Thermophile respiratory complex's structure determined by cryoEM

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Energy is the basis of life, and all organisms depend on mechanisms of energy transformation for growth and reproduction. Living beings get their energy through cellular respiration. In eukaryotes, like us humans, this is done in the presence of oxygen in an organelle called the mitochondria through four protein complexes, which constitute the respiratory chain. Bacteria have more diverse protein complexes and they are able to use other compounds besides oxygen, such as sulfur and nitrogen species or iron. This diversity is what enables microorganisms to colonize environments as extreme as volcanoes, the bottom of the ocean or the inside of our bowls. In this work, ITQB NOVA researchers from Manuela Pereira Lab and Miguel Teixeira Lab with colleagues from Max Planck Institute in Germany have described a new bacterial respiratory complex from a deep see organism. The results were published today in *Nature Communications*, open access magazine from Nature Publishing group.

Rhodothermus marinus is a thermophile collected from Azores, at Ribeira Quente Beach. It grows at 65 °C but it also needs oxygen, so it colonizes a thin layer of sea water where it finds optimal temperature and oxygen pressure. This bacterium has been studied at ITQB NOVA, at Manuela Pereira Lab and Miguel Teixeira Lab, for many years. Now, they were able to take a big advancement by obtaining a cryo-electron microscopy image of the membrane protein complex that is responsible for energy transduction in these bacteria. Cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution is the technique that awarded the Nobel Chemistry Prize to Joachim Frank,

Richard Henderson and Jacques Dubochet in 2017. In fact, the results now obtained gave fundamental structural information to understand how this "molecular machine" transforms energy into the usable ATP. (more on the Portuguese consortium that is is committed in bringing this technique to Portugal to make it more available for researchers).

"In this work we have described a new respiratory alternative complex, that is increasing the knowledge we have on the great diversity of microorganisms molecular strategies for life and reproduction", according to Manuela Pereira, corresponding author. "Rhodothermus marinus presents a unique structure, which provides insights into a mechanism for energy transduction and introduces ACIII as a redox-driven proton pump."

More information: Joana S. Sousa et al. Structural basis for energy transduction by respiratory alternative complex III, *Nature Communications* (2018). DOI: 10.1038/s41467-018-04141-8

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