

International Conference on
NANOMEDICINE AND NANOTECHNOLOGY
August 20-21, 2018 Rome, Italy

Nano-and microsensors in determination of cardiovascular system lifespan

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The imbalance between pro-oxidative and anti-oxidative processes increases with age. Dysfunctional endothelium is associated with impaired generation of Nitric Oxide (NO) and overproduction of superoxide (O_2^-). This work describes the study of the relationship between the degree of endothelial dysfunction and the lifespan of the cardiovascular system. Ames dwarf, transgenic giant (Tg), Hypertensive (SHR) and normal mice were used for these studies. The dwarf mice appear to outlive their normal siblings by an average of at least one year. However, the Tg mice have an over-expressed growth hormone that stimulates the growth of their bodies. One of the most important features of these mice is their reduced life expectancy. An array of NO, O_2^- and peroxynitrite (ONOO $^-$) electrochemical nano sensors was used for the *in vitro* measurements. The balance between NO, O_2^- and ONOO $^-$ formations in Ames, giant and normal mice as well as SHR rats were investigated in their cardiovascular systems. More favorable kinetics of NO production with a concurrent quenched O_2^- release was revealed in Ames compared to normal mice. The NO/ O_2^- peak ratio was found to be 3.0 ± 0.29 times higher for Ames dwarf than their normal siblings. The case of transgenic mice was reversed, where the NO/ O_2^- ratio was 2.8 ± 0.22 times less than that of controls from same Tg line. The ONOO $^-$ release was also determined in all species. The rate of NO production decreased from $1.2 \pm 0.1 \mu\text{mol s}^{-1}$ in WKY to $0.46 \pm 0.04 \mu\text{mol s}^{-1}$ in the SHR rats. Also, maximum NO concentration in SHR was found to be much lower than that in WKY. On the other hand, the O_2^- and ONOO $^-$ concentrations dramatically increased in SHR compared to WKY. Therefore, the change in dynamics of NO release in the dysfunctional endothelium can be attributed to the increase in generation of O_2^- as well as that of ONOO $^-$. Our data indicated that the reduced lifespan in Tg mice with dysfunctional endothelium is associated with high concentrations of O_2^- and ONOO $^-$ that most likely leads to accumulation of tissue oxidative damage.

Biography

Louka holds a Ph.D. in Medicinal Analytical Chemistry (2004) from Ohio University, Athens OH. Currently, she is an associate professor in the Chemistry Department at the University of Louisiana at Lafayette. Her expertise is in environmental and medicinal analytical chemistry. She has accumulated over 25 years of teaching and research experience in instrumental analysis and has been certified by "Monitoring the environmental pollutants" by the [Marine Environmental Laboratories of the International Atomic Energy Agency in Monaco]. Louka started to focus on a new point of interest, by using biological backbone synthesized surfactants in drug delivery especially, for cancer cells and DNA cleavage. She is and will be investigating new inexpensive methods and eco-friendly adsorbents from Louisiana waste products and biological backbone synthesized surfactants. Currently, Louka is the primary operator for all instruments in the analytical laboratories. She has extensive experience in the development of techniques and refinement of existing techniques of instrumental analysis. She was awarded the Outstanding Teaching Award College of Sciences 2016. She has published over 65 articles and presentations in peer-reviewed journals and conferences. She is a member of the American Chemical Society. She was one of four professors chosen from the whole university who established and initiate the Undergraduate Research Council. She has mentored more than 75 undergraduate students and two graduate students. Nowadays, most of students under her supervision presented their results in the ACS meeting; others are co-authors in publications in highly ranked journals or professional meetings. A student in her undergraduate students' research group was awarded the American Chemical Society Undergraduate Outstanding Analytical Chemist Award (2015). Louka was the awardee of Outstanding Undergraduate Research Mentoring 2014 and the Marvin and Warren Boudreaux / BoRSF Professorship in Chemistry 2012 – 2015 and 2015-2018. In 2016, She was the awarded Outstanding Teaching Award College of Sciences. She is also a member of the honors program which take the students to a level higher than regular students, preparing them for graduate, medical, pharmacy, and dental schools.

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