

Lipids in Aquatic Ecosystems

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Lipids in Aquatic Ecosystems provides a comprehensive summary of the most recent literature on the role of lipids in aquatic systems from many world experts. Essential fatty acids (EFAs), or omega-3 and omega-6 fatty acids as they are known in the popular press, have garnered considerable attention in the technical and popular literature during the last decade. Lipids are important energy storage molecules in most organisms. However, equally or even more important, specific lipids (e.g. EFAs) play critical roles in a wide range of physiological processes such as regulating the structural properties of cell membranes and serving as precursors to eicosanoid signaling molecules (i.e. prostaglandins, prostacyclins, the thromboxanes and the leukotrienes). It is well established the EFAs have important impacts on human health, and it is widely agreed that the classic "Western diet" is particularly imbalanced vis-à-vis foods containing omega-3 versus omega-6 fatty acids. But beyond the specialist literature, it is not widely known that the most physiologically important long chain, polyunsaturated omega-3 fatty acids, i.e. eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are produced de novo principally by aquatic algae. Furthermore, within aquatic ecosystems these molecules may be synthesized from precursor fatty acid molecules and/or concentrated as they are conveyed to animals consumed by humans. For example, in salmonid fish DHA and EPA constitute ~40% of total fatty acids, whereas in typical marine and freshwater phytoplankton EPA and DHA account for between 2% and 20% of total fatty acids. In humans, EPA and DHA play key roles in heart health, immune and inflammatory responses, and visual acuity, as well as in the spinal cord and brain. This realization has prompted great concern in the fisheries management community that the world's natural supply of EPA and DHA is being overexploited. There is also concern that global climate change and/or eutrophication processes may be modifying the production and availability of these molecules in aquatic ecosystems.

Tremendous strides, as summarized in this book, have been made in our understanding of the specific enzymatic pathways by which various lipids are synthesized by producers and transformed by consumers within aquatic ecosystems. Recent research also indicates that in addition to EFAs, phyto-sterol lipids may play critical roles in the nutritional physiology aquatic fauna. This book includes chapters with the most up-to-date research on the utility of fatty acids as biomarkers of material and energy transfer in aquatic ecosystems. Primary producers at the base of aquatic food webs generally have distinctive fatty acid profiles and many studies have shown that these fatty acid "signatures" can be used as tracers of food web dynamics. Lipids also play important roles in the trophic transfer of a variety of contaminants including methyl-mercury and fat-soluble persistent organic pollutants. Certain fatty acids may also serve as the substrates from which some toxins and allelopathic metabolites are produced.

This book will be of interest to a wide range of scientists from the fields of marine and freshwater plankton ecology, algal physiology, fisheries management, nutritional science, food web ecology, aquaculture, toxicology, and environmental science.

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The artwork depicted in the small inset on the front cover is a collaboration between the three editors and the artist, Andrew Turnbull (www.turnbullsculpture.com), with subsequent modifications by graphic artist Lucas Neilson.

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