

Membrane lipids and longevity: insights from vertebrates and invertebrates

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Approaches to investigating the mechanisms that determine longevity include: (i) the comparison of species that vary in longevity, (ii) examination of how calorie-restriction extends longevity, and (iii) examination of genetic mutants that exhibit extended longevity. In all three approaches there is evidence that membrane fatty acid composition may be an important determinant of maximum lifespan (MLSP). Only polyunsaturated fatty acids are substrates for lipid peroxidation (& the more polyunsaturated the greater the peroxidation-susceptibility). Knowing the fatty acid composition of membrane lipids, one can calculate a peroxidation index (PI) that indicates the membrane's susceptibility to lipid peroxidation. The 'membrane pacemaker' modification of the oxidative stress theory of aging emphasises lipid peroxidation, both as a source of lipid-based free radicals and also a pathway that results in damage to many other important biomolecules (e.g. proteins and DNA). Lipid peroxidation is a chain-reaction positive-feedback process and in this respect it is of interest that MLSP is inversely proportional to the cube power of PI. Examples of the link between membrane fatty acid composition and the maximum lifespan of both vertebrates (many mammal and bird species) and invertebrates (including insects and nematodes) will be presented and discussed.