



LIVING COLORS:  
Microbes of Yellowstone National Park

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*Phormidium* is a rod-shaped cyanobacterium that forms bacterial mats and performs photosynthesis for energy. *Phormidium* is found around Yellowstone in features such as Octopus Spring, Grand Prismatic Spring, and Queen's Laundry Spring, and in some thermal features in Mammoth Hot Springs, as well as at sites around the world, including Chile, Turkey and even Antarctica.



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*Synechococcus* species are rod-shaped cyanobacteria that create green mats and can form some of the most prominent green colors in thermal features. *Synechococcus* is found in neutral to alkaline springs that are non-sulfidic (do not smell like rotten eggs) such as Mammoth Hot Springs, Grand Prismatic Spring, Imperial Geyser and Octopus Spring and are very prevalent in the oceans around the world and may play an important role in the global carbon cycle by transforming abundant amounts of carbon dioxide into oxygen.



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*Thermus* is a rod-shaped bacterium that sometimes forms bright red or orange streamers. Discovered in 1968, it was one of the first extremophiles found in Yellowstone. Scientists to make many copies of DNA. *Thermus* is found in thermal areas around Firehole Lake Drive and Octopus Spring. *Thermus* species have also been found in deep-sea hydrothermal vents; hot springs in California and Iceland; and even in hot-water heaters in residential homes.



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*Metallosphaera* is a spherical-shaped member of the domain Archaea that appears orange when in large groups. *Metallosphaera* is found in acidic springs such as Whirligig Geyser in Norris Geyser Basin. Similar species have been found in thermal areas in Italy and in acidic mine drainages, such as a slagheap of a uranium mine in Germany.



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*Caldisphaera* grows in high-temperature and acidic environments. It uses organic forms of carbon and elemental sulfur as sources of energy and will convert yellow precipitated sulfur into hydrogen sulfide — a gas that smells like rotten eggs and is very poisonous and corrosive. *Caldisphaera* is widely distributed in acidic hydrothermal features such as Monarch Geyser in Norris, and species have been found in hot springs in the Philippines, Russia, and California.



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*Zygogonium* is a green rod-shaped alga that obtains its energy by performing photosynthesis in the same manner as plants. When it is exposed to intense sunlight, a dark purplish pigment is formed within its cell. Therefore, these purple cells can look almost black. *Zygogonium* is found in acidic springs such as those found at Nymph Lake, Norris Geyser Basin and Lemonade Creek, as well as in Canada, Australia, South Africa and India.



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*Euglena* is a free-moving single cell organism that displays characteristics of both animals and plants. *Euglena* can live in acidic environments but is also commonly found in freshwater streams and lakes. They often multiply into large enough groups that they form a green layer on water. *Euglena* can be found around Lemonade Creek, Nymph Creek and Beaver Lake. Species of *Euglena* can be found in freshwater ponds and streams around the world.



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*Sulfurihydrogenibium* species are straight to slightly curved rods of bacteria. They often form cream filaments or streamers. *Sulfurihydrogenibium* can be found in Mammoth Hot Springs, Calcite Springs, and Obsidian Pool. Species have been found in hot springs in Iceland, Russia, and the Archipelago of the Azores, in deep-sea hydrothermal vents and even in a hot subsurface aquifer in a Japanese gold mine.



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*Thermocrinis* is a rod-shaped bacterium that grows in the outflow of several alkaline hot springs in Yellowstone. Long chains of its cells form yellowish or pink streamers that attach to the sinter (a chemical crust) created by the precipitation of silicates in the water. *Thermocrinis* is found in many alkaline hot springs such as Octopus Spring in the Lower Geyser Basin. A similar species was found in a volcano in Costa Rica.

