Project area: Biochemistry

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Lab/Institution: Inorganic Biochemistry and NMR Laboratory / ITQB-UNL

Duration: 12 months

Number of students: 1 or 2

Title: Structural and biochemical characterization of FccA from human pathogen *Shewanella algae*

Project Summary/abstract:

Members of the *Shewanella* genus are well-known for their unparalleled capacity to reduce an array of inorganic and organic compounds. Their capacity to respire various insoluble metals and potential application in several biotechnologies has ignited tremendous interest in the characterization of these microorganisms.

Besides the prospective biotechnological applications, recent reports on increasing number of infections attributed to *Shewanella* indicates the pathogenic potential of this genus, with more than 80% of the known cases being reported since 2000. In humans, *Shewanella* has been mostly associated with septicemia, cellulitis, skin and soft tissue infections. Presently, one hospital outbreak and over 300 cases have been reported worldwide, with death occurring in 13% of the patients. Mainly two species, *S. algae* and *S. putrefaciens*, have been isolated from infected samples. Nonetheless, to date, virtually nothing is known regarding *Shewanella* pathogenicity.

In *Shewanella,* the Mtr pathway is one of its main respiration pathways. It is composed by four multiheme *c*-type cytochromes CymA, MtrA, MtrC and OmcA and a porin protein MtrB, which together span the periplasmic space and transport electrons from the cytoplasmic membrane to the outer surface of the cell. Recent studies have demonstrated that the periplasmic proteins STC and FccA are also involved in the extracellular electron transfer process of *Shewanella*, being responsible for mediating electron transfer within the periplasmic space. This electron transfer pathway is initiated by the transfer of electrons from the menaquinol pool to the inner-membrane associated tetraheme cytochrome CymA, that subsequently transfers them to periplasmic terminal reductases or to periplasmic redox shuttles, such as STC and FccA. These tetraheme cytochromes can transfer the electrons to porin-cytochrome complexes that permeate the outer-membrane, such as the MtrCAB for the reduction of extracellular electron acceptors.

This project focuses on the structural and biochemical characterization of FccA from human pathogen *S. algae*. Subsequent comparative studies with homologous FccA from non-pathogenic *Shewanella* species will also be performed. This will allow us to understand if certain evolutionary mutations in key intervenient enzymes have improved the respiration process in *Shewanella* and therefore the growth of these emerging opportunistic pathogens under the anaerobic conditions prevailing in infection sites in hosts.