Geno- and Neuro- Toxicity of Nanoparticles and Risk Reduction

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Over the past several years, we have examined the effects of fetal exposure to diesel exhaust emissions on the genital and cranial nerve systems in mice. In the course of these studies, we showed that nano-sized black particulates that were supposed to be derived from the exhaust emission remained accumulated in intracellular granules of granular peritherial cells around the cerebral vessels even after birth. It is thought that the nanoparticles were transferred from the mother to the fetal brain because of the undeveloped blood-brain barrier and taken into the intracellular granules of granular peritherial cells around the cerebral vessels. In diesel exhaust exposed mice, small vessel occlusion and perivascular edema were observed, and vascular endothelial cell apoptosis, as well as abnormally swollen perivascular astrocyte end-foot and myelin-like material, were detected. In addition, caspase 3-positive cells were observed in the cerebral cortex, hippocampus, and cerebellum, and there were abnormalities in brain monoamine metabolism and behavior. For these reasons, the relation to the increasing frequency of cranial nerve disease due to minimal brain dysfunction has drawn recent attention. Various histological or functional effects on the male reproductive system were also observed. In Leydig cells, accumulation of nano-sized black particulates was found in lipid droplets. Changes in sperm parameters and the histological observations of testis were also revealed that the testicular function was disordered in the exposed group. These results have been examined from various angles, e.g., whether the particulates found in the cells are derived from exhaust emission, to what extent and by what mechanism nanoparticles are related to these abnormalities, what kind of protective measures can be taken, etc., and hereinafter we consider this subject in light of some of the above results.