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CHEMWATCH

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### PUBLIC HEALTH RESEARCH

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### ENVIRONMENTAL RESEARCH

#### Sorption properties of hydrophobic organic chemicals to micro-sized polystyrene particles

2019-09-17

It has been reported that microplastics (MPs) have strong affinity for hydrophobic organic chemicals (HOCs) and can be ingested accidentally by aquatic organisms, posing a potential threat to the environment. To date, the sorption data used in modelling to clarify the mechanism were mostly obtained in varied sampling durations and regions from different works, which might cause inevitable deviation in modelling results. The current study aimed to illustrate the sorption properties of HOCs to the micro-sized polystyrene (PS). The sorption behaviours of HOCs to the PS were investigated at a certain pre-equilibrium status, and the theoretical analysis was taken into consideration. A bottle-shaped passive dosing system was designed to measure the concentration ratio of HOCs in different phases of the exposure suspension at a certain time ( $\log a_{MP}$ ), including polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) with  $\log K_{ow}$  ranging from 3.17 to 10.20, between water and PS MPs with different dimensions (diameters of 100 nm, 1  $\mu$ m and 2  $\mu$ m, respectively). The calculated  $\log a_{MP}$  ranged from 3.73 to 8.34, and a positive correlation was found between  $\log a_{MP}$  and  $\log 1/r_0$  ( $r_0$  is the MP radius). The results indicated that HOCs would diffuse into the PS particles, but the mass transfers inside the particles were slow and would be negligible in some environmental cases. Under theoretical considerations, the diffusion through the boundary layer of the particle was considered as the dominating process because it was fast, and the contributions of absorbed amounts on the particle surface were larger for smaller PS particles (i.e. 100-nm PS). This study could provide applicable data for further exploring the effects of micro-sized plastics on the HOCs in environmental samples.

Authors: Lin W, Jiang R, Wu J, Wei S, Yin L, Xiao X, Hu S, Shen Y, Ouyang G.

Full Source: Science of the Total Environment. 2019 Jul 2; 690:565-572. doi: 10.1016/j.scitotenv.2019.06.537. [Epub ahead of print]

The current study aimed to illustrate the sorption properties of HOCs to the micro-sized polystyrene

#### Functions of thioredoxin1 in brain development and in response to environmental chemicals in zebrafish embryos

2019-09-17

Thioredoxin is an evolutionarily conserved antioxidant protein that plays a crucial role for fundamental cellular processes and embryonic

development. Growing evidence support that Thioredoxin influences cellular response to chemicals insults, particularly those accompanying oxidative stress. The mechanisms underlying the functions of Thioredoxin1 in the embryonic development under the environmental toxicant exposure remain, however, largely unexplored. In this study, the authors report that thioredoxin1 becomes differentially expressed in zebrafish embryos after exposure to 9 out of 11 environmental chemicals. In situ gene expression analysis show that thioredoxin1 is expressed in neurons, olfactory epithelia, liver and swim bladder under normal conditions. After MeHg exposure, however, thioredoxin1 is ectopically induced in the hair cells of the lateral line and in epithelia cells of the pharynx. Knockdown of Thioredoxin1 induces hydrocephalus and increases cell apoptosis in the brain ventricular epithelia cells. In comparison with 5% malformation in embryos injected with control morpholino, MeHg induces more than 77% defects in Thioredoxin1 knockdown embryos. The findings suggest that there is an association between hydrocephalus and Thioredoxin1 malfunction in embryonic development, and provide valuable information to elucidate the protective role of Thioredoxin1 against chemicals disruption.

Authors: Yang L, Zeng C, Zhang Y, Wang F, Takamiya M, Strähle U.  
Full Source: Toxicology Letters. 2019 Jul 13; 314:43-52. doi: 10.1016/j.toxlet.2019.07.009. [Epub ahead of print]

### Selection of new chemicals to be used in conditioned aversion for non-lethal predation control

2019-09-17

Globally, native predators and scavengers are threatened through the incidence of illegal poisoning due to increasing human-wildlife conflicts. The use of conditioned taste aversion (CTA) may mitigate such conflicts. CTA is a robust learning paradigm that occurs when animals associate a food with a discomfort induced by a chemical, thereby avoiding that food in subsequent encounters. The authors reviewed the potential of 167 chemical compounds to be used in CTA, considering effects, margin of safety, accessibility, and detectability. After the review, 15 compounds fulfilled the required characteristics, but only five (thiabendazole, thiram, levamisole, fluconazole and fluralaner) were finally selected to be tested in CTA assays with dogs. Of the tested compounds, thiabendazole, thiram and levamisole caused target food rejection by dogs and reduced the time spent eating during post-conditioning. However, despite being microencapsulated, levamisole appeared to be detectable by dogs, whereas thiram and thiabendazole were not. Fluconazole and fluralaner

The authors reviewed the potential of 167 chemical compounds to be used in conditioned taste aversion, considering effects, margin of safety, accessibility, and detectability.

did not produce any CTA effect. Thiabendazole, thiram and levamisole can therefore induce CTA, and thus are potential candidates as aversive compounds for wildlife management. Thiram is an undetectable, relatively safe and accessible compound that can induce CTA in canids, and opens new possibilities to develop methods of non-lethal predation control.

Authors: Tobajas J, Gómez-Ramírez P, María-Mojica P, Navas I, García-Fernández AJ, Ferreras P, Mateo R.

Full Source: Behavioural Processes. 2019 Sep; 166:103905. doi: 10.1016/j.beproc.2019.103905. Epub 2019 Jul 13.

### A critical review of synthetic chemicals in surface waters of the US, the EU and China

2019-09-17

There is a wide concern that emerging organic pollutants (EOPs) in surface water could adversely affect human health and wildlife. However, the geographic distribution, exposure pattern and ecological risk of emerging organic pollutants are poorly understood at a global scale. This study provides a comprehensive survey on the exposure level of EOPs in China, the US and the EU based on the published literature. The hazard level of three categories of EOPs, namely pharmaceuticals and personal care products (PPCPs), pesticides and industrial chemicals was further evaluated by adopting a novel Aquatic HazPi index that jointly accounts for the persistence, bioaccumulation, toxicity and bioactivity. Furthermore, a correlation analysis of land use with the surface water exposure status regarding the synthetic chemicals was conducted. According to the published data reported between 2010 and 2016, the concentration of pesticides in the US was higher than in the EU and China. The concentration of PPCPs in the EU was generally lower than in both the US and China, while the concentration of industrial chemicals in China was higher than in the EU and the US. Among the chemicals whose median concentration in surface water was >10 ng/L, the antiretroviral Efavirenz, the pesticide Fipronil, and octocrylene, an industrial chemical and cosmetic ingredient, were found with the highest aquatic HazPi value. Lastly, the spatial distribution and concentration of hazardous EOPs was shown to depend on local landscape and land usages. This study provides the first broad overview on the geographic distribution, exposure pattern of hazardous EOPs in the three major economic entities: China, the US and the EU.

Authors: Fang W, Peng Y, Muir D, Lin J, Zhang X.

Full Source: Environment International. 2019 Jul 11; 131:104994. doi: 10.1016/j.envint.2019.104994. [Epub ahead of print]

This study provides a comprehensive survey on the exposure level of EOPs in China, the US and the EU

### Linking chemical exposure to lipid homeostasis: A municipal waste water treatment plant influent is obesogenic for zebrafish larvae

2019-09-17

Obesity, a risk factor for the development of type-2 diabetes, hypertension, cardiovascular disease, hepatic steatosis and some cancers, has been ranked in the top 10 health risk in the world by the World Health Organization. Despite the growing body of literature evidencing an association between the obesity epidemic and specific chemical exposure across a wide range of animal taxa, very few studies assessed the effects of chemical mixtures and environmental samples on lipid homeostasis. Additionally, the mode of action of several chemicals reported to alter lipid homeostasis is still poorly understood. Aiming to fill some of these gaps, the combined an *in vivo* assay with the model species zebrafish (*Danio rerio*) to screen lipid accumulation and evaluate expression changes of key genes involved in lipid homeostasis, alongside with an *in vitro* transactivation assay using human and zebrafish nuclear receptors, retinoid X receptor  $\alpha$  and peroxisome proliferator-activated receptor  $\gamma$ . Zebrafish larvae were exposed from 4th day post-fertilisation until the end of the experiment (day 18), to six different treatments: experimental control, solvent control, tributyltin at 100 ng/L Sn and 200 ng/L Sn (positive control), and wastewater treatment plant influent at 1.25% and 2.5%. Exposure to tributyltin and to 2.5% influent led to a significant accumulation of lipids, with white adipose tissue deposits concentrating in the perivisceral area. The highest *in vitro* tested influent concentration (10%) was able to significantly transactivate the human heterodimer PPAR $\gamma$ /RXR $\alpha$ , thus suggesting the presence in the influent of HsPPAR $\gamma$ /RXR $\alpha$  agonists. The results demonstrate, for the first time, the ability of complex environmental samples from a municipal waste water treatment plant influent to induce lipid accumulation in zebrafish larvae.

Authors: Barbosa MAG, Capela R, Rodolfo J, Fonseca E, Montes R, André A, Capitão A, Carvalho AP, Quintana JB, Castro LFC, Santos MM.

Full Source: *Ecotoxicology & Environmental Safety*. 2019 Oct 30; 182:109406. doi: 10.1016/j.ecoenv.2019.109406. Epub 2019 Jul 6.

In this study, the authors combined an *in vivo* assay with the model species zebrafish (*Danio rerio*) to screen lipid accumulation and evaluate expression changes of key genes involved in lipid homeostasis, alongside with an *in vitro* transactivation assay using human and zebrafish nuclear receptors, retinoid X receptor  $\alpha$  and peroxisome proliferator-activated receptor  $\gamma$

### MEDICAL RESEARCH

#### Susceptibility to the acute toxicity of acrylonitrile in streptozotocin-induced diabetic rats: protective effect of phenethyl isothiocyanate, a phytochemical CYP2E1 inhibitor

2019-09-17

Diabetes mellitus is a significant global public health issue. The diabetic state not only precipitates chronic disease but also has the potential to change the toxicity of drugs and chemicals. Acrylonitrile (AN) is a potent neurotoxin widely used in industrial products. This study used a streptozotocin (STZ)-induced diabetic rat model to examine the role of cytochrome P450 2E1 (CYP2E1) in acute AN toxicity. The protective effect of phenethyl isothiocyanate (PEITC), a phytochemical inhibitor of CYP2E1, was also investigated. A higher incidence of convulsions and loss of the righting reflex, and decreased rates of survival, as well as elevated CYP2E1 activity, were observed in diabetic rats treated with AN when compared to those in non-diabetic rats, suggesting that diabetes confers susceptibility to the acute toxicity of AN. Pre-treatment with PEITC (20-80 mg/kg) followed by AN injection alleviated the acute toxicity of AN in diabetic rats as evidenced by the decreased incidence of convulsions and loss of righting reflex, and increased rates of survival. PEITC pre-treatment at 40 and 80 mg/kg decreased hepatic CYP2E1 activity in AN-exposed diabetic rats. PEITC pre-treatment (20 mg/kg) increased the glutathione (GSH) content and glutathione S-transferase (GST) activity and further decreased ROS levels in AN-exposed diabetic rats. Collectively, STZ-induced diabetic rats were more sensitive to AN-induced acute toxicity mainly due to CYP2E1 induction, and PEITC pre-treatment significantly alleviated the acute toxicity of AN in STZ-induced diabetic rats. PEITC might be considered as a potential effective chemo-preventive agent against AN-induced acute toxicity in individuals with an underlying diabetic condition.

Authors: Li F, Dong Y, Lu R, Yang B, Wang S, Xing G, Jiang Y.

Full Source: Drug and Chemical Toxicology. 2019 Jul 1:1-10. doi:

10.1080/01480545.2019.1566354. [Epub ahead of print]

This study used a streptozotocin (STZ)-induced diabetic rat model to examine the role of cytochrome P450 2E1 (CYP2E1) in acute AN toxicity.

### Inverse associations of bisphenol A and phthalate metabolites with serum bilirubin levels in Korean population

2019-09-17

Bisphenol A (BPA) and phthalates are endocrine disruptors that can induce oxidative stress. Serum bilirubin has antioxidant properties and may serve as a biomarker of oxidative stress. The objective of this study was to explore the relationship of BPA and phthalates with serum bilirubin levels in a Korean population. Urinary concentrations of BPA and six phthalate [mono-n-butyl phthalate (MnBP), mono-iso-butyl phthalate (MiBP), mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP), mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP), mono-(2-ethyl-5-carboxypentyl) phthalate (MECPP), and mono-benzyl phthalate (MBzP)] were measured in 709 participants. Serum concentrations of BPA and three phthalate metabolites [MnBP, MiBP, and mono-(2-ethylhexyl) phthalate (MEHP)] were measured in 752 participants. After excluding missing variables, associations between above chemicals and serum bilirubin levels were analysed using multivariate linear regression with age, sex, BMI, GGT, GOT, GPT, and alcohol intake adjustment. Participants were further stratified by sex. Among the urinary chemicals, BPA and four phthalate metabolites (MnBP, MEOHP, MEHHP and MECPP) were inversely associated with serum bilirubin levels (BPA:  $\beta = -0.071$ ,  $P < 0.0001$ ; MnBP:  $\beta = -0.055$ ,  $P = 0.025$ ; MEOHP:  $\beta = -0.101$ ,  $P < 0.0001$ ; MEHHP:  $\beta = -0.106$ ,  $P < 0.0001$ ; MECPP:  $\beta = -0.052$ ,  $P = 0.003$ ). In a case of serum chemicals, only MiBP showed significantly positive association ( $\beta = 0.036$ ,  $P = 0.016$ ). After stratification by sex, the associations of urinary BPA remained both in male and female, of which urinary phthalates disappeared in female. The association of serum MiBP was disappeared after stratification. Urinary BPA and phthalate metabolites were inversely associated with serum bilirubin levels, whereas serum MiBP showed positive association with bilirubin. These results could provide clues for understanding the mechanisms of endocrine disruptor from oxidative stress to excretion from our body.

The objective of this study was to explore the relationship of BPA and phthalates with serum bilirubin levels in a Korean population.

Authors: Choi Y, Lee SJ, Jeon J, Jung KJ, Jee SH.

Full Source: Environmental Science & Pollution Research International. 2019 Jul 11. doi: 10.1007/s11356-019-05205-y. [Epub ahead of print]

In this study, the authors examined predictors of plasma PCB concentrations in a cross-sectional analysis of baseline data from a prospective cohort study of 1693 premenopausal Black women aged 23-35 years from Detroit, Michigan

### Predictors of plasma polychlorinated biphenyl concentrations among reproductive-aged black women

2019-09-17

Polychlorinated biphenyls (PCBs) are a class of lipophilic endocrine-disrupting chemicals with wide industrial use in the U.S. from the 1930s through 1977. Due to their environmental and biological persistence, low levels of PCBs remain detected in wildlife and humans. Although U.S. studies have shown higher serum PCB concentrations among Black women compared with White women, studies of correlates of PCB exposure among Black women are scarce. In this study, the authors examined predictors of plasma PCB concentrations in a cross-sectional analysis of baseline data from a prospective cohort study of 1693 premenopausal Black women aged 23-35 years from Detroit, Michigan (2010-2012). The authors collected demographic, behavioural, dietary, and medical data via self-administered questionnaires, telephone interviews, and in-person clinic visits, as well as non-fasting blood samples. Concentrations of 24 PCB congeners were measured in baseline plasma from a subset of 762 participants. Linear regression was used for log-transformed lipid-adjusted PCB concentrations to calculate percentage differences across levels of selected predictors. This was done separately for individual PCBs, sum of total PCBs, and sum of PCBs by degree of chlorination and hormonal activity. PCB concentrations were positively associated with age, duration of urban residence, cigarette smoking, heavy alcohol intake, and being breastfed in infancy, and inversely associated with body mass index (BMI) and lactation duration. The strength of some associations varied by degree of chlorination. For example, a 5-kg/m<sup>2</sup> higher BMI corresponded to a 2.9% lower summed concentration of tri- and tetra-substituted PCBs (95% CI -4.6%, -1.2%), an 8.3% lower summed concentration of penta- and hexa-substituted PCBs (95% CI -10.0%, -6.5%), and a 12.1% lower summed concentration of hepta-, octa-, nona-, and deca-substituted PCBs (95% CI -13.7%, -10.4%). Likewise, associations for age and being breastfed in infancy were stronger for higher-chlorinated PCBs. Results agree with studies on predictors of PCB body burdens, few of which include large numbers of Black women.

Full Source: Wesselink AK, Bethea TN, McClean M, Weuve J, Williams PL, Hauser R, Sjödin A, Brasky TM, Baird DD, Wise LA.

Full Source: International Journal of Hygiene & Environmental Health. 2019 Aug;222(7):1001-1010. doi: 10.1016/j.ijheh.2019.06.008. Epub 2019 Jul 5.

This study was conducted to evaluate the association between several POP concentrations in maternal serum and DNA methylation of thyroid hormone-related genes in the placenta.

## Technical

### CHEMWATCH

### Maternal exposures to persistent organic pollutants are associated with DNA methylation of thyroid hormone-related genes in placenta differently by infant sex

2019-09-17

Exposure to persistent organic pollutants (POPs) during pregnancy is associated with a disruption in thyroid hormone balance. The placenta serves as an important environment for foetal development and also regulates thyroid hormone supply to the foetus. However, epigenetic changes of thyroid regulating genes in placenta have rarely been studied. This study was conducted to evaluate the association between several POP concentrations in maternal serum and DNA methylation of thyroid hormone-related genes in the placenta. The placenta samples were collected from 106 Korean mother at delivery, and the promoter methylation of the placental genes was measured by a bisulfite pyrosequencing. The deiodinase type 3 (DIO3), monocarboxylate transporter 8 (MCT8), and transthyretin (TTR) genes were selected as the target genes as they play an important role in the regulation of foetal thyroid balance. Because people are exposed to multiple chemicals at the same time, a multiple-POP model using principal component analysis (PCA) was applied to evaluate the association between the multiple POPs exposure and the epigenetic change in placenta. In addition, a single-POP model which includes one chemical each in the statistical model for association was conducted. Based on the single-POP models, serum concentrations of p,p'-dichlorodiphenyldichloroethylene (p,p'-DDE) and brominated diphenyl ether-47 (BDE-47) were significantly associated with an increase in placental DIO3 methylation, but only among female infants. Among male infants, a positive association between serum p,p'-DDT and MCT8 methylation level was found. According to the multiple-POP models, serum DDTs were positively associated with DIO3 methylation in the placenta of female infants, while a positive association with MCT8 methylation was observed in those of the male infants. The authors observation showed that in utero exposure to DDTs may influence the DNA methylation of DIO3 and MCT8 genes in the placenta, in a sexually dimorphic manner. These alterations in placental epigenetic regulation may in part explain the thyroid hormone disruption observed among the newborns or infants followed by in utero exposure to POPs.

Authors: Kim S, Cho YH, Won S, Ku JL, Moon HB, Park J, Choi G, Kim S, Choi K.

Full Source: Environment International. 2019 Sep; 130:104956. doi: 10.1016/j.envint.2019.104956. Epub 2019 Jul 1.

This review examines BPA co-exposure studies to highlight potentially unexplored mechanisms of action and their possible associations with the adverse health effects attributed to BPA.

### Bisphenol A co-exposure effects: a key factor in understanding BPA's complex mechanism and health outcomes

2019-09-17

Bisphenol A (BPA) is an environmental endocrine disrupting chemical widely used in the production of consumer products, such as polycarbonate plastics, epoxies, and thermal receipt paper. Human exposure to BPA is ubiquitous due to its high-volume production and use. BPA exposure has been associated with obesity, diabetes, reproductive disorders, and cancer. Yet, the molecular mechanisms or modes of action underlying these disease outcomes are poorly understood due to the pleiotropic effects induced by BPA. A further confounding factor in understanding BPA's impact on human health is that co-exposure of BPA with endogenous and exogenous agents occurs during the course of daily life. Studies investigating BPA exposure effects and their relationship to adverse health outcomes often ignore interactions between BPA and other chemicals present in the environment. This review examines BPA co-exposure studies to highlight potentially unexplored mechanisms of action and their possible associations with the adverse health effects attributed to BPA. Importantly, both adverse and beneficial co-exposure effects are observed between BPA and natural chemicals or environmental stressors in in vitro and in vivo models. These interactions clearly influence cellular responses and impact endpoint measures and need to be considered when evaluating BPA exposures and their health effects.

Authors: Sonavane M, Gassman NR.

Full Source: Critical Review in Toxicology. 2019 Jul 1:1-16. doi:

10.1080/10408444.2019.1621263. [Epub ahead of print]

To reduce radiation exposure, the authors propose a novel passive robotic device for fluoroscopy-guided arterial puncturing.

## OCCUPATIONAL RESEARCH

### Reduction of operator radiation exposure using a passive robotic device during fluoroscopy-guided arterial puncture: an experimental study in a swine model

2019-09-17

Vascular interventions imply radiation exposure to the operating physician (OP). To reduce radiation exposure, the authors propose a novel passive robotic device for fluoroscopy-guided arterial puncturing. X-ray dose rates were measured for a total of 30 fluoroscopy-guided puncture femoral arteries in 15 pigs. Fifteen punctures were performed with the device while the other 15 were performed without the device

by an interventional cardiologist with 10 years of experience. Parametric t test was used. The success rate with the device was 100%. Overall, the OP received more radiation (0.41 mSv/h) as compared to the assistant (0.06 mSv/h) ( $p < 0.001$ ) and, amongst OP's body parts, hands received more radiation than other body parts ( $p < 0.001$ ). The radiation dose rate to the OP's hands during arterial puncturing performed manually without the device was  $0.95 \pm 0.25$  mSv/h whereas it was  $0.14 \pm 0.006$  mSv/h using the device, resulting in an 85% reduction ( $p < 0.001$ ). For the head, the dose was reduced from 0.16 mSv/h to 0.08 mSv/h (50% reduction,  $p < 0.001$ ), and for the dominant arm, from 0.12 mSv/h to 0.07 mSv/h (42% reduction,  $p < 0.001$ ). The fluoroscopy time was reduced from  $4.5 \pm 0.15$  min to  $4.3 \pm 0.11$  min device ( $p = 0.002$ ). In a swine model, fluoroscopy time and radiation exposure for the OP puncturing femoral artery were significantly reduced by using the passive robotic device.

Authors: Khan MUA, Yoon CH, Yi BJ.

Full Source: European Radiology Experimental. 2019 May 29;3(1):20. doi: 10.1186/s41747-019-0098-1.

### Filaggrin variations are associated with PAH metabolites in urine and DNA alterations in blood

2019-09-17

Dermal chemical exposure is common in many professions. The filaggrin protein is important for the skin barrier and variations in the filaggrin gene (FLG) may influence the uptake of chemicals via the skin, and consequently, the degree of systemic effects. The aim of this study was to investigate, in chimney sweeps with occupational exposure to polycyclic aromatic hydrocarbons (PAH) from soot, the influence of variation in FLG on internal PAH dose and DNA alterations, including epigenetic, previously linked to cancer and cardiovascular disease. TaqMan PCR was used to genotype 151 chimney sweeps and 152 controls for four FLG null variants (R501X, R2447X, S3247X and 2282del4) which cause impaired skin barrier, and FLG copy number variation (12th repeat, CNV12) which potentially is beneficial for the skin barrier. The internal dose of PAH was represented by urinary PAH metabolites (e.g. 1-hydroxypyrene and 3-hydroxybenzo[a]pyrene) that the authors measured by LC-MS/MS. Epigenetic alterations (methylation of AHRR and F2RL3) in blood were measured by pyrosequencing; and DNA alterations (telomere length and mitochondrial DNA copy number) by real-time PCR. Hypomethylation of AHRR or F2RL3 is a risk factor for lung cancer and shorter telomere length a risk factor for cardiovascular disease. The frequencies of FLG null were 8.6 and 11.8% ( $p = 0.35$ ), and CNV12 27.8 and 19.7% ( $p = 0.09$ ) in chimney

The aim of this study was to investigate, in chimney sweeps with occupational exposure to polycyclic aromatic hydrocarbons (PAH) from soot, the influence of variation in FLG on internal PAH dose and DNA alterations, including epigenetic, previously linked to cancer and cardiovascular disease.

sweeps and controls, respectively. It was found that among chimney sweeps working predominately with soot sweeping (high PAH exposure), CNV12 carriers had lower concentrations of PAH metabolites in urine compared with non-carriers (median 1-hydroxypyrene = 0.37 vs 0.86  $\mu\text{g/g}$  creatinine respectively;  $p = 0.025$  by linear regression models adjusted for age, BMI and smoking) compared to sweeps not carrying CNV12. Further, FLG null was associated with approximately 2.5% higher methylation of F2RL3 (cg03636183,  $p = 0.019$  after adjustment for exposure group, age, BMI and smoking). FLG null was associated with approximately 7% shorter telomere length ( $p = 0.015$ , adjusted model). These results suggest that FLG variations may influence the dose of PAH in highly exposed workers, possibly via dermal uptake. It also suggests that FLG variation may influence the degree of (epi)genotoxicity in the body. FLG variation is common in the working population and should be considered in risk assessment.

Authors: Wahlberg K, Liljedahl ER, Alhamdow A, Lindh C, Lidén C, Albin M, Tinnerberg H, Broberg K.

Full Source: Environmental Research. 2019 Jul 22; 177:108600. doi: 10.1016/j.envres.2019.108600. [Epub ahead of print]

### Health risk in transport workers. Part II. Dietary compounds as modulators of occupational exposure to chemicals

2019-09-17

Professional drivers are exposed to a number of factors that have a negative influence on their health status. These include vibrations, noise, the lack of fresh air in the car cabin, shift work (frequently at night), monotony resulting from permanent repetition of certain actions, static loads due to immobilisation in a sitting position, stress resulting from the need to ensure safety in heavy traffic, as well as air pollution (dust, volatile organic substances, nitrogen and sulfur oxides, polycyclic aromatic hydrocarbons, heavy metals, dioxins, furans and others). Factors associated with the specificity of the profession of a driver, including exposure to chemical substances, result in an increased risk of the development of many diseases, i.e., obesity, diabetes, heart disease, hypertension, extensive genitourinary pathology experienced by taxi drivers, lung cancer and other forms of cancer. In the case of drivers, especially those covering long distances, there are also actual difficulties related to ensuring a proper diet. Although attempts at interventional research that would change the principles of nutrition, as well as ensure physical activity and weight reduction, have been made, their results have not been satisfactory. This study focuses on the discussion on the role of a diet

and dietary phytochemicals in the prevention of adverse health effects of such chemicals as a mix of chemicals in the polluted air, benzo(a)pyrene, benzene and metals (lead, cadmium, chromium, nickel), which are the main sources of exposure in the case of transport workers.

Authors: Kozłowska L, Gromadzińska J, Wąsowicz W.

Full Source: International Journal of Occupational Medicine & Environmental Health. 2019 Jul 15;32(4):441-464. doi: 10.13075/ijomeh.1896.01434. Epub 2019 May 8.

### Semi-quantitative health risk assessment of exposure to chemicals in an aluminium rolling mill

2019-09-17

The main goal of this study was to evaluate the health risks resulting from occupational exposure to chemicals in an aluminium rolling mill to propose effective control measures. Exposure of workers to chemicals was assessed based on the Singapore Health Department's methodology. The health risks of exposure to the identified chemicals and the relative risk of developing cancer due to exposure to benzene were assessed. According to the results, the risk level of exposure to sulfuric acid in the washing line and to manganese in the manufacturing unit were high. In assessing the risk of developing cancer arising from benzene exposure, the lifetime cancer risk was found in the range  $10^{-4}$ - $10^{-6}$  (the possible range). The results indicated that in the aluminium rolling industry, occupational exposure to 75% of the chemicals had a low risk level, 15% had a moderate risk level and 10% had a high-risk level.

Authors: Sanjari A, Saeedi R, Khaloo SS.

Full Source: International Journal of Occupational Safety & Ergonomic. 2019 Jul 24:1-8. doi: 10.1080/10803548.2019.1617459. [Epub ahead of print]

The main goal of this study was to evaluate the health risks resulting from

## PUBLIC HEALTH RESEARCH

### Occurrence, distribution and human exposure to 20 organophosphate esters in air, soil, pine needles, river water, and dust samples collected around an airport in New York state, United States

2019-09-17

Organophosphate esters (OPEs) are used in aircraft lubricating oil and hydraulic fluids, and, thus, airplane emissions are thought to be an important source of these chemicals in the environment. In this study,

concentrations of 20 OPEs, comprising seven alkyl-OPEs, three chlorinated (Cl)-OPEs, seven aryl-OPEs, and three oligomeric-OPEs, were determined in outdoor air, soil, pine needles, river water, and outdoor dust samples collected around an airport in Albany, New York, in 2018. Elevated  $\Sigma$ OPE concentrations were found in outdoor air, soil, pine needles, outdoor dust, and river water in the ranges of 1320-20,700 pg/m<sup>3</sup> (median: 3880), 1.16-73.1 (14.3) ng/g dry weight (dw), 23.2-534 (102) ng/g (dw), 153-2140 (824) ng/g (dw), and 174-24,600 (1250) ng/L, respectively. The total OPE concentrations in air, soil, water, and outdoor dust samples in the study area were dominated by Cl-OPEs, whereas those in pine needles were dominated by aryl-OPEs. The spatial distribution of OPEs in air, soil, and pine needles showed a gradual decreasing trend with increasing distance from the airport. A significant correlation was observed between  $\Sigma$ OPE concentrations in air and soil, and the fugacity ratio showed the flux of OPEs from air to soil. The spatial distribution of OPEs between air and pine needles was similar and highly correlated, suggesting that pine needles are suitable indicators of atmospheric OPE concentrations. In addition to urban activities, aircraft hydraulic/lubricant oils are a major source of OPEs in the vicinity of the airport. The average daily intake of OPEs via air inhalation and outdoor dust ingestion in the vicinity of the airport was up to 1.53 ng/kg bw/day for children and 0.73 ng/kg bw/day for adults.

Authors: Li W, Wang Y, Kannan K.

Full Source: Environment International. 2019 Jul 27; 131:105054. doi: 10.1016/j.envint.2019.105054. [Epub ahead of print]

### Lung health in the Eastern Mediterranean Region: the need to end designated smoking areas in public places

2019-09-17

Tobacco use is a fatal habit that causes harm to almost all organs of the human body and kills up to half of its users. Studies have shown that tobacco contains a poisonous mix of more than 7000 chemicals that have major consequences, including heart attacks and strokes, and are considered major risk factors for many types of cancer (4) and the leading cause of lung cancer. Moreover, tobacco use dramatically affects the respiratory system, damaging its airways and alveoli, and leading to chronic obstructive lung diseases<sup>1</sup> including emphysema and chronic bronchitis.

Authors: El-Awa F, Tageldin MA, Prasad V, Al-Mulla A, Heydari G, Alebshehy R.

Full Source: Eastern Mediterranean Health Journal. 2019 Jul 24;25(5):297-298. doi: 10.26719/2019.25.5.297.

Tobacco use is a fatal habit that causes harm to almost all organs of the human body and kills up to half of its users.

### Neuro-toxic and reproductive effects of BPA

2019-09-17

Bisphenol A (BPA) is one of the highest volume chemicals produced worldwide. It has recognised activity as an endocrine disrupting chemical and has suspected roles as a neurological and reproductive toxicant. It interferes in steroid signalling, induces oxidative stress, and affects gene expression epigenetically. Gestational, perinatal and neonatal exposures to BPA affect developmental processes, including brain development and gametogenesis, with consequences on brain functions, behaviour, and fertility. This review critically analyses recent findings on the neuro-toxic and reproductive effects of BPA (and its analogues), with focus on neuronal differentiation, synaptic plasticity, glia and microglia activity, cognitive functions, and the central and local control of reproduction. BPA has potential human health hazard associated with gestational, peri-and neonatal exposure. Beginning with BPA's disposition, this review summarises recent findings on the neurotoxicity of BPA and its analogues, on neuronal differentiation, synaptic plasticity, neuro-inflammation, neuro- degeneration, and impairment of cognitive abilities. Furthermore, it reports the recent findings on the activity of BPA along the HPG axis, effects on the hypothalamic Gonadotropin Releasing Hormone (GnRH), and the associated effects on reproduction in both sexes and successful pregnancy. BPA and its analogues impair neuronal activity, HPG axis function, reproduction, and fertility. Contrasting results have emerged in animal models and human. Thus, further studies are needed to better define their safety levels. This review offers new insights on these issues with the aim to find the "fil rouge", if any, that characterize BPA's mechanism of action with outcomes on neuronal function and reproduction.

Authors: Santoro A, Chianese R, Troisi J, Richards S, Nori SL, Fasano S, Guida M, Plunck E, Viggiano A, Pierantoni R, Meccariello R.

Full Source: Current Neuropharmacology. 2019 Jul 26. doi: 10.2174/1570159X17666190726112101. [Epub ahead of print]

This study investigated the accumulation of phthalates in infant cotton clothing from production to first wearing.

### Phthalates in infant cotton clothing: Occurrence and implications for human exposure

2019-09-17

Clothing easily adsorbed the chemicals in the environment, and became a source of human exposure to chemicals. However, large contacted surface area and long exposure duration have elevated human exposure to chemicals from clothing, such as phthalates. Among them, cotton clothing, which infants prefer to wear, has been proven to adsorb

phthalates more easily than other fabrics. While infants are developing, they are easily affected by phthalates. In this study, in order to study accumulation of phthalates in infant cotton clothing during the whole process from production to the first wearing, 24 infant cotton clothing samples were collected from shopping malls in Harbin, China. High detection rates and concentrations suggest that phthalates in the environment are widely adsorbed to infant cotton clothing, and traditional laundering for infant clothing cannot remove phthalates completely. The median concentration of the total phthalates was 4.15  $\mu\text{g/g}$ . Di-(2-ethylhexyl) phthalate (DEHP) has become the dominant phthalate. For the estimated daily intakes (EDIs) for infants, dibutyl phthalate (DBP) had the highest contribution, followed by di-iso-butyl phthalate (DiBP) and DEHP. Dermal absorption has become the main route of infant exposure to phthalates, and ingestion contributed very little. The result of comparing with the EDIs via dermal absorption from house air and dust suggests that clothing plays an important role of dermal absorption exposure to phthalates. For risk assessment, the carcinogenic risk of BBP and DEHP indicates that the level of DEHP in infant cotton clothing might pose potential adverse effects to infant health.

Authors: Li HL, Ma WL, Liu LY, Zhang Z, Sverko E, Zhang ZF, Song WW, Sun Y, Li YF.

Full Source: Science of the Total Environment. 2019 Sep 15; 683:109-115. doi: 10.1016/j.scitotenv.2019.05.132. Epub 2019 May 11.

### Building and Applying Quantitative Adverse Outcome Pathway Models for Chemical Hazard and Risk Assessment

2019-09-17

An important goal in toxicology is the development of new ways to increase the speed, accuracy and applicability of chemical hazard and risk assessment approaches. A promising route for this is the integration of in vitro assays with biological pathway information. In the present study, the authors examine how the Adverse Outcome Pathway (AOP) framework can be used to develop pathway based quantitative models useful for regulatory chemical safety assessment. By using AOPs as initial conceptual models and the AOP knowledge base as a source of data on key event relationships, different methods can be applied to develop computational quantitative AOP models (qAOPs) relevant for decision making. A qAOP model may not necessarily have the same structure as the AOP it is based on. Useful AOP modelling methods range from statistical, Bayesian networks, regression, and ordinary differential equations to

In the present study, the authors examine how the Adverse Outcome Pathway (AOP) framework can be used to develop pathway based quantitative models useful for regulatory chemical safety assessment.

## Technical

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individual-based models and should be chosen according to the questions being asked and the data available. The authors discuss the need for toxicokinetic models to provide linkages between exposure and qAOPs, to extrapolate from in vitro to in vivo, and to extrapolate across species. Finally, we identified best practices for modelling, model building and the necessity for transparent and comprehensive documentation to gain confidence in the use of a quantitative AOP models and ultimately their use in regulatory applications.

Authors: Perkins EJ, Ashauer R, Burgoon L, Conolly R, Landesmann B, Mackay C, Murphy CA, Pollesch N, Wheeler JR, Zupanec A, Scholz S.

Full Source: Environmental Toxicology & Chemistry. 2019 May 25. doi: 10.1002/etc.4505. [Epub ahead of print]