

# Bulletin Board

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## Technical

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## CHEMICAL EFFECTS

## Prenatal exposure to synthetic chemicals in relation to HPA Axis activity: A systematic review of the epidemiological literature

2024-10-31

Background: Pregnant people are widely exposed to numerous synthetic chemicals with known endocrine-disrupting properties (e.g., phthalates, phenols, per- and poly-fluoroalkyl substances (PFAS)). To date, most epidemiological research on how endocrine-disrupting chemicals (EDCs) disrupt hormone pathways has focused on estrogens, androgens, and thyroid hormones. Far less research has examined the impact of EDCs on the hypothalamic-pituitary-adrenal (HPA) axis, despite its central role in the physiologic stress response and metabolic function.

Objective: To systematically review the epidemiological literature on prenatal synthetic EDC exposures in relation to HPA axis hormones (e.g., corticotropin-releasing hormone, adrenocorticotrophic hormone, cortisol, cortisone) in pregnant people and their offspring.

Methods: A literature search of PubMed, Scopus, and Embase was conducted. Primary research studies were selected for inclusion by two independent reviewers and risk of bias was assessed using the Office of Health Assessment and Translation guidelines established by the National Toxicology Program with customization for the specific research topic. Data were extracted from each study and included in a qualitative synthesis.

Results: 22 published studies met the inclusion criteria. Phthalates were the most prevalent EDC studied, followed by PFAS, phenols, and parabens, with fewer studies considering other synthetic chemicals. Offspring glucocorticoids were the most commonly considered outcome, followed by maternal glucocorticoids and placental corticotropin-releasing hormone. There was considerable heterogeneity in methods across studies, particularly in HPA axis outcome measures and matrices, making cross-study comparisons challenging. Numerous studies suggested disruption of HPA axis hormones and sex differences in association, but results varied considerably across studies and EDC classes.

Conclusions: The limited literature to date suggests the HPA axis may be vulnerable to disruption by synthetic EDCs. Carefully designed studies that prioritize biospecimen collection specific to HPA axis hormones are

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needed along with greater standardization of biospecimen collection and analysis protocols to facilitate cross-study comparisons and interpretation.

Authors: Anushka Pande, Carolyn W Kinkade, Nashae Prout, Sadia F Chowdhury, Zorimar Rivera-Núñez, Emily S Barrett

Full Source: The Science of the total environment 2024 Oct 31:177300. doi: 10.1016/j.scitotenv.2024.177300.

Mixture toxicity of the heavy metal copper and the fluoroquinolone antibiotic ciprofloxacin on *Microcystis aeruginosa*

2024-10-26

Exposure to chemical mixtures is the norm in natural environments. Yet, water quality regulations are still mostly constructed for individual chemicals. However, an important ambition of the European Green Deal is the future implementation of mixture toxicity to address the risks posed by the joint presence of multiple chemicals in aquatic ecosystems (e.g., via a mixture allocation factor, MAF). This study aimed to contribute to this by investigating the ecotoxicity of a series of binary ciprofloxacin-copper (CIP-Cu) mixtures at environmental realistic concentrations to the cyanobacterium *Microcystis aeruginosa*, which is the most CIP-sensitive freshwater species identified so far. The two chemicals have distinct modes of action, however, the bioavailability of both is influenced by pH. The toxicity data of CIP-Cu mixtures were analysed to examine if significant interactions exist relative to the concentration addition (CA) and independent action (IA) models. CIP-Cu mixtures behaved antagonistically relative to the CA model, whereas there was no interactive toxicity relative to the IA model, which better describes the CIP-Cu mixture toxicity, in line with expectations based on the distinct modes of action of Cu and CIP. Furthermore, attention was placed to the influence of Cu in the low-effect concentration range ( $\leq$  EC10, the 10 % effective concentration) on CIP ecotoxicity, in order to identify potential synergistic effects that may lower the toxic threshold of CIP in the presence of Cu. Across the pH range 7.3-9.0, the presence of ' $\leq$  EC10' level of Cu did not affect the EC10 of CIP. Only at pH 8.0, but not at pH 7.3 or 9.0, the addition of an (EC10)/2 level of Cu lowered the 50 % effect concentration (EC50) of CIP from 2.8 to 2.0  $\mu\text{g L}^{-1}$ . The overall observations confirmed that there are no significant interactive effects between Cu and CIP relative to the IA model. Therefore, regulatory environmental threshold concentrations for CIP derived from

Exposure to chemical mixtures is the norm in natural environments.



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single-chemical tests, are protective in situations of co-occurrence with Cu, provided that Cu remains below its own environmental quality standards.

Authors: Qiyun Zhang, Kristof Demeestere, Karel A C De Schamphelaere  
Full Source: The Science of the total environment 2024 Oct 26:177144. doi: 10.1016/j.scitotenv.2024.177144.

### Environmental behavior and risk of the emerging organic contaminants halogenated carbazoles in chemical industrial park clusters

2024-11-01

Polyhalogenated carbazoles (PHCZs) are emerging organic contaminants and have attracted extensive concern because of their widespread occurrence and dioxin-like toxicity. However, the distribution characteristics, environmental behavior, and fate of PHCZs are still poorly understood. In this study, 74 composite environmental samples from 21 Chinese cities were collected around industrial parks in the Yangtze River Delta. The PHCZ concentration ranges in sediment and soil samples were  $12.7\text{-}5.21 \times 10^3$  and  $34.6\text{-}1.81 \times 10^3$  ng/g, respectively, which is equivalent to or higher than those of well-known persistent organic pollutants in the similar areas. The dominant congeners of PHCZs in sediment and soil were 3-chlorocarbazole and 3,6-dichlorocarbazole. Industrial emissions, especially from printing and dyeing textiles, were the main contributors to the high PHCZ environmental concentrations. Potential toxic effects of the PHCZs were evaluated using the toxic equivalent (TEQ) method. The TEQs of PHCZs in sediment and soil were up to 550 and 554 pg TEQ/g dry weight, respectively. The estimated TEQ value of sediment and soil exceeded the corresponding safety guideline, which indicated that PHCZs in the Yangtze River Delta posed high health risks. This study provides an important theoretical basis for controlling and reducing the ecological risks of PHCZs in the chemical industry. At the same time, it also provides reference for the priority control and revision of discharge standards for PHCZs in sewage treatment plants in future.

Authors: Jinglin Deng, Lirong Gao, Wenbin Liu, Tianao Mao, Fei Yin, Tianqi Jia, Wenqi Wu, Chunci Chen

Full Source: The Science of the total environment 2024 Nov 1:177253. doi: 10.1016/j.scitotenv.2024.177253.

Polyhalogenated carbazoles (PHCZs) are emerging organic contaminants and have attracted extensive concern because of their widespread occurrence and dioxin-like toxicity.

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## ENVIRONMENTAL RESEARCH

### E-waste in the environment: Unveiling the sources, carcinogenic links, and sustainable management strategies

2024-10-25

E-waste refers to electrical and electronic equipment discarded without the intent of reuse by choice or at the end of its functional lifespan. In 2022, approximately 62 billion kilograms of e-waste, equivalent to 7.8 kilograms per capita, was generated globally. With an alarming annual growth of approximately 2 million metric tonnes, e-waste production may exceed 82 billion kilograms by 2030. Improper disposal of e-waste can be detrimental to human health and the entire biosphere. E-waste encompasses a wide range of chemicals, including heavy metals, Polychlorinated Biphenyls (PCBs), Per- and Polyfluoroalkyl Substances (PFAS), Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Dibenzo-dioxins and -furans (PCDD/Fs), Polybrominated Diphenyl Ethers (PBDEs), and radioactive elements. Improper disposal of e-waste equipment can directly contaminate the aquatic and terrestrial environment, leading to human exposure through ingestion, inhalation, dermal absorption, and trans-placental transfer. These contaminants can directly enter the human body from the environment, potentially fueling carcinogenesis by modulating cell cycle proteins, inducing oxidative stress, and mutations. Heavy metals such as cadmium, mercury, arsenic, lead, chromium, and nickel along with organic pollutants like PAHs, PCBs, PBDEs, PFAS, and radioactive elements, play a crucial role in inducing malignancy in humans. Effective collection, sorting, proper recycling, and appropriate disposal techniques are essential in reducing environmental contamination by e-waste-derived chemicals. Hence, this comprehensive review aims to uncover the global environmental burden of e-waste and its links to carcinogenesis in humans. Furthermore, it provides an inclusive discussion on potential treatment approaches to minimize environmental e-waste contamination.

Authors: Md Abdullah, Satadal Adhikary, Suchandra Bhattacharya, Sudharani Hazra, Abhratanu Ganguly, Sayantani Nanda, Prem Rajak  
Full Source: Toxicology 2024 Oct 25:153981. doi: 10.1016/j.tox.2024.153981.

E-waste refers to electrical and electronic equipment discarded without the intent of reuse by choice or at the end of its functional lifespan.



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### Microplastic and antibiotics in waters: Interactions and environmental risks

2024-11-01

Antibiotics (ATs) are ubiquitously detected in natural waters worldwide, and their tendency to co-migrate with microplastics (MPs) post-adsorption leads to heightened environmental risk. Research on the adsorption of ATs on MPs and their subsequent effects on the environmental risks is gaining significant attention globally. This adsorption process predominantly occurs through hydrophobic forces, hydrogen bonds, and electrostatic interactions and is influenced by various environmental factors. The interaction between MPs and ATs exhibited varying degrees of efficiency across different pH levels and ionic strengths. Furthermore, this paper outlines the environmental risks associated with the co-presence of MPs and ATs in aquatic environments, emphasizing the potential effect of MPs on the distribution of antibiotic resistance genes (ARGs) and related environmental risks. The potential hazards posed by MPs and ATs in aquatic systems warrant serious consideration. Future research should concentrate on the adsorption of ATs/ARGs on MPs under real environmental conditions, horizontal gene transfer on MPs, as well as biofilm formation and agglomeration behavior on MPs that needs to be emphasized.

Authors: Jiayi Guo, Xinbai Jin, Yi Zhou, Bowen Gao, Yang Li, Yanbo Zhou  
Full Source: Journal of environmental management 2024 Nov 1:371:123125. doi: 10.1016/j.jenvman.2024.123125.

### Assessing the environmental impact of fertilizer consumption in Turkey

2024-10-25

The technique of fertilizer consumption increases yields from agriculture, but because it involves chemicals, there are disagreements regarding how it affects the environment. Based on this, the aim of this study is to investigate the effects of fertilizer consumption on load capacity factor in Turkey through novel technique (multivariate quantile-on-quantile regression) for the period 1970-2021. In this regard, factors that have significant effects on the environment, such as trade globalization, renewable energy usage, natural resources, are also included in the empirical model to avoid omitted variable bias. In addition, real national income and the square of real national income are also included in the model to check the validity of the possible load capacity curve (LCC) hypothesis. According to the findings of the study, a U-shaped

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relationship between economic growth and environmental quality is valid, thus proving the existence of the LCC hypothesis. Additionally, trade globalization and fertilizer consumption appear to increase environmental damage. On the other hand, renewable energy consumption increases load capacity. In addition, Kernel-based regularized least squares technique is used for robustness control. According to the findings obtained from here, 1 % increase in fertilizer consumption reduces the load capacity factor by 0.03 %. Based on the findings, policy recommendations are made to provide subsidies or financial incentives for the use of organic fertilizers and biofertilizers. Indeed, these alternatives can increase load capacity by improving soil health and reducing chemical runoff.

Authors: Oktay Özkan, Mehmet Akif Destek, Azad Erdem

Full Source: The Science of the total environment 2024 Oct 25:177107. doi: 10.1016/j.scitotenv.2024.177107.

### PHARMACEUTICAL/TOXICOLOGY

#### Environmental pollution and cancer

2024-10-30

Objective: To identify and describe pollutants with carcinogenic potential that contaminate indoor and outdoor air, food and soil.

Data source: The descriptors environmental pollutants, occupational cancer, prevention and soil pollutants were used to conduct the research for literature review. Articles published from 2003 to 2024 in the electronic databases Pubmed Medline, Lilacs and Scielo, in Portuguese and English, were included.

Summary of findings: There are multiple sources of pollution in the external and internal environments, including motor vehicles, industrial facilities, smoke from tobacco products, agricultural activities, fires and domestic combustion devices. The most important pollutants related to chemical substances include all forms of asbestos, benzene, exhaust gases from gasoline engines, food and water contaminants, such as arsenic and inorganic arsenic compounds, in addition to persistent organic pollutants, such as dioxins. The use of fossil fuels and biomass for domestic heating are also important sources of pollution. The carcinogenic potential of pollutants varies according to the sources of pollution, climate conditions and the region's topography.

Conclusions: Global environmental pollution is an international public health problem with multiple health effects. Many environmental pollutants are proven to be carcinogenic to adults, while few causes have

Objective: To identify and describe pollutants with carcinogenic potential that contaminate indoor and outdoor air, food and soil.



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been scientifically established for children. Pollution is mainly caused by uncontrolled urbanization and industrialization. Preventing environmental exposure to carcinogenic pollutants requires both government regulation and community action and commitment.

Authors: Denise Bousfield da Silva, Mara Albonei Dudeque Pianovski, Neviçolino Pereira de Carvalho Filho

Full Source: *Jornal de pediatria* 2024 Oct 30;S0021-7557(24)00132-3. doi: 10.1016/j.jpmed.2024.09.004.

## OCCUPATIONAL

### Occupational exposure to Blood and Body Fluids among Healthcare Professionals in a military hospital in Greece: A retrospective single-center study

2024-10-25

Background: Healthcare Professional (HCP) worldwide are subjected to various occupational hazards, including exposure to Blood and Body Fluids (BBF). However, with systematic training and supervision, the impact of such incidents can be significantly mitigated.

Objective: This study aims to assess the incidence of occupational exposure to BBF among HCPs reported to a military hospital over a five-year period. Additionally, it seeks to explore the characteristics of the affected HCP and the conditions of exposure, and to evaluate HCP' overall compliance with the hospital's guidelines.

Methods: This is a retrospective, single-center study that includes all self-reported forms submitted from January 1, 2019, to December 31, 2023.

Results: The overall incidence of BBF exposure was 3.05 per 100 full-time employment-years (FTEYs) or 3.01 per 100 HCP per year, whereas the incidence of needlesticks and sharps injuries (NSSIs) was 2.73 per 100 FTEYs or 2.54 per 100 HCPs per year. Overall HCP' compliance was 34.1%, with an increase from 1.6% in 2019 to 45.9% in 2023.

Conclusions: There is a need for a unified process for the collection of nationwide, longitudinal data on exposure to BBF, as well as for the development of targeted training programs on occupational health and safety for HCP.

Authors: Petroula Stamataki, Angeliki Angeletopoulou, Angeliki Chandrinou, Maria Kagialari, Konstantina Gaitanou, Marigo Tseroni

Full Source: *American journal of infection control* 2024 Oct 25;S0196-6553(24)00806-X. doi: 10.1016/j.ajic.2024.10.017.

Background: Health-care Professional (HCP) worldwide are subjected to various occupational hazards, including exposure to Blood and Body Fluids (BBF).

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### Dynamics of the airway microbiome in response to exposure to particulate matter 2.5 in patients with chronic obstructive pulmonary disease

2024-11-01

Background: Particulate matter (PM) and air pollution have been suggested to be associated with chronic obstructive pulmonary disease (COPD), contributing significantly to global respiratory disease-related mortality. This study aimed to investigate whether seasonal exposure to PM influences dysbiosis in the respiratory microbiota of patients with COPD.

Methods: Sputum samples were collected four times over 1 year from 102 patients with COPD, and 16S rRNA sequencing was performed. The dynamics of the airway microbiota were analyzed depending on PM exposure levels and season.

Results: The PM-low exposure group had higher  $\alpha$ -diversity compared to the PM-high exposure group, particularly noted in spring. Some bacterial groups, including seven species such as *Treponema socranskii*, were more abundant in the low exposure group. Additionally, the bacterial community structure in summer significantly differed from that in other seasons, with significantly increased  $\alpha$ -diversity in this season. The difference in the airway microbiome due to PM exposure was prominent in patients with moderate COPD.

Conclusions: PM exposure may influence changes in the sputum microbiome depending on exposure levels and seasonal variations. Our results suggest that airway microbiomes could vary with PM exposure according to seasonal trends.

Authors: Sun-Hee Heo, Bo-Yun Choi, Jieun Kang, Ji Ye Jung, Hwan-Cheol Kim, Seon-Jin Le, Woo Jun Sul, Sei Won Lee

Full Source: *The Science of the total environment* 2024 Nov 1;177314. doi: 10.1016/j.scitotenv.2024.177314.

Background: Particulate matter (PM) and air pollution have been suggested to be associated with chronic obstructive pulmonary disease (COPD), contributing significantly to global respiratory disease-related mortality.

### Potential advantage of invasive estuarine worms over native species under exposure to relevant concentrations of graphene oxide: Behavioral and biochemical insights

2024-10-30

Technological development using graphene oxide (GO) has increased in the last years, leading to the release of this contaminant to final sinks, such as estuaries. Due to their potential to flocculate and deposit when interacting with high ionic strength media, GO poses a threat, especially to benthic organisms like polychaetes. In addition to chemical

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contamination, estuaries also face a severe threat from invasive species, which can cause irreversible damage to ecosystems. The combination of abiotic and biotic stressors may work together on native species, decreasing their resilience. Thus, this study aims to assess the effects of an abiotic stressor, GO nanosheets (0.001, 0.01, 0.1, 1, 10 mg GO/Kg dw) on *Hediste diversicolor* (native species) and *Arenicola marina* (invasive species) through several behavioral assays and biochemical markers. The impact of invasive species *A. marina* (biotic factor) on *H. diversicolor* avoidance behavior was also evaluated. Obtained results demonstrated that *H. diversicolor* fled from lower GO contamination compartments to higher ones and that exposure to increased GO concentrations negatively impacted its burrowing activity. They were unable to escape from higher contamination compartments, but at the highest concentrations, the bioturbation activity was significantly higher, which may indicate that *H. diversicolor* tended to dwell deeper in the sediment. *A. marina* showed an escape behavior from compartments with higher GO concentrations. Additionally, this species' bioturbation activity significantly decreased when exposed to GO. Moreover, avoidance tests demonstrated that the presence of *A. marina* affected the behavior of *H. diversicolor*. Regarding oxidative stress, *H. diversicolor* seems to be more impacted than *A. marina*, since Lipid peroxidation levels were higher in all GO concentrations and Superoxide dismutase activity significantly increased in the lowest GO levels. Overall, *H. diversicolor* spatial distribution may be severely constrained under abiotic and biotic stress, while *A. marina*'s higher foraging activity may promote its propagation in the estuary. Behavioral tests, combined with biochemical markers have shown to be relevant tools for the development of more environmental-realistic assessment and monitoring frameworks for estuaries.

Authors: Maria João Figueiredo, Cátia Venâncio, Paulo Cardoso, Paula A A P Marques, Etelvina Figueira, Adília Pires

Full Source: Marine environmental research 2024 Oct 30:202:106821. doi: 10.1016/j.marenvres.2024.106821.