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NRP Endocrine Disruptors

Intermediate Summary

UV filters: Mechanisms of developmental toxicity in mammalian brain and human exposure
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Project number 4050-066583

English Summary

Hormone-like activity of UV filters and UV absorbers: What do we know so far?

Some UV filters in sunscreens and UV absorbers used for product protection in various materials exhibit hormone-like activity. Exposure of mammals (rats) during development affected brain and reproductive organs. In parallel to these toxicological studies, human milk pollutants are analysed to compare effect levels with current human loads.

Project description:

UV filters are used for skin protection in cosmetics, UV absorbers for product protection in diverse materials. UV filters are applied to human skin and released into surface waters from where they may enter animal and human food chains. Skin penetration needs clarification with regard to different conditions (baby, aged, inflamed skin).

The project studies sensitive live stages and addresses human exposure, key issues in risk assessment. It started with the discovery that some UV filters used in sunscreens act like female hormones (estrogens) in cell culture and in the uterotrophic test in rats where they induced precocious uterus growth. Sex hormones are key regulators of reproduction and of the development of reproductive organs and brain. Chemicals interacting with hormones are therefore considered as a serious health threat. The developing organism is particularly sensitive to endocrine active chemicals.

We investigated effects of UV filters on development of a mammal, the rat. The UV filter 4-methylbenzylidene camphor (4-MBC) and the UV absorber 3-benzylidene camphor (3-BC) were administered in the feed to the parent generation (F0) before and during pregnancy, and to their offspring (F1). The chemicals affected physiological functions in the offspring – delay of puberty in males, disturbance of estrous cycle and sex behavior in females. Higher doses reduced early postnatal survival rate. Effects on the development of reproductive organs are indicated by changes in organ weight. Both chemicals caused changes in gene expression (messenger ribonucleic acid and protein level) in reproductive organs (uterus, prostate) and in brain regions controlling sex behavior and hormone secretion. The sensitivity of genes to the natural hormone estradiol was also altered in brain and

reproductive organs, and factors involved in the regulation of gene expression by steroid hormones (coregulators) were changed. Lowest effective doses were 0.7 mg/kg of body weight of 4-MBC and 0.24 mg/kg of 3-BC. Lower doses of 4-MBC resulted in body fat concentrations approaching levels found in Swiss fish.

These findings clearly indicate that 4-MBC and 3-BC can interfere with neuro-endocrine systems in the developing organism, and thus, represent a potential risk for the progeny. In order to obtain information on human exposure, we initiated an analytical study on human milk. Milk yields information on exposure during pre- and early postnatal stages.