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CHEMICAL EFFECTS

Glycine/glycine N-methyltransferase/sarcosine axis mediates benzene-induced hematotoxicity

2021-08-18

Benzene, an important and widely used industrial chemical, is the cause of different types of blood disorders. However, the mechanisms of benzene-induced hematotoxicity are still unclear. This study aimed to explore the effects of benzene on metabolism, especially in amino acid metabolism, in human peripheral blood B lymphocyte cells (AHH-1 cells) treated with 1,4-benzoquinone (1,4-BQ) and in benzene-exposed population based on the un-targeted and targeted metabolomics platforms. The results showed that 1,4-BQ disturbed the metabolic activity, such as arginine biosynthesis, citrate cycle, glycine, serine, and threonine metabolism pathways, and significantly upregulated the ratio of sarcosine/glycine in vitro. Meanwhile, the targeted metabolomics further showed that the ratio of sarcosine/glycine was also increased in the benzene exposure population. Notably, the expression of glycine N-methyltransferase (GNMT), an enzyme catalyzing the transformation of glycine to sarcosine, was upregulated both in 1,4-BQ treated AHH-1 cells and benzene-exposed workers. These results imply that the glycine/GNMT/sarcosine axis was involved in benzene-induced hematotoxicity. Such evidence will help to develop a better understanding of the underlying mechanism of benzene-induced hematotoxicity at the level of amino acid metabolism.

Authors: Wei Zhang, Xiaoli Guo, Jing Ren, Yujiao Chen, Jingyu Wang, Ai Gao

Full Source: Toxicology and applied pharmacology 2021 Aug 18;428:115682. doi: 10.1016/j.taap.2021.115682.

Systematic review of prenatal exposure to endocrine disrupting chemicals and autism spectrum disorder in offspring

2021-08-19

Autism spectrum disorders comprise a complex group with many subtypes of behaviorally defined neurodevelopmental abnormalities in two core areas: deficits in social communication and fixated, restricted, repetitive, or stereotyped behaviors and interests each with potential unique risk factors and characteristics. The underlying mechanisms and the possible causes of autism spectrum disorder remain elusive and while increased prevalence is undoubtable, it is unclear if it is a reflection

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of diagnostic improvement or emerging risk factors such as endocrine disrupting chemicals. Epidemiological studies, which are used to study the relation between endocrine disrupting chemicals and autism spectrum disorder, can have inherent methodological challenges that limit the quality and strength of their findings. The objective of this work is to systematically review the treatment of these challenges and assess the quality and strength of the findings in the currently available literature. The overall quality and strength were "moderate" and "limited," respectively. Risk of bias due to the exclusion of potential confounding factors and the lack of accuracy of exposure assessment methods were the most prevalent. The omnipresence of endocrine disrupting chemicals and the biological plausibility of the association between prenatal exposure and later development of autism spectrum disorder highlight the need to carry out well-designed epidemiological studies that overcome the methodological challenges observed in the currently available literature in order to be able to inform public policy to prevent exposure to these potentially harmful chemicals and aid in the establishment of predictor variables to facilitate early diagnosis of autism spectrum disorder and improve long-term outcomes.

Authors: Salvador Marí-Bauset, Isabel Peraita-Costa, Carolina Donat-Vargas, Agustín Llopis-González, Amelia Marí-Sanchis, Juan Llopis-Morales, María Morales Suárez-Varela

Full Source: Autism : the international journal of research and practice 2021 Aug 19;13623613211039950. doi: 10.1177/13623613211039950.

Novel chemicals engender myriad invasion mechanisms

2021-08-20

Non-native invasive species (NIS) release chemicals into the environment that are unique to the invaded communities, defined as novel chemicals. Novel chemicals impact competitors, soil microbial communities, mutualists, plant enemies, and soil nutrients differently than in the species' native range. Ecological functions of novel chemicals and differences in functions between the native and non-native ranges of NIS are of immense interest to ecologists. Novel chemicals can mediate different ecological, physiological, and evolutionary mechanisms underlying invasion hypotheses. Interactions amongst the NIS and resident species including competitors, soil microbes, and plant enemies, as well as abiotic factors in the invaded community linked to novel chemicals. However, we poorly understand how these interactions might enhance NIS performance. New empirical data and analyses of how novel chemicals act in the invaded

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community will fill major gaps in our understanding of the chemistry of biological invasions. A novel chemical-invasion mechanism framework shows how novel chemicals engender invasion mechanisms beyond plant-plant or plant-microorganism interactions.

Authors: Inderjit, Daniel Simberloff, Harleen Kaur, Susan Kalisz, T Martijn Bezemer

Full Source: The New phytologist 2021 Aug 20. doi: 10.1111/nph.17685.

ENVIRONMENTAL RESEARCH

Exposure of men and lactating women to environmental phenols, phthalates, and DINCH

2021-08-10

Phthalates and 1,2-Cyclohexane dicarboxylic acid diisononyl ester (DINCH), bisphenols (BPs), parabens (PBs), and triclosan (TCS) are high-production-volume chemicals of pseudo-persistence that are concerning for the environment and human health. This study aims to assess the exposure to 10 phthalates, DINCH, and environmental phenols (3 BPs, 7 PBs, and TCS) of Slovenian men (n = 548) and lactating primiparous women (n = 536). We observed urinary concentrations comparable to studies from other countries and significant differences among the sub-populations. In our study, men had significantly higher levels of phthalates, DINCH, and BPs, whereas the concentrations of PBs in urine were significantly higher in women. The most significant determinant of exposure was the area of residence and the year of sampling (2008-2014) that mirrors trends in the market. Participants from urban or industrialized sampling locations had higher levels of almost all monitored analytes compared to rural locations. In an attempt to assess the risk of the population, hazard quotient (HQ) values were calculated for individual compounds and the chemical mixture. Individual analytes do not seem to pose a risk to the studied population at current exposure levels, whereas the HQ value of the chemical mixture is near the threshold of 1 which would indicate a higher risk. We conclude that greater emphasis on the risk resulting from cumulative exposure to chemical mixtures and additional studies are needed to estimate the exposure of susceptible populations, such as children.

Authors: Agneta A Runkel, Danja Mazej, Janja Snoj Tratnik, Uga Tkalec, Tina Kosjek, Milena Horvat

Full Source: Chemosphere 2021 Aug 10;286(Pt 3):131858. doi: 10.1016/j.chemosphere.2021.131858.

Phthalates and 1,2-Cyclohexane dicarboxylic acid diisononyl ester (DINCH), bisphenols (BPs), parabens (PBs), and triclosan (TCS) are high-production-volume chemicals of pseudo-persistence that are concerning for the environment and human health.

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Prenatal air pollution exposure increases the risk of macrosomia: evidence from a prospective cohort study in the coastal area of China

2021-08-21

Effects of prenatal ambient air pollution exposure could increase the risk of adverse pregnancy outcomes, which have been well documented by various studies. However, only very few studies investigated the effects on macrosomia. This study investigated the effects of prenatal air pollution exposure on the risk of macrosomia in a coastal city of China. Data of birth outcomes and air pollution in a coastal city in China between November 1, 2013, and December 31, 2017, were collected. Finally, 58,713 eligible births, including 8159 (13.9%) macrosomia and 50554 (86.1%) normal birth weight (NBW) infants, were included in the analysis. Logistic regression analyses were used to evaluate the effects of prenatal air pollution exposure on macrosomia. In the single-pollutant models, each 10 µg/m³ increase of PM_{2.5}, PM₁₀, and SO₂ exposures, during the entire pregnancy or three trimesters, were related to elevated risk of macrosomia (adjusted RR, 95% CI) ranging from 1.018 (1.001, 1.035) to 1.314 (1.188, 1.454). In addition, O₃ exposure in the first trimester (adjusted RR = 1.034, 95% CI 1.009, 1.059) also increased the macrosomia risk. Prenatal PM_{2.5}, PM₁₀, and SO₂ exposure could significantly increase the risk of macrosomia. These findings need to be further verified in more studies with multiple coastal cities included.

Authors: Changlian Li, Liangliang Ju, Mei Yang, Qi Zhang, Shu Sun, Jiyu Cao, Rui Ding

Full Source: Environmental science and pollution research international 2021 Aug 21. doi: 10.1007/s11356-021-16054-z.

Health impact assessment of auto rickshaw and cab drivers due to exposure to vehicular pollution in Delhi: an integrated approach

2021-08-20

Vehicular emission is an important contributor to air pollution in the urban environment and impacts the health of commuters as well as drivers. The in-vehicle concentration of pollutants is known to be higher than the ambient environment and varies with the mode of transport. Thus, this study attempts to assess the health impacts of air pollution exposure on auto rickshaws and cab drivers. The study was conducted in Delhi using a triangular approach involving a health perception survey, lung function test and in-vehicle monitoring of particulate matter (PM₁,

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PM_{2.5}, PM₁₀) concentration to assess the health impacts of air pollution on auto rickshaw and cab drivers. A total of 150 respondents (75 from each occupation) were surveyed, and spirometry was performed for 40 respondents (20 from each occupation). Binary logistic regression showed auto rickshaw drivers were exposed to significantly higher in-vehicle PM concentrations in summers and winters and, thus, had a significantly higher risk of developing respiratory, ophthalmic and dermatological health symptoms ($p < 0.05$ and relative risk > 1). Pulmonary function test showed obstructive lung impairment was reported only among auto rickshaw drivers (6%) and restrictive lung impairment was also more prevalent among auto rickshaw drivers (48%) than cab drivers (33%), suggesting a greater vulnerability of auto rickshaw drivers to respiratory health issues. Lung function impairment was associated with age ($p = 0.002$). The health and well-being of individuals is a matter of global concern, also highlighted in sustainable development goal no. 3. However, it was observed that neither auto rickshaw drivers nor cab drivers used formal/standard protective measures mainly due to unawareness or unaffordability. The study suggests increasing awareness and formulating guidelines to highlight the use of proper protective measures by these vulnerable groups and specific policy measures to protect outdoor workers like auto rickshaw drivers.

Authors: Suresh Jain, Vaishnavi Barthwal

Full Source: Environmental science and pollution research international 2021 Aug 20. doi: 10.1007/s11356-021-16058-9.

OCCUPATIONAL

Occupational noise exposure and Raynaud's phenomenon: a nested case-control study

2021-12

The primary aim of this study was to determine if self-reported occupational noise exposure was associated with Raynaud's phenomenon. In northern Sweden, a nested case-control study was performed on subjects reporting Raynaud's phenomenon ($N=461$), and controls ($N=763$) matched by age, sex and geographical location. The response rate to the exposure questionnaire was 79.2%. The study showed no statistically significant association between occupational noise exposure and reporting Raynaud's phenomenon (OR 1.10; 95% CI 0.83-1.46) in simple analyses. However, there was a trend towards increasing OR for Raynaud's phenomenon with increasing noise exposure, although not statistically significant. Also, there was a significant association between

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noise exposure and hearing loss (OR 2.76; 95% CI 2.00-3.81), and hearing loss was associated with reporting Raynaud's phenomenon (OR 1.52; 95% CI 1.03-2.23) in a multiple regression model. In conclusion, self-reported occupational noise exposure was not statistically significantly associated with Raynaud's phenomenon, but there was a dose-effect trend. In addition, the multiple model showed a robust association between hearing loss and Raynaud's phenomenon. These findings offer some support for a common pathophysiological background for Raynaud's phenomenon and hearing loss among noise-exposed workers, possibly through noise-induced vasoconstriction.

Authors: Albin Stjernbrandt, Mahmoud Abu Mdaighem, Hans Pettersson

Full Source: International journal of circumpolar health 2021

Dec;80(1):1969745. doi: 10.1080/22423982.2021.1969745.

The relationship between pesticide exposure during critical neurodevelopment and autism spectrum disorder: A narrative review

2021-08-17

Agricultural pesticides have been one of the most extensively used compounds throughout the world. The main sources of contamination for humans are dietary intake and occupational exposure. The impairments caused by agricultural pesticide exposure have been a significant global public health problem. Recent studies have shown that low-level agricultural pesticide exposure during the critical period of neurodevelopment (pregnancy and lactation) is closely related to autism spectrum disorder (ASD). Inhibition of acetylcholinesterase, gut microbiota, neural dendrite morphology, synaptic function, and glial cells are targets for the effects of pesticides during nervous system development. In the present review, we summarize the associations between several highly used and frequently studied pesticides (e.g., glyphosate, chlorpyrifos, pyrethroids, and avermectins) and ASD. We also discuss future epidemiological and toxicological research directions on the relationship between pesticides and ASD.

Authors: Xiu He, Ying Tu, Yawen Song, Guanghong Yang, Mingdan You

Full Source: Environmental research 2021 Aug 17;203:111902. doi: 10.1016/j.envres.2021.111902.

Agricultural pesticides have been one of the most extensively used compounds throughout the world.

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PHARMACEUTICAL/TOXICOLOGY

Microextraction and Determination of Poly- and Perfluoroalkyl Substances, Challenges, and Future Trends

2021-08-20

Per- and polyfluoroalkyl substances (PFAS) are fluorocarbon compounds in which hydrogen atoms have been partly or entirely replaced by fluorine. They have a very wide range of applications, while they are persistent in the environment and exhibit bioaccumulative and toxic properties. Neither chemical nor biological mechanisms can decompose PFAS due to their strong C-F bonds. PFAS have shown adverse effects on various organisms, even at trace levels. Accordingly, highly sensitive and selective analytical methods are required for their tracing in biological and environmental matrices. The physicochemical properties of PFAS like surfactant characteristics and high-water solubility are unique and different from other known pollutants. Accordingly, the number of articles on the analysis of PFAS is less than the other well-known contaminants. The routine PFAS sample preparation methods (like solvent extraction) coupled with chromatographic systems, face challenges such as high limits of detection, need for laborious derivatization, limited selectivity, and expensive instrumentation. Recent efforts to address these limitations have aroused considerable attention to the development of microextraction techniques, which are consistent with the principles of green chemistry and can be made easily portable and automated. Moreover, these methods have shown enough sensitivity and selectivity for the analysis of different analytes (including PFAS) in a wide range of samples with different matrices. This research aims to review the microextraction methods and detection techniques, applied for the sample pretreatment of PFAS in various matrices, along with a critical discussion of the challenges and potential future trends.

Authors: Vahid Jalili, Abdullah Barkhordari, Brett Paull, Alireza Ghiasvand
Full Source: Critical reviews in analytical chemistry 2021 Aug 20;1-20.

Potential molecular mechanism of cardiac hypertrophy in mice induced by exposure to ambient PM 2.5

2021-08-19

Cardiac hypertrophy could be induced by ambient fine particulate matter (PM_{2.5}) exposure. Since cardiac hypertrophy represents an early event leading to heart dysfunction, it is necessary to explore the molecular

Per- and polyfluoroalkyl substances (PFAS) are fluorocarbon compounds in which hydrogen atoms have been partly or entirely replaced by fluorine.

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mechanisms, which are largely unknown. In the present study, an ambient particulate matter exposure mice model was established to explore its adverse effects related to the heart and the potential mechanisms. Forty-eight male C57BL/6 mice were randomly subjected to three groups: filtered air group, unfiltered air group and concentrated air group, and were exposed for 8 and 16 weeks, 6 h/day, respectively. In vitro experiments, the cardiac muscle cell line (HL-1) was treated with PM_{2.5} (0, 25, 50 and 100 µg/mL) for 24 h. In the present study, cardiac hypertrophy was occurred in vivo and vitro after exposure to PM_{2.5}. Mechanistically, circ_0001859 could sponge miR-29b-3p, which could interact with 3'UTRs of Ctnnb1 (gene name of β -catenin). And Ctnnb1 expression was transcriptionally inhibited by si-circ_0001859 or miR-29b-3p mimic in HL-1 cells. Additionally, miR-29b-3p inhibitor could also make a reversion about the inhibition effect of circ_0001859 silencing on Ctnnb1 mRNA level in HL-1 cells. Functionally, knockout of circ_0001859 or overexpression of miR-29b-3p could inhibit LEF1/IGF-2R pathway and alleviate the progress of hypertrophy induced by PM_{2.5} in HL-1 cells. And miR-29b-3p inhibitor could reverse the inhibition effect of circ_0001859 silencing on hypertrophic response induced by PM_{2.5} in HL-1 cells. Consequently, the data demonstrated that circRNA_0001859 promoted the process of cardiac hypertrophy through suppressing miR-29b-3p leading to enhance Ctnnb1 level, and activated downstream pathway molecules LEF1/IGF-2R.

Authors: Qingping Liu, Bin Han, Yaling Zhang, Tao Jiang, Jie Ning, Aijuan Kang, XiaoYan Huang, Huaxing Zhang, Yaxian Pang, Boyuan Zhang, Qian Wang, Yujie Niu, Rong Zhang

Full Source: Ecotoxicology and environmental safety 2021 Aug 19;224:112659. doi: 10.1016/j.ecoenv.2021.112659.