**Název a anotace pedagogické přednášky (v anglickém jazyce)**

**Name and annotation of pedagogical lecture (in English)**

**NÁZEV/NAME**

Mitochondrial ATP synthases: fascinating multifaceted nanomotors

**ANOTACE/ANNOTATION**

In this pedagogical lecture, I would like to take a journey through the history of our understanding of how a cell converts and stores energy. The principle of this fundamental process lies in the chemiosmotic theory postulated by Peter Mitchell in the 1960s. In this theory, Mitchell defines how redox energy derived from the oxidation of biomolecules is used to generate a proton motive force across a biological membrane. Central to this process are FoF1-ATP synthases, molecular nanomachines driven by the proton gradient to generate ATP, the energy currency of the biological world.

In my talk, I will focus on mitochondrial FoF1-ATP synthase and explain how, in the 1980s, X-ray crystallography was used to determine the atomic structures of bovine F1-ATPase and reveal the molecular mechanism of ATP generation by mechanical rotation - a discovery that was awarded the Nobel Prize. It took another 25 years and the development of single-particle cryo-electron microscopy approaches to provide further mechanistic details of how proton translocation across the Fo particle generates the rotational force, and finally to reveal a complete picture for one of the most fundamental biological processes, ATP generation.

One might think that this is all we need to know about mitochondrial FoF1-ATP synthases, but the opposite is true. Recent discoveries clearly indicate that this nanomolecular turbine has functions other than ATP generation. Mitochondrial FoF1-ATP synthase dimers are involved in the biogenesis of cristae, the microenvironment crucial for cellular bioenergetic processes, and in the formation of the permeability transition pore, the opening of which leads to cell death. This multifaceted complex continues to fascinate us.