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Particulate air pollution has been associated with an increased risk of cardiovascular disease and cancer in humans. Air pollution may also adversely affect pregnancy outcome and the integrity of sperm cells DNA. Animal studies have shown that inhalation of air particulates can induce mutations in meiotic sperm cells. The investigation of potential mutagenic risk is of utmost importance, as it may lead to cancer. Furthermore, heritable mutations may be passed on to descendents and thereby pose a permanent genetic risk to the population.

The nanosized fraction of particulate air pollution has recently come into focus. Inhaled nanoparticles are cleared very slowly from the lungs and a small fraction may translocate into the bloodstream and compartments of the body. In the airways nanoparticles can induce a high degree of pulmonary inflammation and oxidative stress. Nanoparticles are more reactive than larger sized particles and may have unique properties as a result of their size. The exposure to nanoparticles in the occupational setting and from consumer products will most likely increase greatly in the near future and thorough investigations of their potentially hazardous effects are needed.

Expanded simple tandem repeat (ESTR) loci in mice are sensitive markers of mutagenic effects resulting from environmental exposures; Studies on adult mice have revealed that while particulate air pollution induced ESTR mutations in meiotic sperm cells, the female germline was not affected. Unlike sperm cells that are continuously developed in adulthood, the majority of oocytes are in a dormant state during long periods of adult life and may therefore be less sensitive to mutations. However, female germ cells may be vulnerable during pregnancy when the female germ cells of the fetus when are actively dividing.

The aim of this PhD study was to determine if two widely used nanoparticles titanium dioxide UV-Titan and carbon black Printex 90 induce ESTR mutations in the germ cells of prenatally exposed females. Pregnant generation P mice were exposed to ~42 mg UV-Titan/m3/1 h/d during gestation days 8-18 or carbon black Printex 90 at gestation days (7, 10, 15 and 18) (total dose of 268 μg/animal) by intratracheal instillation. Maternal inflammation and DNA damage were assessed in order to assess the potential for indirect effects on offspring during pregnancy. Prenatally exposed F1 females were grown to maturity and mated with unexposed males. The ESTR mutation rate in F2 offspring was estimated from full pedigrees (mother, father, offspring). ESTR mutation rates of 0.029/0.0025 (maternal allele) and 0.047/0.053 (paternal allele) in UV-Titan/Printex 90-exposed F2 offspring were not statistically different from those of F2 controls: 0.037/0.024 (maternal allele) and 0.061/0.038 (paternal allele). UV-Titan and Printex 90 exposure induced pulmonary inflammation in pregnant generation P mothers as well as changes in hepatic gene expression in the F1 prenatally exposed females. However, ESTR mutation rates were not increased by UV-Titan or Printex 90 in prenatally exposed F1 females.

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