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Midichloria mitochondrii, unique intramitochondrial bacterium and novel tool to explore mitochondria

PUBLIC ABSTRACT

Mitochondria are organelles that perform fundamental functions in eukaryotic cells. They are responsible of cellular respiration, energy generation and an array of biosynthetic processes. Additionally, they play a key regulatory role in programmed cell death. In medicine they are widely studied, as mitochondrial dysfunction/disease have enormous health consequences, due to their involvement in aging and in a number of pathologies including, cancer, metabolic disorders and heart disease.

Despite their importance, and the effort of numerous researches, multiple aspects of mitochondrial biology are still unclear. In this project we propose to exploit a unique system to develop novel tools to study and to interact with mitochondria, with potential groundbreaking applications. *Midichloria mitochondrii* is an intracellular bacterium that presents a characteristic that makes it unique: it is able to enter the mitochondria of its host cells. This unique interaction has been discovered recently, and is still widely uncharacterized. Our multidisciplinary team envisioned an integrated experimental approach, using state of the art technologies in the fields of bioinformatics, -omics, imaging, biochemistry, and cellular biology to investigate this novel biological system.

This research project will allow us to understand the evolution and the functional details of the relationship between *M. mitochondrii* and its host at the organismal, cellular and molecular level. We will use this novel information to develop an in vitro model system that will allow us to use this unique bacterium to interact with mitochondria in novel ways. This approach will ultimately lead to the development of new experimental tools to characterize mitochondrial mechanisms, including mitochondrial fusion/fission, inner and outer membrane repair, metabolism and apoptotic signaling.