**NANOMEDICAL STUDIES OF ENDOTHELIAL AGING IN THE CARDIOVASCULAR** **SYSTEM**

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**Background:** Dysfunction of endothelium, followed by a decrease in the efficiency of the cardiovascular system, can be directly related to biological aging. The deficiency of bioavailable nitric oxide (NO) and the excessive production of peroxynitrite (ONOO-) are the most common denominators of dysfunctional endothelium. These studies elucidate the progress of endothelial dysfunction with age, as well as an increase in risk factors for cardiovascular diseases.

**Methods and Results***:* Systems of nanomedical sensors (diameter 100-300 nm) were used for the simultaneous measurements of NO, ONOO- and super oxide (O2-) concentrations and the length of telomeres in a single endothelial cell. Cellular models of human umbilical vein endothelial cells (HUVECs), as well as animal models: normotensive (WKY) and hypertensive (SHR) rats were used in these studies. We introduced the parameter of R (concentration ratio of [NO]/[O2-] + [ONOO-]) to measure the degree of endothelial dysfunction, with age, as well as the rate (K) of NO, O2- and ONOO- production (nmol/s). R value was 3.9±0.5 in young endothelium and decreased to 0.4±0.3 in aged endothelium. The rate, K, of NO release decreased during the life-span, from 200±30 nmol/s to 70±30 nmol/s. The decrease in R and K values directly correlate with the length of telomeres. Environmental factors like hypertension and diabetes further decreased both R and K values by decreasing NO availability and increasing oxidative/nitroxidative stress (O2- and ONOO-).

**Conclusion***:* The dysfunction of endothelium gradually increases with aging and is manifested by a significant decrease of bioavailable, cytoprotective NO. This effect is coupled with an increase in cytotoxic O2- and ONOO- and a decrease in the length of telomeres.