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Metabolic Pathways Involving Arsenic in Marine Organisms: A Unifying Hypothesis

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ABSTRACT

Arsenic is potentially a highly toxic element in marine ecosystems, and in inorganic form represents a threat to consumers of marine products, including man. Chemical forms of arsenic in marine biota are diverse, however, and are usually of uncertain toxicological significance. The element has been reported in association with lipids, as arsenobetaine and as arseno-sugars. These data are critically reviewed, and a novel hypothesis is presented to account for the chemical forms of arsenic reported to date. The hypothesis relies upon the replacement of nitrogen by arsenic in substrates involved in phospholipid synthesis. This would give rise to a large number of arsenic-containing intermediates, which would be either water-soluble or lipid-soluble. The derivation of the arseno-sugars found recently in brown kelp and giant clams is explained as an incidental side-product of the phospholipid biosynthesis in algae. These various arsenic-containing compounds are all thought to be catabolised (in some cases by several organisms in sequence) as they pass through the food web, yielding arsenobetaine as a stable end-product.

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