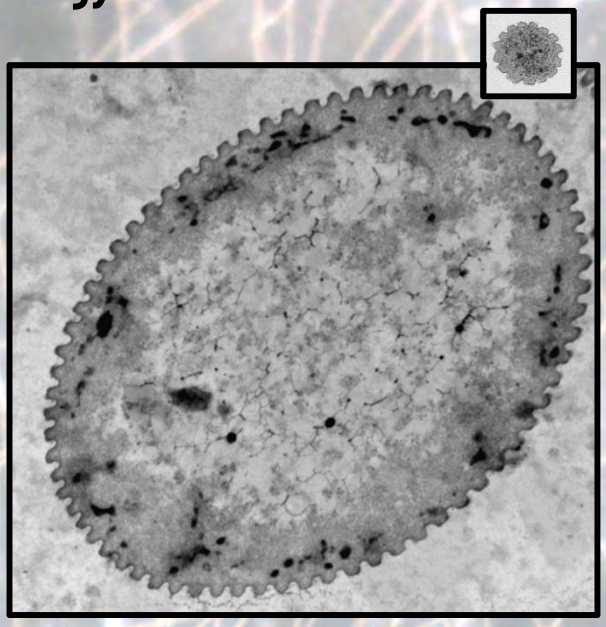
HIGHLIGHTS 2018:
Center for Elecromicrobiology

A cable bacterium is an electrically conductive bacterium, consisting of many thousands of cells forming filaments up to several centimeters in length. The main goal of the Center for Electromicrobiology is to solve the mystery of how this peculiar life form functions. The year's highlights were three publications that have presumably cleared up any remaining skepticism of cable bacteria in the scientific community: there is now insurmountable evidence that cable bacteria are living electrical cables in a very literal sense.



Cross section of a thick cable bacterium and a thin cable bacterium from Aarhus Bay. New results confirm that elecrical conductors run under the ridges on the cell surface. These ridges have been found to have a standard size. Jiang mfl. 2018, PNAS 115:8517-8522; Cornelissen mfl. 2018, Front. Microbiol. 9:3044.

Electrically conductive structures in cable bacteria

Cable bacteria have a characteristically ridged surface, and we have assumed that each of these ridges encloses a strand that functions as an electrical conductor. To test this hypothesis we developed a highly novel and sophisticated dissection method, where cells were slit open with a fine needle tip and turned inside out. As expected, this method revealed a regular pattern of strong, continuous strands under each ridge. Further microscopic investigations indicated a common, standard conductive structure in several different cable bacteria species and living conditions. The next step will be to better understand the molecular structure of these strands.

Electrical potential in cable bacteria

The use of a voltmeter to measure electrical potential along conductors in living cable bacteria has continued to prove elusive. However, the use of microscopic spectrometry has allowed us to exploit the cells' own voltage-sensitive molecules as a biological voltmeter. When a cable bacterium actively conducted electrons from one end to the other we could measure a voltage drop of around 13 millivolts per millimeter. This number indicates that resistance sets the upper limit of the current's effective range at a few centimeters, a distance consistent with observations in natural settings. The conductivity of the bacteria's biomolecular conductors are nonetheless much greater than we can currently explain.

CEM postdoc Jesper T. Bjerg at the microscope. Jesper used confocal Raman microscopy to measure the electrical potential along active cable bacteria by observing the redox status of cytochromes. Bjerg mfl. 2018, PNAS 115:5786-5791.