed hero may have been used in?*

In the 16th century, Paracelsus, a famous scientist and alchemist, named this organism *Nostoc*. The name is derived from Old English and German words that mean "nostril", which refers to the appearance of the lumpy green masses that resemble boogers (appropriate, isn't it?).

Later, it became clear that these masses are formed by the growth of slime colonies of the cyanobacterium *Nostoc*, which are cylindrical or barrel-shaped cells that form moniliform trichomes (elongated hair-like structures, which can contain hundreds to thousands of cells).

But not all cells of *Nostoc* are the same. In a colony, different cells can specialize in different tasks, rather than trying to do everything at once. Some cells specialize in reproduction, while other cells fix nitrogen (heterocytes) and provide this essential nutrient to the other members of the colony. A rare type of cell called akinete (enveloped, non-motile, cold- and desiccation-resistant cell) remains dormant under thick walls. Its main task is to ensure the survival of *Nostoc* colonies, when environmental conditions deteriorate.

So far, phycologists have identified over 100 different species of *Nostoc*.

Blue-green slime. The fascination with *Nostoc* stems from its lumpy, mysterious jelly-like structures that, after rain, fill with water and turn into blue-green slimes. We can easily see, touch, and feel them (and yes, sometimes even eat them).

As you might have guessed, trichomes are held together by a gelatinous matrix made of sugars. This mucus not only holds the colony together, but also protects cyanobacteria from solar radiation, drying, and other environmental hazards. And: *Nostoc* thereby helps not only itself, but also other microorganisms in its vicinity, by protecting them from solar radiation and dehydration. *Nostoc is a truly generous hero!*

Ancient snacks. *Nostoc* has been a part of Asian cuisine for thousands of years, and it is an essential ingredient in traditional bird's nest soup. Now, *Nostoc* is also enjoyed in many countries because it provides protein and vitamin C. *Nostoc* can be eaten as a salad, stir-fried, or used as an ingredient in vegetarian dishes like Buddha's Delight, a stew. If you would like to try this unique treat, you can purchase dried *Nostoc* at most Asian grocery stores.

Sniff Nostoc. When scientists open a Petri dish in which *Nostoc* is growing, they are greeted by the rich aroma of damp earth after a rainstorm. This is due to the presence of geosmin, a strongly-smelling organic substance produced by various microorganisms, including our hero. The human nose has an extreme sensitivity to geosmin, being able to detect it at concentrations as low as five molecules per trillion in the air. This sensitivity may be beneficial for animals, as it allows them to use geosmin to find a source of water and sense an approaching thunderstorm, allowing them to take shelter in advance. Now, this odorant is used in the perfume industry ("rain" perfumes).

Nostoc is a soil improver! Due to the fact that *Nostoc* is able to convert inaccessible nutrients, such as nitrogen, phosphorus, and iron, into forms that are accessible to plants, as well as release phytohormones that promote plant growth, and toxins that inhibit the growth of pathogenic microorganisms, it has been used as a biofertilizer in agriculture. Moreover, filamentous and slimy *Nostoc* acts as glue, binding soil particles, promoting their aggregation, increasing stability, improving water retention, and attracting other beneficial microorganisms. Nature knows best, and we should learn from its wisdom.

Nostoc, of Star Jelly fame, is an amazing, multi-talented microbial hero