3rd Lecture: Mitochondrial dysfunction

General part

- Mitochondria structure
- Mitochondrial functions
- Mitochondrial protective mechanisms (UPR and chaperones, mitophagy, apoptosis)

Experimental part on *C. elegans*

- Mitochondrial age-associated changes
- Mitochondrial stress control of longevity (genetic, RNAi and compounds mediated)

Take home messages

1. Mitochondria are the cellular powerhouses
2. Mitochondria are highly dynamic organelles (altered dynamics is implicated in numerous diseases)
3. Different mechanisms surveil mitochondrial functionality: UPR^{mt} and chaperones, mitophagy and apoptosis.
4. Mitochondria play an important role during aging (i.e. somatic mtDNA mutations, MRC dysfunction) - progeroid phenotypes.
5. Human mitochondria-associated diseases (HMAD) are a clinically heterogeneous group of disorders due to a dysfunction of the MRC.
6. Surprisingly, mild mitochondrial dysfunction can result in life extension (in different species). This paradox has been extensively studied in the long-lived *Mit* mutants of the nematode *C. elegans*.
7. Mild mitochondrial stress, achieved through genetic or environmental interventions targeting MRC, promotes *C. elegans* healthy aging (*mitochondrial hormesis*).
8. Severe mitochondrial stress leads to different HMAD in human and to short lifespan or arrest development in *C. elegans* by modulating gene.