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10th International Conference on
Neuroscience and Neurochemistry
&
6th International Conference on Vascular Dementia February 27-March 01, 2017

Biodistribution and permeability of the blood-brain barrier by biodegradable ZnO na-noparticles in the living organism

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Zinc oxide nanaoparticles (ZnO NPs) be-came promising material for numerous ap-plications, including biomedicine. Avaible reports assessing their biodistribution pre-sent contradictory conclusions. Furthermore transfer of NPs through the blood-brain barrier has not been reported extensively. In our study, we orally administrated fluores-cent. ZnO NPs doped with Europim (ZnO:Eu) to mice (n=35). After 3 h, 24 h, 7 d, 14 d or 1 m mice were sacrificed and internal organs were collected for the as-sessment of biodistribution and localization of NPs in the organism. For the analyses, we proposed a novel comprehensive and innovative approach. Along with the meas-urement of Zn concentration in organs with spectroscopy method (AAS), we performed quantitative and qualitative cytometric evaluation of collected samples. The distri-bution patterns of ZnO:Eu NPs within tis-sues were statistically assessed with scan-ning cytometry, while the extent of biodeg-radation was semiquantitatively elucidated by confocal microscopy. Results revealed very rapid and efficient uptake and distribu-tion of ZnO:Eu NPs to key organs and tis-sues, also crossing physiological barriers. Spleen, as well as fat tissue were responsible for accumulation of NPs, and liver with kidney were designated for their elimina-tion. An interesting pattern of biodistribu-tion of NPs in the brain was also observed. Following 3 h after IG administration, we observed crossing of the blood-brain barrier by ZnO:Eu NPs and their uniform distribu-tion in the brain. Similar observations were reported earlier for non-biodegradable ZrO_2:Pr NPs and Y_2O_3:Eu NPs. The peek of NPs transfer to the brain seems to take place 24 h post IG with majority of NPs allocated in the areas of dense neuronal networks, limbic system and cerebellum. During fol-lowing days, we observed a drop of NPs-related fluorescence. However, the associa-tion with limbic system and dense neuronal networks remained. We speculate that elim-ination of the NPs from the brain might be consequential of biodegradation of NPs and their efficient elimination via neuronal transport.

Biography

Paula Kielbik is currently a PhD student at Warsaw University of Life Sciences, Faculty of Veterinary Medicine. She completed both her Bachelor Degree and Master of Science Degree under supervision of Dr Michal Godlewski in Nanotechnology laboratory in collaboration with Polish Intitute of Physics. In her scientific work, she focused mainly on "Biodistribution of biodegradable nanoparticles in the living organism". The main aspect of her work was transfer of nanoparticles through the organism barriers (i.e. intestinal barrier, blood-brain barrier, blood-testis barrier) by ZnO-derieved NPs in adult organism. Working as a member of a team in Nanotechnology laboratory, she was involved in the development and assessment of compherehesive methodology for the evaluation of gastrointestinal absorption, circulation and elimination from the organism of biodegradable nanoparticles.

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