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Specificity of membrane lipid compositions and their influence on the molecular activity of membrane proteins.

For many it is surprising to consider that the primary role of lipids in the biology of animals is not as fuel depots but as dynamic constituents of membranes.

Works over the last decade have demonstrated striking relationships between membrane lipid compositions and the structural integrity and functional specialization of membrane proteins involved in important cellular processes. Membrane lipids are structures that in turn can impose organization on the distribution of proteins in the bilayer and play a key role in setting their activities.

Membrane lipids come in a number of different forms that can differ in their structure, chemical and physical properties. Phylogeny, body size, ontology, metabolism, diet, temperature, salinity are all examples of factors that can effect membrane lipids composition and therefore the biochemistry and physiology of animal species. Membrane lipids are responsive to the needs of animals and the varied environments that they inhabit, but at the same time appear to be highly regulated (within species limits). Emerging ideas suspect that variations of their composition beyond these limits would have significant effects on cellular metabolism and regulation.

Part of a new collaboration between researchers from the University of Wollongong (P. Else and T. Hulbert) and the University of Brest (France) aims to understand fine mechanisms by which variations of lipid membrane structures influence cellular functions, and among them those associated to mitochondrial energetic and oxidative metabolism. The cytochrome *c* oxidase, an important membrane proteins component implicated in oxidative phosphorylation process in mitochondria, was used to test the lipid specificity requirement for its enzymatic activity. These experiments will determine the degree to which specific membrane lipids and fatty acids and/or membrane lipid mixtures are involved in changing the molecular activity of this membrane protein.

For this purpose, the use of "marine lipids" should represent an attractive source of molecules to be tested with their high levels of membrane polyunsaturation, the famous ω 3. A striking example in marine bivalves will be presented.

The implications of this study will be to go further in our understanding of membrane action based on lipid composition, but also to further elucidate the role and importance of membrane lipid composition on the biology of living animals.