HIGHLIGHTS 2020

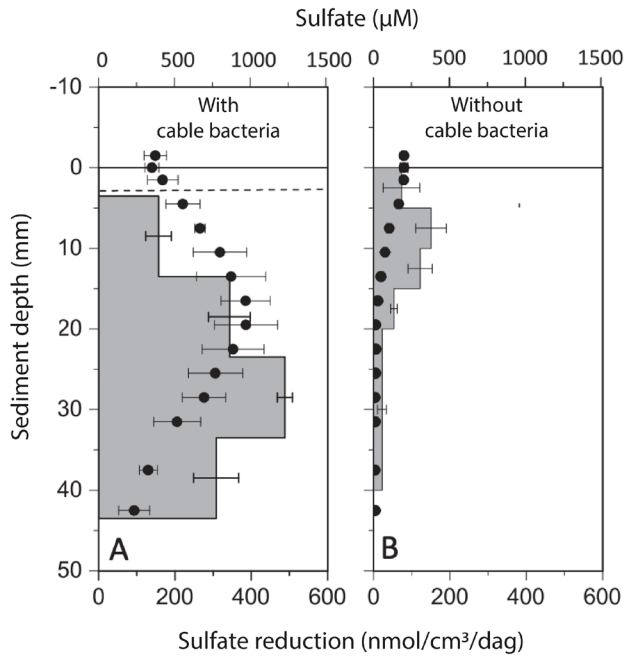
THE IMPORTANCE OF CABLE BACTERIA FOR THE ENVIRONMENT

Cable bacteria live in the bottom of the oceans, lakes, and streams, and several of the publications from Center for Electromicrobiology in 2020 highlighted their significance for the environment through their interactions with other microorganisms.

Besides confirming that cable bacteria improve the living conditions of benthic animals by removing toxic hydrogen sulfide, the studies also revealed how the cable bacteria affect the entire turnover of organic matter in lake sediments, stimulate the decomposition of polluting oil products on the seabed, and inhibit the release of the potent greenhouse gas methane from rice fields.

Cable bacteria are unique by having inner electrical wires, and the impact on the environment may be attributed to their function as centimeter long "electric snorkels" in oxygen free seafloor layers. Here, the decomposition processes are inhibited because the microorganisms are unable to transfer their electrons directly to oxygen, and this is solved by the cable bacteria by sending the electrons through their wires to oxygen in other places, typically in a thin film at the surface of the seabed or around the roots of water and swamp plants.

Through collaborations with external partners and other funding bodies, Center for Electromicrobiology ensures that the many potential applications that the new discoveries bring are being pursued.



Metabolism in lakebed with and without cable bacteria. In the presence of cable bacteria, the sediment is enriched with sulfate (circles) down to a depth of nearly 50 millimeters, which stimulates a microbial turnover of the buried organic matter through reduction of sulfate (grey histogram). The enrichment with sulfate is caused by two effects of the cable bacteria. One is that the cable bacteria regenerate sulfate by immediately oxygenating the sulfide produced during sulfate reduction. The other is that the electric currents in the cable bacteria form electric fields that ensure the attraction and retention of the negatively charged sulfate ions from the overlying lake water [Sandfeld et al., The ISME Journal, 2020]. A separate study showed how the degradation of petroleum was also increased when the cable bacteria stimulated the sulfate reduction.

Methane from rice soil. The release of methane to the atmosphere from flooded rice plant pots was 10 times higher when cable bacteria were absent. The dramatic effect can, as in the study of the lakebed in the figure above, be explained by the stimulated sulfate reduction caused by the cable bacteria. This enabled the sulfate reducing bacteria to displace the methane producing microorganisms [Scholz et al., Nature Communications, 2020].