Decoupling membrane lipid/protein interactions: an adaptive strategy.

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Membrane restructuring as part of a homeoviscous response for environmental adaptation is well established. Other adaptive membrane modifications also occur that are not involved in maintaining membrane fluidity per se. These changes are less well understood. Many membrane proteins have an obligatory requirement for specific lipid types. These interactions seem to be the foci of adaptive modifications targeting membrane proteins. Our studies of the relationships between membrane lipids and the activities of membrane enzymes and transporters indicate such modification of key lipids may mediate membrane protein function in environmental adaptations such as estivation and salinity acclimation. We have examined the membrane lipid changes in mitochondrial and plasma membranes of estivating and active African lungfish and how these influence cytochrome c oxidase and several transport ATPases. Additionally, we have identified membrane changes associated with salinity acclimation in the gills of salmonid fishes. These studies point to 2 strategies. One is a modification of the lipid class composition of the membranes. The other involves a decoupling of sensitivity of the membrane proteins to key lipids. The mechanisms whereby these modifications occur will be discussed.