

6th International Congress; Nanotechnology in Medicine & Biology; April 8.-10. 2015, Graz, Austria

Nanoparticles alter the formation of lamellar bodies in pulmonary type II cells in vitro

Kononenko Veno^{(1)*}, Drobne Damjana⁽¹⁾, Novak Sara⁽¹⁾, Erman Andreja⁽²⁾, Veranič Peter⁽²⁾

(1) Department of Biology, Biotechnical Faculty, University of Ljubljana, Slovenia (2) Institute of Cell Biology, Faculty of Medicine, University of Ljubljana, Slovenia * veno.kononenko@bf.uni-lj.si www.bionanoteam.com

INTRODUCTION:

Undisturbed synthesis and secretion of pulmonary surfactants, i.e. the substances that reduce surface tension of alveoli, is essential for unimpeded breathing. The surfactants are embedded inside the concentric membranes of lamellar bodies (LBs), secretory organelles that are formed inside type II pulmonary cells. Several studies have shown that inhaled nanoparticles (NPs) can reach the alveoli where they can remain for longer periods of time and potentially disturb the function of pulmonary cells [1].

EXPERIMENTAL APPROACH:



RESULTS:

Transmission electron microscopy (TEM)



FIGURE 1: Control cell filled with lamellar bodies (LBs).



FIGURE 2: Cell exposed to 20 µg/mL silica coated γ -Fe₂O₃NPs. Internalised NPs were stored mainly in multivesicular bodies (MVB). Number of LBs was reduced.



FIGURE 3: Cell exposed to 50 µg/mL silica coated γ -Fe₂O₃NPs. Internalised NPs were stored predominantly in amphisomes (AMP). Number of LBs was strongly reduced.

Colorimetric phosphatidylcholine measurement

150-Cells exposed to silica idylcholine/proteir (% of control) coated γ -Fe₂O₃ NPs have significantly phosphatidylcholine content.

CONCLUSIONS:

Despite the significant increase in the intracellular phosphatidylcholine content in the NP-exposed cells, the TEM showed markedly reduced levels of LBs. The TEM micrographs revealed that the NP-exposed cells were fulfilled with increased number of multivesicular bodies and autophagic vacuoles, which are involved in the biogenesis of LBs [2]. These results suggest that the selected NPs affect the LB biogenesis. Our findings are of particular importance since disturbed formation of the surfactant film in the alveoli can lead to life-threatening conditions [3].

REFERENCES:

[1] Todoroff J, Vanbever R, Curr Opin Colloid Interface Sci. 3 (2011) 246 - 254 [2] Weaver TE, Na CL, Stahlman M. Semin Cell Dev Biol. 13 (2002) 263 - 70 [3] Devendra G, Spragg RG, Respir Res. 3 (2002) 19

increased

Univerza *v Ljubljan*

ACKNOWLEDGEMENT::

We are grateful to Darko Makovec and Slavko Kralj (Institute Jožef Stefan, Ljubljana, Slovenia) for the synthesis and the characterization of nanoparticles used in this study. This work was financially supported by the Slovenian Research Agency (ARRS), grant No. 1000-14-0510.