

Contents in Context

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Current Perspectives in Arsenic Environmental and Biological Research

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Arsenic occurs in rock, fresh water and seawater. Organic arsenic compounds are found as natural constituents of many organisms and, because some, e.g. seafood, are consumed by humans, there is ongoing health interest in their arsenic content. Thio-arsenicals, a newly discovered group of arsenic compounds, may be integral to understanding the environmental behaviour of arsenic. This paper reviews recent research in arsenic environmental chemistry and discusses ideas intended to stimulate future research in this area.

Environmental Contamination of Arsenic and its Toxicological Impact on Humans

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Tens of millions of people in developing countries are being exposed to excessive levels of arsenic in their drinking water, and this contamination is widely regarded as the largest current calamity of chemical poisoning in the world. However, arsenic can exist in many chemical forms, and these vary widely in solubility, toxicity, and in bioavailability. Therefore, it is critical to be able to measure arsenic speciation accurately and reliably in order to understand its toxicity and design effective measures of remedial action.

Commonalities in Metabolism of Arsenicals

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Health effects associated with inorganic arsenic include various cancers and increased risk of diabetes. Millions of people in Bangladesh and India are at risk through use of contaminated drinking water. When humans ingest inorganic arsenic, it is rapidly converted to methylated metabolites. Although this methylation process is largely understood, the metabolism of other arsenicals (e.g. arsenosugars to dimethylarsenic) is very unclear. Connections among pathways for metabolism of various arsenicals are now being elucidated. Commonalities and differences in these pathways may be important determinants of the risk associated with exposure to these agents.

Unexpected Beneficial Effects of Arsenic on Corn Roots Grown in Culture

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Phytoremediation, the process of using plants to remove metals from contaminated soils, shows promise as a low-technology method for economically removing arsenic, and other toxic metals, from soil. Arsenic transport studies in vascular plants have examined how arsenic is taken up, chemically modified, and transported from roots to other parts of the plant. No studies, to our knowledge, have examined the effect of low-level doses of arsenic on the roots themselves. This paper shows, for the first time, that arsenic at low levels may beneficially affect root development.

Two Novel Thio-Arsenosugars in Scallops Identified with HPLC–ICPMS and HPLC–ESMS

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A new group of arsenic compounds, namely thio-arsenosugars, has recently been discovered in some marine samples, including seafood products. We do not yet understand how these arsenic compounds are produced by living organisms, nor do we know their implications for human health. Their unusual chromatographic properties are the reason that they are difficult to detect by existing methods. We present a new method for finding these thio-arsenosugars, and we also report two new thio-arsenosugars.

Distribution and Speciation of Arsenic in Temperate Marine Saltmarsh Ecosystems

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The pathways by which arsenic is accumulated and transferred in aquatic ecosystems are relatively unknown. Examination of whole marine ecosystems rather than individual organisms provides greater insights into the biogeochemical cycling of arsenic. Saltmarshes with low ecological diversity are an important terrestrial–marine interface about which little is known regarding arsenic concentrations and species distribution. This study examines the cycling of arsenic within Australian saltmarsh ecosystems to further understand its distribution and trophic transfer.

Arsenosugar Metabolism Not Unique to the Sheep of North Ronaldsay

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Seaweed is enjoying a revival in farming practice, in particular by organic farmers. However, seaweed accumulates arsenic, and these arsenic compounds can enter the food chain. It is known that the arsenic is present mainly as arsenosugars, but the metabolism of these compounds by ruminants needs clarification.

Surfactants in South East Asian Aerosols

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Surfactants are present in all atmospheric aerosols with potential effects on surface tension, cloud droplets and even human health. They appear to be anionic and associated with yellow aqueous extracts, suggesting a humic-like character. These surfactants are probably derived from the oxidation of combustion-generated soot (from vehicles and forest fires).

A Two-Phase Box Model to Study Mercury Atmospheric Mechanisms

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Elemental mercury (Hg^0) is converted to divalent mercury (Hg^{2+}) in the atmosphere, largely in water droplets. The wet deposition of Hg^{2+} is a major concern to human health. Because it is bio-accumulated through the food chain, consumption of contaminated fish can be particularly dangerous. Currently the budgets of mercury in the atmosphere are poorly understood, due in part to uncertainties in the chemical pathways controlling the speciated forms of mercury. Improved mercury chemistry models are needed to better predict Hg^{2+} levels in water droplets and to estimate wet deposition of Hg^{2+} in order to help assess the potential health risks of mercury.

Thermal Metamorphism of Primitive Meteorites—XII. The Enstatite Chondrites Revisited

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The first Solar System material condensed 4.567 billion years ago, rapidly forming planetesimals—solid bodies that might combine to form planets (accretion) or survive as asteroidal meteorites. Earth's main accretion ended within the next 30 million years, but subsequent high temperatures essentially erased evidence of this history. However, heating in these early episodes produced effects uniquely recorded by 14 volatile trace elements. The volatile element composition of chondritic meteorites, whose parent material formed closest to Earth, may thus provide important information about early planetesimal evolution.

High Throughput Determination of BTEX by a One-Step Fluorescence Polarization Immunoassay

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Benzene, toluene, ethylbenzene, and xylenes (BTEX) are used as solvents in paints and coatings and are constituents of petroleum products. BTEX can contaminate air, water or soil and is toxic; benzene, in particular, is a recognized human carcinogen. Most existing methods for detecting BTEX are time-consuming, complicated and very expensive for routine screening. A rapid immunoassay of BTEX is presented that greatly simplifies environmental monitoring of water contamination.

Investigating the Mechanism of Uranium Removal by Zerovalent Iron

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Groundwater is the water that fills the spaces between sand, soil, and rock below the water table. It discharges into ecologically sensitive wetlands and is used as drinking water or in agriculture and industry. Inappropriate waste disposal and poor land management can contaminate groundwater and may minimize its use for decades. The common method for pumping contaminated groundwater to the surface for treatment is costly and labour intensive. Zerovalent iron is a new, more cost-effective method of groundwater remediation.