Oxidative coupling during gut passage in marine deposit-feeding invertebrates

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ABSTRACT: We tested for oxidative coupling of phenolic materials, including organic contaminants and tyrosine, in gut fluid from marine deposit-feeding invertebrates. A phenolic metabolite (pyrenol) of a polycyclic aromatic hydrocarbon (PAH), which can arise during accumulation by deposit-feeding invertebrates, was found to participate in oxidative coupling reactions to organic matter in gut fluid. Gut fluid from four species of marine deposit-feeding invertebrates (three polychaetes and one holothuroid) catalyzed oxidative coupling of pyrenol (1-hydroxypyrene) in rough proportion to their enzyme activity and dissolved organic matter levels. *Nereis virens* gut fluid also catalyzed coupling of tyrosine monomers to form dityrosine, a common marker of oxidative damage in proteins. An antioxidant enzyme activity, similar to that of heme peroxidase and capable of oxidative coupling, was tentatively identified in gut fluid from *N. virens* by protein precipitation, dye decolorization assays, and enzyme inhibitor studies. Unaltered *N. virens* gut fluid had high total oxyradical scavenging capacity, indicating the presence of fast-acting antioxidants. Oxidative coupling of PAHs will reduce subsequent bioavailability, toxicity, and transport of these compounds in marine environments. Furthermore, oxidative coupling of PAHs represents a hitherto overlooked sink for organic contaminants in marine sediments and suggests a biological mechanism for formation of aquatic humic material.