CHEMWATCH

Bulletin Board

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ENVIRONMENTAL RESEARCH

Association of particulate matter air pollution with leukocyte mitochondrial DNA copy number

2020-05-06
BACKGROUND:
Ambient particulate matter (PM) has been associated with mitochondrial damage and dysfunction caused by excessive oxidative stress, but the associations between long-term PM exposure and leukocyte mitochondrial DNA copy number (mtDNAcn), a biomarker of mitochondrial dysfunction due to oxidative stress, are less studied.
OBJECTIVES:
To investigate the associations between short-, intermediate- and long-term exposure (1-, 3- and 12-months) to different size fractions of PM ($PM_{2.5}$, $PM_{2.5-10}$ and PM_{10}) and leukocyte mtDNAcn in a cross-sectional study.
METHODS:
The associations between each of the PM exposure metrics with z scores of log-transformed mtDNAcn were examined using generalized linear regression models in 2758 female participants from the Nurses' Health Study (NHS). Monthly exposures to PM were estimated from spatio-temporal prediction models matched to each participants' address history. Potential effect modification by selected covariates was examined using multiplicative interaction terms and subgroup analyses.
RESULTS:
In single-size fraction models, increases in all size fractions of PM were associated with decreases in mtDNAcn, although only models with longer averages of $PM_{2.5}$ reached statistical significance. For example, an interquartile range (IQR) increase in 12-month average ambient $PM_{2.5}$ (5.5 µg/m^3) was associated with a 0.07 [95% confidence interval (95% CI): -0.13, -0.01; p-value = 0.02] decrease in mtDNAcn z score in both basic- and multivariable-adjusted models. Associations for $PM_{2.5}$ were stronger after controlling for $PM_{2.5-10}$ in two size-fraction models.
CONCLUSIONS:
Our study suggests that long-term exposure to ambient $PM_{2.5}$ is associated with decreased mtDNAcn in healthy women.
Authors: Wang X, Hart JE, Liu Q, Wu S, Nan H, Laden F
Full Source: Environment International. 2020 May 6;141:105761. doi: 10.1016/j.envint.2020.105761. [Epub ahead of print]

Monthly exposures to PM were estimated from spatio-temporal prediction models matched to each participants' address history.

MAY. 15, 2020

Designing 3D-MoS2 Sponge as excellent cocatalysts in advanced oxidation processes for pollutant control

2020-05-09

3D-MoS2 can adsorb organic molecules and provide multidimensional electron transport pathways, implying a significant potential application for environment remediation. Here, we study the degradation of aromatic organics in AOPs by a 3D-MoS2 sponge loaded with MoS2 nanospheres and graphene oxide (GO). Exposed Mo4+ active sites on 3D-MoS2 can significantly improve the concentration and stability of Fe2+ in AOPs, and keep the Fe3+/Fe2+ in a stable dynamic cycle, thus effectively promoting the activation of H2O2/PMS. The degradation rate of organic pollutants in the 3D-MoS2 system is ~50 times higher than that in the case without cocatalyst. Even after 140 L pilot-scale experiment, it still maintains high efficiency and stable AOPs activity. After 16 days of continuous reaction, the 3D-MoS2 can achieve the degradation rate of 120 mg/L antibiotic wastewater up to 97.87%. The operating cost of treating a ton of wastewater is only 0.33 $, suggesting it has huge industrial applications.
Authors: Zhu L, Ji J, Liu J, Mine S, Matsuoka M, Zhang J, Xing M
Full Source: Angewandte Chemie (International ed. in English). 2020 May 9. doi: 10.1002/anie.202006059. [Epub ahead of print]

Critical evaluation of human health risks due to hydraulic fracturing in natural gas and petroleum production

2020-05-09

The use of hydraulic fracturing (HF) to extract oil and natural gas has increased, along with intensive discussions on the associated risks to human health. Three technical processes should be differentiated when evaluating human health risks, namely (1) drilling of the borehole, (2) hydraulic stimulation, and (3) gas or oil production. During the drilling phase, emissions such as NO_x, NMVOCs (non-methane volatile organic compounds) as precursors for tropospheric ozone formation, and SO_x have been shown to be higher compared to the subsequent phases. In relation to hydraulic stimulation, the toxicity of frac fluids is of relevance. More than 1100 compounds have been identified as components. A trend is to use fewer, less hazardous and more biodegradable substances; however, the use of hydrocarbons, such as kerosene and diesel, is still allowed in the USA. Methane in drinking water is of low toxicological relevance but may indicate inadequate integrity of the gas well. There is a great concern regarding the contamination of ground- and surface water during the production phase. Water that flows to the surface

The degradation rate of organic pollutants in the 3D-MoS2 system is ~50 times higher than that in the case without cocatalyst.

from oil and gas wells, so-called ‹produced water›, represents a mixture of flow-back, the injected frac fluid returning to the surface, and the reservoir water present in natural oil and gas deposits. Among numerous hazardous compounds, produced water may contain bromide, arsenic, strontium, mercury, barium, radioactive isotopes and organic compounds, particularly benzene, toluene, ethylbenzene and xylenes (BTEX). The sewage outflow, even from specialized treatment plants, may still contain critical concentrations of barium, strontium and arsenic. Evidence suggests that the quality of groundwater and surface water may be compromised by disposal of produced water. Particularly critical is the use of produced water for watering of agricultural areas, where persistent compounds may accumulate. Air contamination can occur as a result of several HF-associated activities. In addition to BTEX, 20 HF-associated air contaminants are group 1A or 1B carcinogens according to the IARC. In the U.S., oil and gas production (including conventional production) represents the second largest source of anthropogenic methane emissions. High-quality epidemiological studies are required, especially in light of recent observations of an association between childhood leukemia and multiple myeloma in the neighborhood of oil and gas production sites. In conclusion, (1) strong evidence supports the conclusion that frac fluids can lead to local environmental contamination; (2) while changes in the chemical composition of soil, water and air are likely to occur, the increased levels are still often below threshold values for safety; (3) point source pollution due to poor maintenance of wells and pipelines can be monitored and remedied; (4) risk assessment should be based on both hazard and exposure evaluation; (5) while the concentrations of frac fluid chemicals are low, some are known carcinogens; therefore, thorough, well-designed studies are needed to assess the risk to human health with high certainty; (6) HF can represent a health risk via long-lasting contamination of soil and water, when strict safety measures are not rigorously applied.
Authors: Wollin KM, Damm G, Foth H, Freyberger A, Gebel T, Mangerich A, Gundert-Remy U, Partosch F, Röhl C, Schupp T, Hengstler JG
Full Source: Archives of Toxicology. 2020 May 9. doi: 10.1007/s00204-020-02758-7. [Epub ahead of print]

Marriage as a social tie in the relation of depressive symptoms attributable to air pollution exposure among the elderly

2020-05-01
BACKGROUND:

This study included 2122 marrieds and 607 non-marrieds, recruited in 2014-2017 from different regions of South Korea.

Air pollution is a risk factor for depression or depressive symptoms. However, few studies have examined an effect modifier as a protective factor against depressive symptoms associated with air pollution, including social support. Notably, less is known about a married relationship in the association between exposure to air pollution and depressive symptoms among the elderly.

METHODS:

This study included 2122 marrieds and 607 non-marrieds, recruited in 2014-2017 from different regions of South Korea. Depressive symptoms were measured by the Korean version of the Geriatric Depression Scale Short Form (SGDS-K). After adjustment for potential confounders using propensity score of being assigned to the marrieds, we examined the extent of whether the effects of exposure to air pollutants (PM_{10}, $PM_{2.5}$, and NO_2) on depressive symptoms were different between marrieds and non-marrieds. Subgroup analyses by gender and residence area were also performed.

RESULTS:

Marrieds than non-marrieds were less likely to have depressive symptoms and had smaller SGDS-K associated with increased exposure to PM_{10} and $PM_{2.5}$ concentrations, respectively. After stratification of subjects by gender and residence area, the interaction term appeared to be significant among men and the non-metropolitan group, indicating the protective effect of married relationships on depressive symptoms attributable to air pollution exposure in them.

LIMITATIONS:

Although we adjusted the propensity score, our findings might be confounded by the contextual effect associated with married relationships.

CONCLUSIONS:

A married relationship, as a social tie, may attenuate the effect of exposure to air pollution on depressive symptoms among the elderly. Nonetheless, additional research is worthwhile to explore the extent of other social relationships in the association between air pollution exposure and depressive symptoms.

CHEMICAL EFFECTS

Distinctive cellular response to aluminium based adjuvants

2020-04-29

Aluminum-based adjuvants (ABAs) are used in human vaccines to enhance the magnitude of protective immune responses elicited against specific pathogens. One hypothesis is that stress signals released by aluminum-exposed necrotic cells play a role in modulating an immune response that contributes to the adjuvant's effectiveness. We hypothesized that aluminum adjuvant-induced necrosis would be similar irrespective of cellular origin or composition of the adjuvant. To test this hypothesis, human macrophages derived from peripheral monocytic cell line (THP-1) and cells derived from the human brain (primary astrocytes) were evaluated. Three commercially available formulations of ABAs (Alhydrogel, Imject alum, and Adju-Phos) were examined. Alum was also used as a reference. Cell viability, reactive oxygen species formation, and production of tumor necrosis factor alpha (TNF-α) and interleukin-6 (IL-6) were quantified. Cells were exposed to different concentrations (10-100 μg/mL) of the adjuvants for 24 h or 72 h. The two FDA approved adjuvants (Alhydrogel and Adju-Phos) decreased cell viability in both cell types. At the 72 h time point, the decrease in viability was accompanied with increased ROS formation. The size of the aluminum agglomerates was not relatable to the changes observed. After exposure to ABAs, astrocytes and macrophages presented a distinct profile of cytokine secretion which may relate to the function and unique characteristics of each cell type. These variations indicate that aluminum adjuvants may have differing capability of activating cells of different origin and thus their utility in specific vaccine design should be carefully assessed for optimum efficacy.

Authors: Nies I, Hidalgo K, Bondy SC, Campbell A
Full Source: Environmental toxicology and pharmacology. 2020 Apr 29;78:103404. doi: 10.1016/j.etap.2020.103404. [Epub ahead of print]

One hypothesis is that stress signals released by aluminum-exposed necrotic cells play a role in modulating an immune response that contributes to the adjuvant's effectiveness.

Computational material flow analysis for thousands of chemicals of emerging concern in European waters

2020-04-18

Knowledge of exposure to a wide range of chemicals, and the spatio-temporal variability thereof, is urgently needed in the context of protecting and restoring aquatic ecosystems. This paper discusses a computational material flow analysis to predict the occurrence of thousands of man-made organic chemicals on a European scale, based

on a novel temporally and spatially resolved modelling framework. The goal was to increase understanding of pressures by emerging chemicals and to complement surface water monitoring data. The ambition was to provide a first step towards a "real-life" mixture exposure situation accounting for as many chemicals as possible. Comparison of simulated concentrations and chemical monitoring data for 226 substance/basin combinations showed that the simulated concentrations were accurate on average. For 65% and 90% of substance/basin combinations the error was within one and two orders of magnitude respectively. An analysis of the relative importance of uncertainties revealed that inaccuracies in use volume or use type information contributed most to the error for individual substances. To resolve this, we suggest better registration of use types of industrial chemicals, investigation of presence/absence of industrial chemicals in wastewater and runoff samples and more scientific information exchange.

Authors: van Gils J, Posthuma L, Cousins IT, Brack W, Alternburger R, Baveco H, Focks A, Greskowiak J, Kühne R, Kutsarova S, Lindim C, Markus A, van de Meent D, Munthe J, Schueder R, Schüürmann G, Slobodnik J, de Zwart D, van Wezel A
Full Source: Journal of Hazardous Materials. 2020 Apr 18;397:122655. doi: 10.1016/j.jhazmat.2020.122655. [Epub ahead of print]

Pyrroloquinoline Quinine and LY294002 changed cell cycle and apoptosis by regulating PI3K-AKT-GSK3β pathway in SH-SY5Y cells

2020-05-08
To verify the role of PI3K-AKT-GSK3β pathway during manganese (Mn)-induced cell death, apoptosis, related indicators were investigated. SH-SY5Y cells were directly exposed to different concentrations of $MnCl_2$. Then, cell viability, apoptosis, necrosis rate, and cell cycle were detected by MTT, FITC Annexin V Apoptosis Detection Kit with PI and PI staining. Then, in two intervention groups, cells were preconditioned with agonist (PQQ) and suppressant (LY294002). The cell viability decreased with a dose-response relationship ($p < 0.05$), while apoptosis and necrosis increased ($p < 0.05$). The ratio of G_0/G1 and G_2/M also decreased, but the percentage of S phase increased ($p < 0.05$). During above process, PI3K-AKT-GSK3β pathway was involved by regulating the expression of PI3K, AKT, p-AKT, and GSK3β ($p < 0.05$). For further research, cell cycle and apoptosis were detected pretreatment with PQQ and LY294002 before Mn exposure. The result showed cell ability, apoptosis, and necrosis rate changed obviously compared with non-pretreated group ($p < 0.05$). The variance of G0/G1

Then, cell viability, apoptosis, necrosis rate, and cell cycle were detected by MTT, FITC Annexin V Apoptosis Detection Kit with PI and PI staining.

and G2/M ratio and percentage of S phase were also different, especially in 2.0 mM (p < 0.05). Mn can cause apoptosis and necrosis, varying cell cycle of SH-SY5Y cells, which could be changed by PQQ and LY294002 by regulating PI3K-AKT-GSK3β pathway.
Authors: Ji H, Ma J, Chen L, Chen T, Zhang S, Jia J, Yang X, guo C, Xiao Z, Niu P
Full Source: Neurotoxicity research. 2020 May 8. doi: 10.1007/s12640-020-00210-3. [Epub ahead of print]

Priorities for improving chemicals management in the WHO European region-stakeholders' views

2020-05-08
BACKGROUND:
Prevention of the impact of chemicals on human health and the environment is an increasing focus of public health polices and policy makers. The World Health Organization European Centre for Environment and Health wanted to know what were stakeholders' priorities for improving chemicals management and prevention.
METHODS:
Semi-structured interviews were undertaken with 18 diverse stakeholders to answer this question. The interview questionnaire was developed using current WHO chemical meeting reports, the Evidence Implementation Model for Public Health Systems and categories of the theory of diffusion. Stakeholder views were attained on three main questions within the questionnaire. (i) What priority actions should be undertaken to minimize the negative impact of chemicals? (ii) Who needs to be more involved and what roles should they have? (iii) How can science and knowledge on chemicals and health be translated into policies more effectively and what are the greatest barriers to overcome?
RESULTS:
Cross cutting issues, such as legislation strengthening and enforcement, further collection of information, capacity building, education and awareness raising were considered priorities. The responders had the same vision on roles and responsibilities of different stakeholders. The greatest barrier to adoption, implementation and enforcement of evidence-based policies reported was leadership and political commitment to chemical safety.
CONCLUSIONS:
Priorities raised differed depending on knowledge, professional background and type of stakeholder. Factors influencing priority identification at the national level include international and global

The World Health Organization European Centre for Environment and Health wanted to know what were stakeholders' priorities for improving chemicals management and prevention.

context, availability of information, knowledge of the current situation and evidence-based good practice, and risks and priorities identified through national assessments.

Authors: Vincenten JA, Zastenskaya I, Schröder-Bäck P, Jaronsinska DI
Full Source: European Journal of Public Health. 2020 May 8. pii: ckaa074. doi: 10.1093/eurpub/ckaa074. [Epub ahead of print]

Innovative bio-based organic UV-A and blue light filters from Meldrum's Acid

2020-05-06
Faced with the ban of some organic UV filters such as octinoxate or avobenzone, especially in Hawaii, it became essential to offer new alternatives that are both renewable and safe for humans and the environment. In this context, a class of bio-based molecules displaying interesting UV filter properties and great (photo) stability has been developed from Meldrum's acid and bio-based and synthetic p-hydroxycinnamic acids, furans and pyrroles. Moreover, p-hydroxycinnamic acid-based Meldrum's derivatives possess valuable secondary activities sought by the cosmetic industry such as antioxidant and anti-tyrosinase properties. The evaluation of the properties of mixture of judiciously chosen Meldrum's acid derivatives highlighted the possibility to modulate secondary activity while maintaining excellent UV protection. Meldrum's acid derivatives are not only competitive when benchmarked against organic filters currently on the market (i.e., avobenzone), but they also do not exhibit any endocrine disruption activity.

Authors: Peyrot C, Mention MM, Brunissen F, Balaguer P, Allais F
Full Source: Molecules (Basel, Switzerland). 020 May 6;25(9). pii: E2178. doi: 10.3390/molecules25092178.

The relatively strong correlation between 24hUCa and UCa/Cr in evening and first morning spot urine samples suggests that these spots could be preferred in clinical practice.

PHARMACEUTICAL/TOXICOLOGY

Spot urine samples to estimate 24-hour urinary calcium excretion in school-age children

2020-05-09
Urinary calcium/creatinine ratio (UCa/Cr) on a single spot urine sample is frequently used in children to evaluate calciuria, but its accuracy to estimate 24-h urinary calcium excretion (24hUCa) has not been properly assessed. We analyzed the correlation between UCa/Cr in various spot samples and 24hUCa among healthy children. A 24-h urine specimen

and three spot urine samples (evening, first, and second morning) were collected in a convenience sample of children aged 6 to 16 years (n = 101). Measured 24hUCa was compared with UCa/Cr in each of the three spot samples. The ability of UCa/Cr to discriminate between children with and without hypercalciuria (calciuria > 4 mg/kg/24 h, 1 mmol/kg/24 h) and optimal timing of the spot sample were determined. Eighty-five children completed an adequate 24-h urine collection. Pearson correlation coefficients between the UCa/Cr on the spot sample and 24hUCa were 0.64, 0.71, and 0.52 for the evening, first, and second morning spot samples, respectively. Areas under the ROC curve were 0.90, 0.82, and 0.75, respectively, for the corresponding spot samples.Conclusion: The relatively strong correlation between 24hUCa and UCa/Cr in evening and first morning spot urine samples suggests that these spots could be preferred in clinical practice. Trial registration:ClinicalTrials.gov, NCT02900261, date of trial registration 14 September 2016.What is Known:•Urinary calcium/creatinine ratio on a single spot urine sample is frequently used as a proxy for 24-h urinary calcium excretion.•Correlation of these indicators, including the best timing for spot urine sampling, has not been properly assessed.What is New:•Relatively strong correlations were found between the calcium/creatinine ratio on a single spot urine sample and 24-h urinary calcium excretion in healthy children.•Evening and first morning spot samples had the highest correlation.

Authors:Paccaud Y, Rios-Leyvraz, Bochud M, Tabin R, Genin B, Russo M, Rossier MF, Bovet P, Chiolero A, Parvex P
Full Source: European Journal of Pediatrics. 2020 May 9. doi: 10.1007/s00431-020-03662-z. [Epub ahead of print]

1,815 and 2,322 patients with bipolar disorder were examined in 2009 and 2018, respectively.

Drug treatment for patients with bipolar disorders in psychiatric practices in Germany in 2009 and 2018

2020-05-01
AIMS:
The aim of this study was to describe the treatment of bipolar disorder patients in psychiatric private practices in Germany in 2009 and 2018.
METHODS:
This retrospective study included patients with bipolar disorder who had received at least one prescription for antidepressants, antipsychotics, antiepileptic drugs or benzodiazepines in 93 neuropsychiatric private practices in Germany between January 2009 and December 2018. Outcomes of this study were the prevalence of prescriptions for defined mood stabilizers, antipsychotics, antidepressants, and benzodiazepines, and the prevalence of mono and combination therapy in 2009 and 2018.

RESULTS:

1,815 and 2,322 patients with bipolar disorder were examined in 2009 and 2018, respectively. Compared to 2009, there was a decrease in the proportion of prescriptions for mood stabilizers by 2018 (58.6% to 49.5%) especially for lithium (from 31.4% to 26.2%) and an increase in the prescription of antipsychotics (38.4% in 2009 and 53.1% in 2018) and antidepressants (32.6% in 2009 and 45.1% in 2018). The share of combination therapy increased moderately from 39.3% to 41%.

CONCLUSIONS:

Quetiapine has displaced lithium from the number one medication of the most commonly prescribed drugs in patients with bipolar disorders. The rate of patients in this study receiving monotherapy was surprisingly high.

A biomonitoring study assessing the exposure of young German adults to butylated hydroxytoluene (BHT)

2020-05-05

The antioxidant 2,6-di-tert-butyl-4-methylphenol (butylated hydroxytoluene, BHT) is used ubiquitously in food, cosmetics, pharmaceuticals, fuels, plastics, rubbers and many other products. Therefore, exposure of the general population to this substance is likely. We analyzed the BHT metabolite 3,5-di-tert-butyl-4-hydroxybenzoic acid ("BHT acid") in 24-h urine samples from the German Environmental Specimen Bank with the aim of gaining a better understanding of the internal burden of BHT in young nonspecifically exposed adults. The study population consisted of students between 20 and 29 years of age at the time of sampling, all from Halle/Saale in Central Germany. In total, 329 samples collected in the years 2000, 2004, 2008, 2012, 2015, and 2018 were measured by ultra high performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS). BHT acid was detected above the limit of quantification (0.2 µg/L) in 98% of the samples. The median of the measured concentrations was 1.06 µg/L and 1.24 µg/g creatinine respectively, the median of the daily excretion was 1.76 µg/24 h and - additionally normalized for body weight - 26.8 ng/24 h $\times$ kg bw respectively. The corresponding 90th percentiles were 3.28 µg/L, 3.91 µg/g creatinine, 5.05 µg/24 h, and 81.9 ng/24 h $\times$ kg bw. Medians of creatinine-corrected values were slightly higher in women than in men, while the opposite situation was observed for the volume concentrations and the 24-h excretion values (not corrected for body weight). Values

> Therefore, exposure of the general population to this substance is likely.

Technical

simultaneously normalized both for 24-h excretion and body weight did not exhibit any significant differences between males and females, probably indicating a virtually identical magnitude of exposure for both genders. The background exposure of the investigated population was found to be largely constant since the year 2000, with only weak temporal trends at most. Daily intakes were estimated from excretion values and found to be largely below the acceptable daily intake (ADI) of BHT at 0.25 mg/kg bw: our worst-case estimate is a daily BHT intake of approximately 0.1 mg/kg bw at the 95th percentile level. However, these intake assessments rely on very limited quantitative data regarding human metabolism of BHT.

The cyclopeptide <alpha>-amatoxin induced hepatic injury via the mitochondrial apoptotic pathway associated with oxidative stress

2020-05-06

In order to explore the role of apoptosis in alpha-amatoxin (α-AMA) induced liver injury and probable upstream activation signals, we established animal and cellular models, respectively, for this pathophysiological condition. To this end, we evaluated the survival rate and serum biochemical parameters in BALB/c mice exposed to α-AMA at different time periods, along with the levels of oxidative and antioxidant enzymes in the liver tissue of these mice and proteins involved in apoptosis-related pathways. Our results reveal that α-AMA-induced apoptosis occurs primarily through the mitochondrial apoptotic pathway and is associated with oxidative damage. Further, in order to verify the key nodes and important upstream activators in this apoptotic pathway, we estimated the levels of p53 protein and downstream mitochondrial apoptotic pathway-related proteins in L-02 cells, all of which were found to change significantly. We also found that the levels of total and mitochondrial reactive oxygen species (ROS) in L-02 cells increased with time. Collectively, our findings suggest that α-AMA affects many cellular processes, including the expression of p53 independent of transcription and the expression of Bax and Bcl-2, thereby activating the subsequent caspase cascade pathways. In addition, we identified ROS to be an

> We also found that the levels of total and mitochondrial reactive oxygen species (ROS) in L-02 cells increased with time.

upstream signaling molecule involved in the α-AMA-induced apoptosis of mouse liver cells and L-02 cells.
Authors: Chen X, Shao B, Yu C, Yao Q, Ma P, Li H, Cai W, Fu H, Li B, Sun C
Full Source: Peptides. 2020 May 6:170314. doi: 10.1016/j. peptides.2020.170314. [Epub ahead of print]

Applying knowledge-driven mechanistic inference to toxicogenomics

2020-05-06
When considering toxic chemicals in the environment, a mechanistic, causal explanation of toxicity may be preferred over a statistical or machine learning-based prediction by itself. Elucidating a mechanism of toxicity is, however, a costly and time-consuming process that requires the participation of specialists from a variety of fields, often relying on animal models. We present an innovative mechanistic inference framework (MechSpy), which can be used as a hypothesis generation aid to narrow the scope of mechanistic toxicology analysis. MechSpy generates hypotheses of the most likely mechanisms of toxicity, by combining a semantically-interconnected knowledge representation of human biology, toxicology and biochemistry with gene expression time series on human tissue. Using vector representations of biological entities, MechSpy seeks enrichment in a manually curated list of high-level mechanisms of toxicity, represented as biochemically- and causally-linked ontology concepts. Besides predicting the canonical mechanism of toxicity for many well-studied compounds, we experimentally validated some of our predictions for other chemicals without an established mechanism of toxicity. This mechanistic inference framework is an advantageous tool for predictive toxicology, and the first of its kind to produce a mechanistic explanation for each prediction. MechSpy can be modified to include additional mechanisms of toxicity, and is generalizable to other types of mechanisms of human biology.
Authors: Tripodi IJ, Callahan TJ, Westfall JT, Meitzer NS, Dowell RD, hunter LE
Full Source: Toxicology in vitro: an international journal published in association with BIBRA. 2020 May 6:104877. doi: 10.1016/j.tiv.2020.104877. [Epub ahead of print]

> Elucidating a mechanism of toxicity is, however, a costly and time-consuming process that requires the participation of specialists from a variety of fields, often relying on animal models.

Technical

Semen quality among young healthy men taking protein supplements

2020-005-06
OBJECTIVE:
To study the association between use of protein supplements (PS) and semen quality among young men.
DESIGN:
Cross-sectional study.
SETTING:
Not applicable PATIENT(S): We used data from the Fetal Programming of Semen Quality (FEPOS) cohort, which is a subsample of 778 men whose mothers enrolled in the Danish National Birth Cohort 1996-2002.
INTERVENTION(S):
Semen samples were collected from April 2017 to March 2019. Relative difference in semen characteristics according to self-reported PS use was estimated with negative binomial regression adjusting for lifestyle factors including exercise, body mass index, and use of anabolic steroids, and maternal and paternal factors potentially confounding the association between PS and semen quality.
MAIN OUTCOME MEASURE(S):
Negative binomial regression yielded the best fit and was used to estimate the percent difference with 95% confidence intervals in semen volume, sperm concentration, total sperm count, proportions of progressive, nonprogressive, and immotile sperm, and percentage of morphologically normal sperm in former and current users of PS relative to never users.
RESULT(S):
PS was used currently by 28% and formerly by 24% of participants. PS use was not associated with reduced semen quality in terms of semen volume, sperm concentration, total sperm count, morphology, or motility in either crude or adjusted analyses.
CONCLUSION:
This study showed no association between use of PS and semen quality characteristics. Still, we encourage others to repeat the study, as even a small harmful effect would have a large impact on the population level because of the widespread use of PS among young men.
Authors: Tøttenborg SS, Glazer CH, Hærvig KK, Høyer BB, Toft G, Hougaard KS, Flachs EM, Deen L, Bonde JPE, Ramlau-Hansen CH
Full Source: Fertility and sterility. 2020 May 6. pii: S0015-0282(20)30204-1. doi: 10.1016/j.fertnstert.2020.02.103. [Epub ahead of print]

OCCUPATIONAL

Flame retardants, dioxins, and furans in air and on firefighters' protective ensembles during controlled residential firefighting

2020-05-07
INTRODUCTION:
Structure fires that involve modern furnishings may emit brominated flame retardants (BFRs) and organophosphate flame retardants (OPFRs), as well as brominated and chlorinated dioxins and furans, into the environment.
OBJECTIVES:
The goal of this study was to quantify the airborne and personal protective equipment (PPE) contamination levels of these compounds during controlled residential fires in the U.S., and to evaluate gross-decontamination measures.
METHODS:
Bulk-sampling was done to confirm the presence of flame retardants (FRs) in the furnishings used in 12 controlled residential structure fires. Area air samples were collected during the fires and PPE wipe samples were collected from the firefighters' turnout jackets and gloves after firefighting. For each fire, half of the jackets were decontaminated and the other half were not.
RESULTS:
Of the BFRs and OPFRs measured in air during the fire period, decabromodiphenyl ether (BDE-209) and triphenyl phosphate (TPP) were the most abundant, with medians of 15.6 and 408 $\mu g/m^3$, respectively, and were also detected during overhaul. These and several other BFRs and OPFRs were measured on PPE. Some gloves had contaminant levels exceeding 100 ng/cm^2 and were generally more contaminated than jackets. Air and surface levels of the brominated furans appeared to be higher than the chlorinated dioxins and furans. Routine gross decontamination appeared to reduce many of the BFR contaminants, but results for the OPFRs were mixed.
CONCLUSIONS:
Structure fires are likely to result in a variety of FRs, dioxins, and furans into the environment, leading to PPE contamination for those working on the fireground. Firefighters should wear self-contained breathing apparatus

Some gloves had contaminant levels exceeding 100 ng/cm2 and were generally more contaminated than jackets.

during all phases of the response and launder or decontaminate their PPE (including gloves) after fire events.
Authors: Kent KW, LaGuardia M, Luellen D, McCormick S, Mayer A, Chen IC, Kerber S, Smith D, Horn GP
Full Source: Environment International. 2020 May 7;140:105756. doi: 10.1016/j.envint.2020.105756. [Epub ahead of print]

[Causality and responsibility in occupational health]

2020-05-05
The objective of this work is to review the imperfect relationship between causality and responsibility, from the perspective of occupational health, where this tension occurs so frequently when addressing the prevention of illnesses and occupational injuries. From epidemiology, we are very demanding in our observations, both in terms of internal and external validity, when establishing causal relationships. An essential rigor in the analysis of causality, which does not prevent us from myopia when a purely biomedical vision is adopted, forgetting the causes at different levels and of an economic and political nature. In turn, we need a governance (administrations, companies and governments) that assumes responsibility through the establishment of policies, many of them based on legal norms. Rules resulting from participatory processes, broad in democratic societies, in which conflicting interests intervene, and sometimes extends for years, which can lead to unacceptable situations of unrecognized suffering. So, helping us with some prosthesis, a glasses for science, to provide evidence that explains from macro to micro the process that takes us from health to disease, and a hearing aids for politics, to assume with all consequences their responsibility for taking preventive measures listening to the interests of the most vulnerable people, we could enjoy a long and healthy life.
Authors: Benavides FG
Full Source: Gaceta Sanitaria. 2020 May 5. pii: S0213-9111(20)30081-9. doi: 10.1016/j.gaceta.2020.03.005. [Epub ahead of print]

> From epidemiology, we are very demanding in our observations, both in terms of internal and external validity, when establishing causal relationships.

Fluorene exposure among PAH-exposed workers is associated with epigenetic markers related to lung cancer

2020-05-08
OBJECTIVES:
Exposure to high-molecular-weight polycyclic aromatic hydrocarbons (PAHs) may cause cancer in chimney sweeps and creosote-exposed workers, however, knowledge about exposure to low-molecular-weight PAHs in relation to cancer risk is limited. In this study, we aimed to

investigate occupational exposure to the low-molecular-weight PAHs phenanthrene and fluorene in relation to different cancer biomarkers.

METHODS:

We recruited 151 chimney sweeps, 19 creosote-exposed workers and 152 unexposed workers (controls), all men. We measured monohydroxylated metabolites of phenanthrene and fluorene in urine using liquid chromatography coupled to tandem mass spectrometry. We measured, in peripheral blood, the cancer biomarkers telomere length and mitochondrial DNA copy number using quantitative PCR; and DNA methylation of F2RL3 and AHRR using pyrosequencing.

RESULTS:

Median PAH metabolite concentrations were higher among chimney sweeps (up to 3 times) and creosote-exposed workers (up to 353 times), compared with controls ($p<0.001$; adjusted for age and smoking). ∑OH-fluorene (sum of 2-hydroxyfluorene and 3-hydroxyfluorene) showed inverse associations with percentage DNA methylation of F2RL3 and AHRR in chimney sweeps (B (95% CI)=-2.7 (-3.9 to -1.5) for F2RL3_cg03636183, and -7.1 (-9.6 to -4.7) for AHRR_cg05575921: adjusted for age and smoking), but not in creosote-exposed workers. In addition, ∑OH-fluorene showed a 42% mediation effect on the inverse association between being a chimney sweep and DNA methylation of AHRR CpG2.

CONCLUSIONS:

Chimney sweeps and creosote-exposed workers were occupationally exposed to low-molecular-weight PAHs. Increasing fluorene exposure, among chimney sweeps, was associated with lower DNA methylation of F2RL3 and AHRR, markers for increased lung cancer risk. These findings warrant further investigation of fluorene exposure and toxicity.

Authors: Alhamdow A, Essig YJ, Krais AM, Gustavsson P, Tinnerberg H, Lindh CH, Hagberg J, Graff P, Albin M, Broberg K

Full Source: Occupational and environmental medicine. 2020 May 8. pii: oemed-2020-106413. doi: 10.1136/oemed-2020-106413. [Epub ahead of print]\

The framework is applied in the lower Liaohe river basin plain, northeast of China.

Risk assessment framework for nitrate contamination in groundwater for regional management

2020-12-20

Nitrate pollution in groundwater is now one of the most important environmental problems all over the world. For this purpose, a new framework for risk screening and assessment of groundwater nitrate was proposed according to source-pathway-receptor-response model

to provide basic for defining environmental management strategies. The framework is composed of groundwater relative risk model (RRM), groundwater contamination risk assessment (CRA), and human health risk assessment (HHRA). The framework is applied in the lower Liaohe river basin plain, northeast of China. The results showed that the priority area with high groundwater relative risk in study area was successfully screened by RRM. Furthermore, the sites with high human health risk for public by groundwater nitrate were selected as hazardous areas. This framework promotes systematic integration of risk assessment of groundwater nitrate and expands traditional research on groundwater management from a scale-based approach to crucial insights into pollution.
Authors: Teng Y, Zuo R, Xiong Y, Wu J, Zhai Y, Su J
Full Source: The science of the total environment. 2019 Dec 20;697:134102. doi: 10.1016/j.scitotenv.2019.134102. Epub 2019 Aug 29.

Assessment of occupationl exposure to stainless steel welding fumes – A human biomonitoring study

2020-05-04
The aim of the study was to determine the concentration of hexavalent and trivalent chromium, nickel, manganese, and iron in welding fumes (WFs) and to evaluate the significant association between the concentration of metals in the biological material of welders. The studies were conducted in welders (n = 67) and controls (n = 52). Stainless steel WFs were continuously collected in the workers' breathing zone during a shift. The serum and urine concentrations of Cr and Ni were determined by ICP-MS. The content of Mn in the whole blood was determined using ET-AAS. The content of Cr in the erythrocytes was determined using ICP-MS. The Cr concentration in the welders' urine positively correlated with a work environment concentration of Cr (R = 0.59, p < 0.0001), Cr(VI) (R = 0.58, p < 0.0001), and Cr(III) (R = 0.64, p < 0.0001) in the inhalable fraction. The Ni concentration in the welders' urine positively correlated with the Ni concentration in the inhalable and respirable fraction (R = 0.34, p < 0.005 and R = 0.44, p < 0.002). The correlation between the Mn concentration in the work environment air and the Mn concentration in the welders' whole blood (R = 0.46, p < 0.0001) was observed.
Authors: Stanislawska M, Janasik B, Kuras R, Malachowska B, Halatek T, Wasowicz W
Full Source: Toxicology Letters. 2020 May 4. pii: S0378-4274(20)30128-4. doi: 10.1016/j.toxlet.2020.04.019. [Epub ahead of print]

The studies were conducted in welders (n = 67) and controls (n = 52).