



CECAD, University of Cologne

## Press release

# New findings on how cardiac arrhythmias develop

**Cardiac arrhythmias affect a high proportion of the aging population. Mitochondria are the 'powerhouses of the cells', and scientists in Cologne have now shown that even a few heart cells with reduced mitochondrial function are sufficient to trigger arrhythmias.**

**Cologne, May 05, 2015.** Mitochondria are cell organelles that are involved in many functions. They are considered to be the 'powerhouses of the cells' because they convert nutrients into energy. They are involved in the regulation of programmed cell death, when a cell is no longer needed or even constitutes a risk to the body. Mitochondria have their own DNA (mitochondrial DNA, mtDNA), which accumulates point mutations in its sequence or loses large portions (mtDNA deletions) during the aging process. If the number of altered mtDNA copies increases too much, there is a dramatic disruption of mitochondrial function and, as a result, of cell function. This phenomenon occurs in individual cells in many organs during the aging process, giving rise to a 'tissue mosaic' of a few isolated cells with mitochondrial dysfunction scattered amongst many normal cells.

Until recently it was not clear whether these few cells with defective mitochondria could be responsible for the loss of tissue and organ function associated with aging. Working in Prof. Rudolf Wiesner's research team in Cologne, Dr. Olivier Baris and his co-workers looked at this tissue mosaic more closely in the context of cardiac arrhythmias. Taking an experimental approach to the problem, the Cologne scientists used mice that express a mutated mitochondrial protein specifically in the heart as model organisms. The normal protein is required for proper mtDNA replication. In the clinic, the same mutation in patients leads to the accumulation of mtDNA deletions and severe neurological disease. Dr. Olivier Baris and his fellow scientists decided to investigate the heart because this organ is particularly dependent on mitochondrial energy production.

Dr. Baris: “The incidence of cardiac arrhythmias increases dramatically with age and contributes significantly to morbidity and mortality in the elderly.” Indeed, the mutated protein in the mouse heart was shown to cause the accumulation of mtDNA deletions and the development of a tissue mosaic. Analysis of long-term electrocardiogram recordings in 18-month-old mice showed typical cardiac arrhythmias that are similar to those described in elderly people (*spontaneous premature heart beats and blocks of the conduction of the electrical wave*), and which intensify under stress. No such increase in arrhythmias was observed in 12-month-old mice that had three times fewer cells with mitochondrial dysfunction.

The results show promise for future new therapeutic approaches. As Dr. Baris concludes: “Our research has shown that the proportion of heart cells with impaired mitochondrial function has to exceed a threshold value in order to cause a functional disturbance of the organ. A significant finding was that no other signs of cardiac dysfunction (increased scarring, dilatation of the heart or reduced pump function) were found in the mutated hearts. We therefore showed that indeed the characteristic tendency towards arrhythmias in aging human hearts could be induced by the random accumulation of defective mitochondria in a few isolated cells and the resultant tissue mosaic.

The challenge of the future is to understand how altered mitochondrial function in just a few heart cells impacts the function of the entire organ. The scientists expect that it will be possible to develop new pharmacological treatment strategies for this aging-associated electrical conduction disorder in the heart – important new findings in aging research from CECAD.

Contact:

Dr. Olivier Baris

CECAD, at the University of Cologne

Phone +49 221 478-7901

[obaris@uni-koeln.de](mailto:obaris@uni-koeln.de)

Astrid Bergmeister MBA

Head of CECAD PR & Marketing

Phone + 49 (0) 221-478 84043

[astrid.bergmeister@uk-koeln.de](mailto:astrid.bergmeister@uk-koeln.de)