Mitochondria are multifunctional, doublemembrane organelles of eukaryotic cells. Their most fundamental function is energy production. Being the powerhouse of the cells they use electron transport coupled with a process, termed oxidative phosphorylation to generate ATP.
Mitochondria possess their own genetic material – mitochondrial DNA (mtDNA). In animals it is typically a circular molecule approximately 15-20 kbp long, that encodes 37 genes. Thirteen of them are genes for subunits of the enzymes of oxidative phosphorylation (related to energy production) Remaining 24 genes encode components of mitochondrial translation system (22 tRNAs and 2 rRNAs).
Mitochondria are present in most species of the eukaryotic domain: with very few exceptions, eukaryotes cannot exist without them. Hence, it is essential to extend our basic knowledge about these indispensable organelles.
In most animal species mitochondrial DNA is maternally inherited. All copies of mtDNA in each cell typically have identical DNA sequence – cells are homoplasmic for mtDNA. However, in some bivalves a different pattern of mtDNA transmission is present, termed doubly uniparental inheritance (DUI). In this system there are two divergent mitochondrial lineages: one transmitted through eggs (F-type) to both female and male offspring, like in classic inheritance mode and the other transmitted through sperm (M-type) only to male offspring. F-type is found in eggs and somatic tissues of both sexes and M-type in sperm. Females are homoplasmic and males are heteroplasmic for mtDNA genomes. Despite peculiarity of DUI system and years of investigation, evolution and mechanism of doubly uniparental inheritance still remain unclear.
This project will contribute to understanding of DUI mechanism - particularly its association with sex determination. The aim of the project is characterization of mtDNA heteroplasmy in a hermaphroditic mussel species. It was believed, that two distinct mtDNA genomes do not occur in hermaphroditic bivalves, but we have observed such phenomenon in our laboratory recently. We would like to confirm this phenomenon at population scale, track distribution of female and male types of mtDNA in different tissues and analyze mtDNA localization in developing embryo. Moreover comparative analysis with another, related species will be performed. The second species is dioecious (has two distinct sexes) and has also DUI system.
We assume, that we will be able to better describe the observed phenomenon, possibly contributing to our understanding of DUI mechanism.