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ENVIRONMENTAL RESEARCH

Following Endocrine-Disrupting Effects on Gene Expression in *Xenopus laevis*

2019-10-29

Endocrine-disrupting chemicals (EDCs), found in all categories of chemicals, are suspected to be a cause of declining well-being and human health, both as single molecules and as mixtures. It is therefore necessary to develop high throughput methods to assess the endocrine-disrupting potential of multiple chemicals currently on the market that are as yet untested. An advantage of *in vivo* chemical screening is that it provides a full spectrum of physiological impacts exerted by a given chemical. *Xenopus laevis* is an ideal model organism to test thyroid axis disruption *in vivo* as thyroid hormones (THs) are highly conserved across vertebrates and orchestrate tadpole metamorphosis. In particular, NF stage 45 *Xenopus laevis* are most apt for *in vivo* screening as at this stage the tadpoles possess all the main elements of thyroid hormone signalling (thyroid receptors, deiodinases transporters) and are metabolically competent, while fitting into multiple well plates, allowing the use of small amounts of test chemicals. One way to assess the endocrine-disrupting potential of chemicals or mixtures thereof is to analyse gene expression in organisms after a short time exposure to the chemical(s). In the present study, the authors describe a protocol using *Xenopus laevis* embryos to detect endocrine disruption of the thyroid axis by analysis of gene expression and an alternative protocol for fluorescence read-out using a transgenic GFP-expressing *Xenopus laevis* line. Taken together, these methods allow detection of subtle changes in TH signalling by EDCs that either activate or inhibit TH signalling *in vivo*.

Authors: Spirhanzlova P, Leemans M, Demeneix BA, Fini JB.

Full Source: Cold Spring Harbor Protocols. 2019 Jul 1;2019(7): pdb.prot098301. doi: 10.1101/pdb.prot098301.

In the present study, the authors describe a protocol using *Xenopus laevis* embryos to detect endocrine disruption of the thyroid axis by analysis of gene expression and an alternative protocol for fluorescence read-out using a transgenic GFP-expressing *Xenopus laevis* line.

Exploring the Fundamental Structures of Life: Non-Targeted, Chemical Analysis of Single Cells and Subcellular Structures

2019-10-29

Cells are a basic functional and structural unit of living organisms. Both unicellular communities and multicellular species produce an astonishing chemical diversity, enabling a wide range of divergent functions, yet each cell shares numerous aspects that are common to all living organisms.

While there are many approaches for studying this chemical diversity, only a few are non-targeted and capable of analysing hundreds of different chemicals at cellular resolution. In the current review, the non-targeted approaches used to perform comprehensive chemical analyses, provide chemical imaging information, or obtain high-throughput single-cell profiling data. Single-cell measurement capabilities are rapidly increasing in terms of throughput, limits of detection, and completeness of the chemical analyses; these improvements enable their application to understand ever more complex physiological phenomena, such as learning, memory, and behaviour.

Authors: Neumann EK, Do TD, Comi TJ, Sweedler JV.

Full Source: *Angewandte Chemie International Edition England*. 2019 Jul 8;58(28):9348-9364. doi: 10.1002/anie.201811951. Epub 2019 Apr 11.

Identifying hotspots for antibiotic resistance emergence and selection, and elucidating pathways to human exposure: Application of a systems-thinking approach to aquaculture systems

2019-10-29

Aquaculture systems are highly complex, dynamic and interconnected systems influenced by environmental, biological, cultural, socio-economic and human behavioural factors. Intensification of aquaculture production is likely to drive indiscriminate use of antibiotics to treat or prevent disease and increase productivity, often to compensate for management and husbandry deficiencies. Surveillance or monitoring of antibiotic usage (ABU) and antibiotic resistance (ABR) is often lacking or absent. Consequently, there are knowledge gaps for the risk of ABR emergence and human exposure to ABR in these systems and the wider environment. The aim of this study was to use a systems-thinking approach to map two aquaculture systems in Vietnam - striped catfish and white-leg shrimp – to identify hotspots for emergence and selection of resistance, and human exposure to antibiotics and antibiotic-resistant bacteria. System mapping was conducted by stakeholders at an interdisciplinary workshop in Hanoi, Vietnam during January 2018, and the maps generated were refined until consensus. Thereafter, literature was reviewed to complement and cross-reference information and to validate the final maps. The maps and component interactions with the environment revealed the grow-out phase, where juveniles are cultured to harvest size, to be a key hotspot for emergence of ABR in both systems due to direct and indirect ABU, exposure to water contaminated with antibiotics and antibiotic-resistant bacteria, and duration of this stage. The pathways for human exposure to

The aim of this study was to use a systems-thinking approach to map two aquaculture systems in Vietnam - striped catfish and white-leg shrimp – to identify hotspots for emergence and selection of resistance, and human exposure to antibiotics and antibiotic-resistant bacteria.

antibiotics and ABR were characterised as: occupational (on-farm and at different handling points along the value chain), through consumption (bacterial contamination and residues) and by environmental routes. By using systems thinking and mapping by stakeholders to identify hotspots we demonstrate the applicability of an integrated, interdisciplinary approach to characterising ABU in aquaculture. This work provides a foundation to quantify risks at different points, understand interactions between components, and identify stakeholders who can lead and implement change.

Authors: Brunton LA, Desbois AP, Garza M, Wieland B, Mohan CV, Häsler B, Tam CC, Le PNT, Phuong NT, Van PT, Nguyen-Viet H, Eltholth MM, Pham DK, Duc PP, Linh NT, Rich KM, Mateus ALP, Hoque MA, Ahad A, Khan MNA, Adams A, Guitian J.

Full Source: Science of the Total Environment. 2019 Oct 15; 687:1344-1356. doi: 10.1016/j.scitotenv.2019.06.134. Epub 2019 Jun 11.

Nitrogen-doped metal-free carbon catalysts for (electro) chemical CO₂ conversion and valorisation

2019-10-29

Carbon dioxide (CO₂) is regarded as the main contributor to the greenhouse effect. As a potential strategy to mitigate its negative impacts, the reduction of CO₂ is environmentally critical, economically meaningful and scientifically challenging. Concerns regarding anthropogenic emissions have recently sparked interest in the CO₂ chemical transformation techniques. Being both thermodynamically and kinetically unfavourable, CO₂ conversion generally requires efficient metal-based catalysts although they have multiple competitive disadvantages such as high costs, low availability and detrimental effects on the environment. A new class of catalysts based on earth-abundant carbon materials has been considered as an efficient, low-cost, metal-free alternative for both the capture and catalytic or electrocatalytic conversion of CO₂. CO₂ electrochemical reduction (CO₂RR) offers a new and important pathway towards renewable energy storage and production of fuels, and CO₂ cycloaddition with epoxides to cyclic or polymeric carbonates opens up new prospects for the production of polymers and fine chemicals. This review provides an overview of the progresses made in nitrogen-doped metal-free carbon catalysts for CO₂ electrochemical conversion and CO₂ conversion into cyclic carbonates into useful fuels and chemicals with a focus on the results underlying their mechanistic behaviour, advantages

This review provides an overview of the progresses made in nitrogen-doped metal-free carbon catalysts for CO₂ electrochemical conversion and CO₂ conversion into cyclic carbonates into useful fuels and chemicals

and/or limitations of this metal-free N-doped carbon catalysts on CO₂ conversion and valorisation.

Authors: Fernandes DM, Peixoto AF, Freire C.

Full Source: Dalton Trans. 2019 Aug 13. doi: 10.1039/c9dt01691k. [Epub ahead of print]

Using *Caenorhabditis elegans* for Studying Trans- and Multi-Generational Effects of Toxicants

2019-10-29

Information about toxicities of chemicals are essential in their application and waste management. For chemicals at low concentrations, the long-term effects are very important in judging their consequences in the environment and on human health. In demonstrating long-term influences, effects of chemicals over generations in recent studies provide new insight. In this study, the authors describe protocols for studying effects of chemicals over multiple generations using free-living nematode *Caenorhabditis elegans*. Two aspects are presented: (1) trans-generational (TG) and (2) multi-generational effect studies, the latter of which is separated to multi-generational exposure (MGE) and multi-generational residual (MGR) effect studies. The TG effect study is robust with a simple purpose to determine whether chemical exposure to parents can result in any residual consequences on offspring. After the effects are measured on parents, sodium hypochlorite solutions are used to kill the parents and keep the offspring so as to facilitate effect measurement on the offspring. The TG effect study is used to determine whether the offspring are affected when their parent is exposed to the pollutants. The MGE and MGR effect study is systematically used to determine whether continuous generational exposure can result in adaptive responses in offspring over generations. Careful pick-up and transfer are used to distinguish generations to facilitate effect measurement on each generation. The authors also combined protocols to measure locomotion behaviour, reproduction, lifespan, biochemical and gene expression changes. Some example experiments are also presented to illustrate the trans- and multi-generational effect studies.

Authors: Li Z, Ai F, Zhang J, Yu Z, Yin D.

Full Source: Journal of Visual Exposure. 2019 Jul 29;(149). doi: 10.3791/59367.

In this study, the authors describe protocols for studying effects of chemicals over multiple generations using free-living nematode *Caenorhabditis elegans*.

MEDICAL RESEARCH

Botulinum toxin and surgical intervention in children and adolescents with cerebral palsy: who, when and why do we treat?

2019-10-29

This audit aimed to increase understanding of the long-term outcomes of evidence-based medical and surgical interventions to improve gross motor function in children and adolescents with Cerebral Palsy. Retrospective audit of a birth cohort (2000-2009) attending a tertiary service in Western Australia. Results: The cohort comprises 771 patients aged 8 to 17 years. Percentage of children receiving no Botulinum Toxin treatments in each Gross Motor Functional Classification System level was: I: 40%, II: 26%, III: 33%, IV: 28% and V: 46%. Of the total cohort, 53% of children received 4 or less Botulinum Toxin treatments and 3.7% received more than 20 treatments. Statistically significant difference in the rate of use of Botulinum Toxin pre and post-surgery ($p < 0.001$) was documented. Children levels IV and V had 5 times the odds of surgery compared to children levels I-III (Odds Ratio 5.2, 95% Confidence Interval 3.5 to 7.8, $p < 0.001$). For 578 (75%) of participants the last recorded level was the same as the first. Conclusion: This audit documents medical intervention by age and Gross Motor Functional Classification System level in a large cohort of children with cerebral palsy over time and confirms stability of the level in the majority. The information from this audit may be of use in discussions with families regarding the timing and use of Botulinum toxin and surgical intervention for motor function in children and adolescents with Cerebral Palsy. Long term use of Botulinum Toxin within an integrated evidence-based clinical program is not associated with loss of gross motor function in the long term as evidenced by the maintenance of Gross Motor Functional Classification System stability.

Authors: Valentine J, Davidson SA, Bear N, Blair E, Ward R, Thornton A, Stannage K, Watson L, Forbes D, Elliott C.

Full Source: Disability and Rehabilitation. 2019 Aug 15:1-8. doi: 10.1080/09638288.2019.1644381. [Epub ahead of print]

Is atopic sensitisation associated with indicators of early vascular ageing in adolescents?

2019-10-29

Chronic systemic inflammation accelerates early vascular ageing. Atopic sensitisation and allergic diseases may involve increased inflammatory

This audit aimed to increase understanding of the long-term outcomes of evidence-based medical and surgical interventions to improve gross motor function in children and adolescents with Cerebral Palsy.

activity. This study aimed to assess whether atopic sensitisation and allergic diseases were associated with altered vascular biomarkers in Norwegian adolescents. Distensibility coefficient of the common carotid arteries, carotid intima-media thickness and atopic sensitisation (serum total and specific IgEs) were assessed in 95 Norwegian adolescents, who participated in the RHINESSA generation study. Symptoms of allergic disease were assessed by an interviewer-led questionnaire. Atopic sensitisation was found in 33 (34.7%) of the adolescents. Symptomatic allergic disease was found in 11 (33.3%) of those with atopic sensitisation. Distensibility coefficient of the common carotid arteries appeared to be lower in participants with atopic sensitization than in those without ($46.99 \pm 8.07 \times 10^{-3}/\text{kPa}$ versus $51.50 \pm 11.46 \times 10^{-3}/\text{kPa}$; $p > 0.05$), while carotid intima-media thickness did not differ between these groups ($0.50 \pm 0.04\text{mm}$ versus $0.50 \pm 0.04\text{mm}$; $p > 0.05$). Crude, as well as age- and sex-adjusted multiple regression, revealed no significant association, neither of atopic sensitisation nor of allergic disease, with distensibility coefficient of the common carotid arteries and carotid intima-media thickness. The results do not support the assumption of an adverse impact of atopic sensitisation and/or allergic disease on distensibility coefficient of the common carotid arteries and carotid intima-media thickness in Norwegian adolescents. Further research is necessary to study whether the clinical severity of allergic diseases might be more important than the status of allergic disease or atopic sensitisation.

Authors: Königstein K, Infanger D, Jacobsen Bertelsen R, Johannessen A, Waje-Andreassen U, Schmidt-Trucksäss A, Svanes C, Dratva J.
Full Source: PLoS One. 2019 Aug 15;14(8):e0220198. doi: 10.1371/journal.pone.0220198. eCollection 2019.

In this study, the authors assessed the dermatological toxicities reported after panitumumab initiation, their impact on the quality of life and the clinical practices for their management.

Management of skin toxicities during panitumumab treatment in metastatic colorectal cancer

2019-10-29

Anti-epidermal growth factor receptor therapy is associated with skin adverse events not previously reported with conventional chemotherapy. Prophylactic actions are recommended, but routine clinical management of these toxicities and their impact on quality of life remain unknown. In this study, the authors assessed the dermatological toxicities reported after panitumumab initiation, their impact on the quality of life and the clinical practices for their management. Patients included in this prospective multicentre observational study were over 18 years of age and began treatment with panitumumab for wild-type KRAS metastatic colorectal cancer. The incidence of dermatological toxicities, clinical

practices for their management and impact on quality of life were recorded during a 6-mo follow-up. Overall, 229 patients (males, 57.6%; mean age, 66.2 years) were included. At day 15, 59.3% of patients had dermatological toxicity; the rate peaked at month 2 (74.7%) and decreased at month 6 (46.5%). The most frequent dermatological toxicities were rash/acneiform rash, xerosis and skin cracks. At least one preventive treatment was administered to 65.9% of patients (oral antibiotics, 84.1%; emollients, 75.5%; both, 62.9%). The rates of patients who received at least one curative treatment peaked at month 2 (63.4%) and decreased at month 6 (44.8%). The impact of the dermatological toxicities on quality of life was limited as assessed with Dermatology Life Quality Index scores and inconvenience visual analogic scale score. The rates of topical corticosteroids administration and visits to specialists were low. The rates of the different skin toxicities peaked at various times and were improved at the end of follow-up. Nevertheless, their clinical management could be optimised with a better adherence to current recommendations. The impact of skin toxicities on patient's quality of life appeared to be limited.

Authors: Bouché O, Ben Abdelghani M, Labourey JL, Triby S, Bensadoun RJ, Jouary T, Des Guetz G.

Full Source: World Journal of Gastroenterology. 2019 Aug 7;25(29):4007-4018. doi: 10.3748/wjg.v25.i29.4007.

Disassembling the complexity of mucus barriers to develop a fast screening tool for early drug discovery

2019-10-29

Mucus is a natural barrier with a protective role that hinders drug diffusion, representing a steric and interactive barrier to overcome for an effective drug delivery to target sites. In diseases like cystic fibrosis (CF), pulmonary mucus exhibits altered features, which hamper clearance mechanisms and drug diffusion, ultimately leading to lung failure. Effectively modelling the passage through mucus still represents an unmet challenge. In the present study, an airway CF mucus model is proposed to disassemble the complexity of the mucus barrier following a modular approach. A hydrogel, mainly composed of mucin in an alginate (Alg) network, is proposed to specifically model the chemical-physical properties of CF mucus. The steric retention of pathological mucus was reproduced by targeting its mesh size (approximately 50 nm) and viscoelastic properties. The interactive barrier was reproduced by a composition inspired from the CF mucus. Optimised mucus models, composed of 3 mg ml⁻¹ Alg and 25 mg ml⁻¹ mucin, exhibited a G' increasing from 21.2 to 55.2 Pa and a G'' ranging from 5.26 to 28.8 Pa in the frequency range of 0.1 to 20 Hz.

In the present study, an airway CF mucus model is proposed to disassemble the complexity of the mucus barrier following a modular approach.

Drug diffusion was tested using three model drugs. The proposed mucus model was able to discriminate between the mucin-drug interaction and the steric barrier of a mucus layer with respect to the parallel artificial membrane permeability (PAMPA) that models the phospholipidic cell membrane, the state-of-the-art screening tool for passive drug diffusion. The mucus model can be proposed as an in vitro tool for early drug discovery, representing a step forward to model the mucus layer. Additionally, the proposed methodology allows to easily include other molecules present within mucus, as relevant proteins, lipids and DNA.

Authors: Pacheco DP, Butnarasu CS, Briatico Vangosa F, Pastorino L, Visai L, Visentin S, Petrini P.

Full Source: Journal of Materials Chemistry B. 2019 Aug 14;7(32):4940-4952. doi: 10.1039/c9tb00957d.

Functional daidzein enhances the anticancer effect of topotecan and reverses BCRP-mediated drug resistance in breast cancer

2019-10-29

Topotecan (TPT), a semisynthetic derivative of camptothecin, has been used in cancer chemotherapy, but side effects and drug resistance limit its clinical application. Daidzein (DAI), a natural isoflavone and bioactive food component widely existing in fruits, nuts, soybeans and soy-based products, is a type of phytoestrogen. Combination treatment with DAI and TPT showed a strong synergistic effect on tumour cells, with a 0.10~0.66 combined index, by increasing TPT inhibition on Topo I, resulting in more cells arresting at the G2/M phase and inducing more cells to undergo apoptosis. In addition, the resistance of MCF7/ADR cells to TPT was reversed (the resistance index decreased from 7.17 to 0.77) by inhibiting the expression of ER α and BCRP to increase TPT accumulation intracellularly. Moreover, the combination of DAI and TPT showed a stronger inhibitory effect ($P < 0.01$) on tumour growth in both MCF7 and MCF7/ADR xenograft models than the 9 mg/kg TPT monotherapy group. The results may provide a reasonable, new approach to develop safe and efficient nutrition components from foods for breast cancer combination treatment.

Authors: Guo J, Wang Q, Zhang Y, Sun W, Zhang S, Li Y, Wang J, Bao Y.

Full Source: Pharmacology Research. 2019 Sep; 147:104387. doi: 10.1016/j.phrs.2019.104387. Epub 2019 Aug 10.

Topotecan (TPT), a semisynthetic derivative of camptothecin, has been used in cancer chemotherapy, but side effects and drug resistance limit its clinical application.

OCCUPATIONAL RESEARCH

Augmented Reality Surgical Navigation in Spine Surgery to Minimise Staff Radiation Exposure

2019-10-29

In this study, the authors assessed staff and patient radiation exposure during augmented reality surgical navigation (ARSN) in spine surgery. Surgical navigation in combination with intraoperative 3D imaging has been shown to significantly increase the clinical accuracy of pedicle screw placement. Although this technique may increase the total radiation exposure compared to fluoroscopy, the occupational exposure can be minimised, as navigation is radiation free and staff can be positioned behind protective shielding during 3D imaging. The patient radiation exposure during treatment and verification of pedicle screw positions can also be reduced. Twenty patients undergoing spine surgery with pedicle screw placement were included in the study. The staff radiation exposure was measured using real-time active personnel dosimeters (APD) and was further compared with measurements using a reference dosimeter attached to the C-arm (i.e., a worst-case staff exposure situation). The patient radiation exposures were recorded, and effective doses (ED) were determined. The average staff exposure per procedure was $0.21 \pm 0.06 \mu\text{Sv}$. The average staff-to-reference dose ratio per procedure was 0.05% and decreased to less than 0.01% after a few procedures had been performed. The average patient ED was $15.8 \pm 1.8 \text{ mSv}$ which mainly correlated with the number of vertebrae treated and the number of CBCT acquisitions performed. A low dose protocol used for the final 10 procedures yielded a 32% ED reduction per spinal level treated. This study demonstrated significantly lower occupational doses compared to values reported in literature. Real-time APD contributed to a fast optimisation and adoption of protective measures throughout the study. Even though the data include both CBCT for navigation planning and intraoperative screw placement verification, we find low patient radiation exposure levels compared to published data.

Authors: Edström E, Burström G, Omar A, Nachabe R, Söderman M, Persson O, Gerdhem P, Elmi A.

Full Source: Spine (Phila Pa 1976). 2019 Aug 13. doi: 10.1097/BRS.0000000000003197. [Epub ahead of print]

In this study, the authors assessed staff and patient radiation exposure during augmented reality surgical navigation (ARSN) in spine surgery.

Physical and chemical characterisation of McIntyre Powder: An aluminium dust inhaled by miners to combat silicosis

2019-10-29

McIntyre Powder (MP) is a finely ground aluminium powder that was used between 1943 and 1979 as a prophylaxis for silicosis. Silicosis is a chronic lung disease caused by the inhalation of crystalline silica dust and was prevalent in the Canadian mining industry during this time period. The McIntyre Research Foundation developed, patented, and produced the MP and distributed it to licensees in Canada, the United States, Mexico, Chile, Belgian Congo, and Western Australia. In the province of Ontario, Canada it is estimated that at least 27,500 miners between 1943 and 1979 were exposed to MP. The present study was undertaken to examine the chemical and physical characteristics of two variations of MP (light grey and black). Chemical analyses (using X-ray Fluorescence and Inductively Coupled Plasma approaches) indicate that the black MP contains significantly higher concentrations of aluminium and metal impurities than the light grey MP ($p < 0.001$). X-ray diffractometry shows that while aluminium hydroxide dominates the aluminium speciation in both variations, the higher total aluminium content in the black MP is attributable to a greater proportion of elemental aluminium. Physical characterisation (using electron microscopy, light microscopy, and dynamic light scattering) indicates that the light grey MP consists of particles ranging from 5 nm to 5 μm in diameter. Atomic Force Microscopy shows that the light grey MP particles in the nanoparticle range (< 100 nm) have a mode between 5 and 10 nm. Consequently, it is possible that inhaled smaller MP nanoparticles may be transported via blood and lymph fluid circulation to many different organs including the brain. It is also possible for inhaled larger MP particles to deposit onto lung tissue and for potential health effects to arise from inflammatory responses through immune activation. This MP characterisation will provide crucial data to help inform future toxicological, epidemiological, and biological studies of any long-term effects related to the inhalation of aluminium dust and nanomaterials.

Authors: Zarnke A, Rasmussen PE, David MO, Eidi H, Kennedy K, Hedges K, Irick T, Thome C, Pirkkanen J, Boreham D.

Full Source: Journal of Occupational & Environmental Hygiene. 2019 Sep 18:1-12. doi: 10.1080/15459624.2019.1657581. [Epub ahead of print]

The present study was undertaken to examine the chemical and physical characteristics of two variations of McIntyre Powder, finely ground aluminium powder, that was used as a prophylaxis for silicosis.

Thyroid function and decabromodiphenyl ethane (DBDPE) exposure in Chinese adults from a DBDPE manufacturing area

2019-10-29

Polybrominated diphenyl ethers (PBDEs), which are persistent organic pollutants, affect thyroid function. Human exposure to decabromodiphenyl ethane (DBDPE), which has a similar structure to PBDEs, has recently increased, and the health effects of DBDPE have not been well studied. The objective of this study was to determine whether human exposure to DBDPE was associated with thyroid hormone levels in adults from a DBDPE manufacturing area. Three hundred-two blood samples were collected from two populations in the largest DBDPE manufacturing area located in North China: 133 DBDPE occupationally exposed workers from a DBDPE manufacturing plant and 169 non-DBDPE occupationally exposed residents from a nearby food processing plant. The levels of DBDPE, and thyroid function parameters [total thyroxine (TT4), free T4 (FT4), total triiodothyronine (TT3), free T3 (FT3), thyroid-stimulating-hormone (TSH), thyroglobulin antibody (TG-Ab), and thyroid peroxidase antibody (TPO-Ab)] were measured in serum samples. Serum concentrations of DBDPE ranged from 3.148 to 54,360 ng g⁻¹ lipid weight (lw), with a geometric mean of 332.6 ng g⁻¹ lw. A 10-fold increase in the DBDPE concentration was associated with increase of 4.73 nmol L⁻¹ [95% confidence interval (CI): 2.75, 6.71] TT4 and 0.046 nmol L⁻¹ TT3 [95% CI: 0.012, 0.081], corresponding to increases of approximately of 4.73% (95% CI: 2.75%-6.71%) and 2.38% (95% CI: 0.62%-4.20%), respectively. DBDPE in serum was also significantly and positively associated with the concentrations of TG-Ab and TPO-Ab. The results of the study showed that exposure to DBDPE was associated with changes in thyroid activity in adults exposed to a high concentration of DBDPE, mainly increases of TT4, TT3, TPO-Ab, and TG-Ab. The association between DBDPE exposure and thyroid homeostasis requires further investigation because increasing DBDPE exposure has emerged in recent years.

Authors: Chen T, Yu D, Yang L, Sui S, Lv S, Bai Y, Sun W, Wang Y, Chen L, Sun Z, Tian L, Wang D, Niu P, Shi Z.

Full Source: Environment International. 2019 Oct 15;133(Pt A):105179. doi: 10.1016/j.envint.2019.105179. [Epub ahead of print]

The objective of this study was to determine whether human exposure to DBDPE was associated with thyroid hormone levels in adults from a DBDPE manufacturing area.

Association of Occupational Exposure to Disinfectants With Incidence of Chronic Obstructive Pulmonary Disease Among US Female Nurses

2019-10-29

Importance: Exposure to disinfectants in health care workers has been associated with respiratory health outcomes, including asthma. Despite the biological plausibility of an association between disinfectants (irritant chemicals) and risk of chronic obstructive pulmonary disease (COPD), available data are sparse. In this study, the authors investigated the association between exposure to disinfectants and COPD incidence in a large cohort of US female nurses.

Design, Setting, and Participants: The Nurses' Health Study II is a US prospective cohort study of 116 429 female registered nurses from 14 US states who were enrolled in 1989 and followed up through questionnaires every 2 years since. The present study included women who were still in a nursing job and had no history of COPD in 2009, and used data from the 2009 through 2015 questionnaires. Clean and complete data used for this analysis were available in July 2018, and analyses were conducted from September 2018 through August 2019.

Exposures: Occupational exposure to disinfectants, evaluated by questionnaire and a job-task-exposure matrix (JTEM).

Main Outcomes and Measures: Incident physician-diagnosed COPD evaluated by questionnaire.

Results: Among the 73 262 women included in the analyses, mean (SD) age at baseline was 54.7 (4.6) years and 70 311 (96.0%) were white, 1235 (1.7%) black, and 1716 (2.3%) other; and 1345 (1.8%) Hispanic, and 71 917 (98.2%) non-Hispanic. Based on 368 145 person-years of follow-up, 582 nurses reported incident physician-diagnosed COPD. Weekly use of disinfectants to clean surfaces only (16 786 [22.9%] of participants exposed) and to clean medical instruments (13 899 [19.0%] exposed) was associated with COPD incidence, with adjusted hazard ratios of 1.38 (95% CI, 1.13-1.68) for cleaning surfaces only and 1.31 (95% CI, 1.07-1.61) for cleaning medical instruments after adjustment for age, smoking (pack-years), race, ethnicity, and body mass index. High-level exposure, evaluated by the JTEM, to several specific disinfectants (ie, glutaraldehyde, bleach, hydrogen peroxide, alcohol, and quaternary ammonium compounds) was significantly associated with COPD incidence, with adjusted hazard ratios ranging from 1.25 (95% CI, 1.04-1.51) to 1.36 (95% CI, 1.13-1.64). Associations were not modified by smoking or asthma status (P for interaction > .15).

In this study, the authors investigated the association between exposure to disinfectants and COPD incidence in a large cohort of US female nurses.

Conclusions and Relevance: These longitudinal results suggest that regular use of chemical disinfectants among nurses may be a risk factor for developing COPD. If future studies confirm these results, exposure-reduction strategies that are compatible with infection control in health care settings should be developed.

Authors: Dumas O, Varraso R, Boggs KM, Quinot C, Zock JP, Henneberger PK, Speizer FE, Le Moual N, Camargo CA Jr.

Full Source: JAMA Network Open. 2019 Oct 2;2(10): e1913563. doi: 10.1001/jamanetworkopen.2019.13563.

Impact of Carcinogenic Chromium on the Cellular Response to Proteotoxic Stress

2019-10-29

Worldwide, several million workers are employed in the various chromium (Cr) industries. These workers may suffer from a variety of adverse health effects produced by dusts, mists and fumes containing Cr in the hexavalent oxidation state, Cr (VI). Of major importance, occupational exposure to Cr(VI) compounds has been firmly associated with the development of lung cancer. Counterintuitively, Cr(VI) is mostly unreactive towards most biomolecules, including nucleic acids. However, its intracellular reduction produces several species that react extensively with biomolecules. The diversity and chemical versatility of these species add great complexity to the study of the molecular mechanisms underlying Cr(VI) toxicity and carcinogenicity. As a consequence, these mechanisms are still poorly understood, in spite of intensive research efforts. In the present study, the authors discuss the impact of Cr(VI) on the stress response-an intricate cellular system against proteotoxic stress which is increasingly viewed as playing a critical role in carcinogenesis. This discussion is preceded by information regarding applications, chemical properties and adverse health effects of Cr(VI). A summary of our current understanding of cancer initiation, promotion and progression is also provided, followed by a brief description of the stress response and its links to cancer and by an overview of potential molecular mechanisms of Cr(VI) carcinogenicity.

Authors: Ferreira LMR, Cunha-Oliveira T, Sobral MC, Abreu PL, Alpoim MC, Urbano AM.

Full Source: International Journal of Molecular Science. 2019 Oct 3;20(19). pii: E4901. doi: 10.3390/ijms20194901.

In the present study, the authors discuss the impact of Cr(VI) on the stress response-an intricate cellular system against proteotoxic stress which is increasingly viewed as playing a critical role in carcinogenesis.

PUBLIC HEALTH RESEARCH

Epigenetic response profiles into environmental epigenotoxicant screening and health risk assessment: A critical review

2019-10-29

The epigenome may be an important interface between exposure to environmental contaminants and adverse outcome on human health. Many environmental pollutants deregulate gene expression and promote diseases by modulating the epigenome. Adverse epigenetic responses have been widely used for risk assessment of chemical substances. Various pollutants, including trace elements and persistent organic pollutants, have been detected frequently in the environment. Epigenetic toxicity of environmental matrices including water, air, soil, and food cannot be ignored. This review provides a comprehensive overview of epigenetic effects of pollutants and environmental matrices. The authors start with an overview of the mechanisms of epigenetic regulation and the effects of several types of environmental pollutants (trace elements, persistent organic pollutants, endocrine disrupting chemicals, and volatile organic pollutants) on epigenetic modulation. Then they discuss the epigenetic responses to environmental water, air, and soil based on in vivo and in vitro assays. Finally, recommendations to promote the incorporation of epigenotoxicity into contamination screening and health risk assessment was discussed.

Authors: Hu J, Yu Y.

Full Source: Chemosphere. 2019 Jul; 226:259-272. doi: 10.1016/j.chemosphere.2019.03.096. Epub 2019 Mar 18.

This review provides a comprehensive overview of epigenetic effects of pollutants and environmental matrices.

Holoprosencephaly: A case series from an area with high mining-related pollution

2019-10-29

The extraction and processing of copper and cobalt in the African Copperbelt in the Democratic Republic of Congo have led to substantial environmental pollution, causing concerns about possible adverse effects on human health, including birth defects. In the present study, the authors report three neonates with clinically diagnosed holoprosencephaly who were part of a case-control study performed in Lubumbashi between February 2013 and February 2015. One mother had a high concentration of uranium in urine, and high manganese concentrations were found in

blood of another mother and in cord blood of one infant. Two of the three fathers had a mining-related job.

The authors hypothesise that these cases of holoprosencephaly were connected to mining-related pollution, possibly via epigenetic alterations induced by paternal occupational exposure to toxic metals.

Authors: Kayembe-Kitenge T, Kasole Lubala T, Musa Obadia P, Katoto Chimusa P, Katshiez Nawej C, Banza Lubaba Nkulu C, Devriendt K, Nemery B.

Full Source: Birth Defects Research. 2019 Aug 16. doi: 10.1002/bdr2.1583. [Epub ahead of print]

Associations between Indoor Air Pollution and Acute Respiratory Infections among Under-Five Children in Afghanistan: Do SES and Sex Matter?

2019-10-29

Low-income families often depend on fuels such as wood, coal, and animal dung for cooking. Such solid fuels are highly polluting and are a primary source of indoor air pollutants (IAP). In this study, the authors examined the association between solid fuel use (SFU) and acute respiratory infection (ARI) among under-five children in Afghanistan and the extent to which this association varies by socioeconomic status (SES) and gender. This is a cross-sectional study based on de-identified data from Afghanistan's first standard Demographic and Health Survey (DHS) conducted in 2015. The sample consists of ever-married mothers with under-five children in the household (n = 27,565). The authors used mixed-effect Poisson regression models with robust error variance accounting for clustering to examine the associations between SFU and ARI among under-five children after adjusting for potential confounders. We also investigated potential effect modification by SES and sex. Additional analyses were conducted using an augmented measure of the exposure to IAP accounting for both SFU and the location of cooking/kitchen (High Exposure, Moderate, and No Exposure). Around 70.2% of households reported SFU, whereas the prevalence of ARI was 17.6%. The prevalence of ARI was higher in children living in households with SFU compared to children living in households with no SFU (adjusted prevalence ratio (aPR) = 1.10; 95% CI: (0.98, 1.23)). We did not observe any effect modification by SES or child sex. When using the augmented measure of exposure incorporating the kitchen's location, children highly exposed to IAP had a higher prevalence of ARI compared to unexposed children (aPR = 1.17; 95% CI: (1.03, 1.32)). SES modified this association with the strongest associations observed among children from the middle wealth quintile.

In this study, the authors examined the association between solid fuel use (SFU) and acute respiratory infection (ARI) among under-five children in Afghanistan and the extent to which this association varies by socioeconomic status (SES) and gender.

Technical

CHEMWATCH

The findings have significant policy implications and suggest that ARI risk in children may be reduced by ensuring there are clean cookstoves as well as clean fuels and acting on the socio-environmental pathways.

Authors: Rana J, Uddin J, Peltier R, Oulhote Y.

Full Source: International Journal of Environmental Research & Public Health. 2019 Aug 14;16(16). pii: E2910. doi: 10.3390/ijerph16162910.

Residential sources of pesticide exposure during pregnancy and the risks of hypospadias and cryptorchidism: the French ELFE birth cohort.

2019-10-29

Prenatal occupational exposure to pesticides has been associated with male reproductive tract abnormalities. Little is known about the possible impact of non-occupational pesticide exposure on foetal and child development in the general population. Using data from a nationwide birth cohort, the authors aimed to assess the association between residential sources of prenatal pesticide exposure and the risks of hypospadias and cryptorchidism. Of the 9281 boys in ELFE (French Longitudinal Study of Children), the national French birth cohort, 53 were diagnosed with hypospadias and 137 with cryptorchidism. Residential exposure sources were assessed from self-reported domestic use of eight types of pesticide products and French spatial land use data with acreage within a 1000 m radius around each family's home for 21 crop types. Logistic regression modelling was used, adjusted for possible confounders that included estimated dietary pesticide intake. Multiple imputations were used to handle missing data. An increased risk of hypospadias was associated with domestic pesticide use against fleas and ticks (OR=2.28, 95% CI 1.09 to 4.75); no associations were found between cryptorchidism and any domestic pesticide use. Slightly increased risks of cryptorchidism were observed in association with all crop acreages near homes during pregnancy, especially for orchards, and no association was observed for hypospadias. The results suggest a possible increased risk of hypospadias associated with prenatal use of some domestic pesticide products, likely to contain insecticides, and of cryptorchidism with nearby orchard acreage (crops repeatedly sprayed with pesticides). This work is limited by its modest number of cases.

Authors: Cognez N, Warembourg C, Zaros C, Metten MA, Bouvier G, Garlantézec R, Charles MA, Béranger R, Chevrier C.

Full Source: Occupational & Environmental Medicine. 2019 Sep;76(9):672-679. doi: 10.1136/oemed-2019-105801.

Using data from a nationwide birth cohort, the authors aimed to assess the association between residential sources of prenatal pesticide exposure and the risks of hypospadias and cryptorchidism.

Isopropylated and tert-butylated triarylphosphate isomers in house dust from South China and Midwestern United States

2019-10-29

In the present study, the authors determined the concentrations and compositions of a suite of isopropylated and tert-butylated triarylphosphate ester (ITP and TBPP) isomers in house dust from the city of Guangzhou located in South China and the city of Carbondale in Midwestern United States. These two groups of organophosphate esters (OPE) are structurally analogous to triphenyl phosphate (TPHP), but have rarely been investigated for environmental occurrences and human exposure risks. The majority of target ITP and TBPP isomers were 100% detected in house dust from the two locations. Median concentrations of Σ ITPs (including all ITP isomers) and Σ TBPPs (including all TBPP isomers) were 63.4 ng/g (range: 16.0-500 ng/g) and 35.4 ng/g (8.1-198 ng/g) in South China house dust, respectively, compared with 476 ng/g (140-1610 ng/g) for Σ ITPs and 81.3 ng/g (35.2-800 ng/g) for Σ TBPPs in Midwestern U.S. dust. The profiles of ITP or TBPP isomers were similar between the two locations and were dominated by 2-isopropylphenyl diphenyl phosphate (2IPDP) and 4-tert-butylphenyl diphenyl phosphate (4tBPDPP), respectively. Although the levels of Σ ITPs and Σ TBPPs were generally one order of magnitude lower than those of TPHP in the same dust samples, the broad occurrences of most of these isomers in house dust from the two locations likely suggest their wide applications in household consumer products. Estimated intakes of Σ ITPs and Σ TBPPs via dust ingestion were generally three orders of magnitude lower than the reference dose proposed for TPHP. However, these emerging OPE chemicals merit continuous environmental surveillance, given their possible applications as specific commercial mixtures or as components/impurities in other flame retardant/plasticiser mixtures.

Authors: Guan Q, Tan H, Yang L, Liu X, Fiedler H, Li X, Chen D.

Full Source: Science of the Total Environment. 2019 Oct 10; 686:1113-1119.

doi: 10.1016/j.scitotenv.2019.06.055. Epub 2019 Jun 5.

In the present study, the authors determined the concentrations and compositions of a suite of isopropylated and tert-butylated triarylphosphate ester (ITP and TBPP) isomers in house dust from the city of Guangzhou located in South China and the city of Carbondale in Midwestern United States.