Effects of Ubiquinone-10 (Q10) in lipid membranes

Emma Eriksson*, Víctor Agmo Hernández, Katarina Edwards

Department of Chemistry-BMC, Uppsala University, Uppsala, Sweden

**emma.eriksson@kemi.uu.se*

In order to function properly, biological membranes need to be both fluid and dense. A common way for Nature to increase the barrier properties and mechanical strength of lipid membranes is by use of sterols, for example cholesterol. Some membranes are however sterol deficient, and therefore need to be reinforced in other ways. Recent studies suggest that ubiquinone, a lipid soluble molecule present in most biological membranes, could have an important membrane stabilizing function.[1][2] We have studied the stabilizing effect of ubiquinone-10 (Q10) (Figure 1a), which is the dominating version of ubiquinone present in humans.

Our investigations show that Q10 acts a stabilizing agent in liposomes composed of POPC, where it increases the lipid packing order and condenses the membranes.[2] These Q10-induced changes result in decreased membrane permeability and make the liposomes more resistant towards rupture. Interestingly, a considerably smaller amount of Q10 than of cholesterol is needed to achieve similar levels of stability. The quinone part of Q10 seems to be essential for the membrane-stabilizing effect, given that a quinone-free reference molecule (solanesol, Figure1b) had no influence on the studied membrane properties.

Currently we are studying how Q10 affects biomimetic systems. The first results indicate that Q10 has a clear ordering effect also in membranes with compositions similar to those of the inner mitochondrial membrane (IMM) and the inner membrane of gram negative bacteria (BM), see Figure 1b. These two systems are of particular significance, since they naturally contain high concentrations of ubiquinone but no, or little cholesterol.

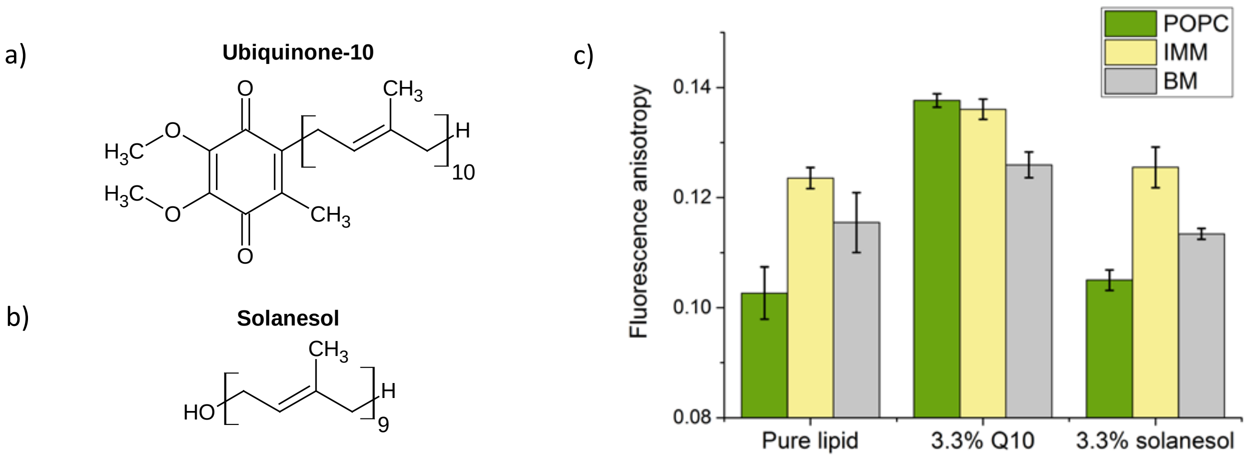

Figure 1 a) The structure of ubiquinone-10 and b) solanesol. c) DPH fluorescence anisotropy, a measure of lipid chain order, in membranes with different lipid compositions. BM = *POPE:POPG:CL (75:6:19)* and IMM = *POPC:POPE:CL:Soy-PI:Soy-PS (43.6:49.2:6.1:1:0.7)*.

[1] D.C. Sevin, U. Sauer, *Nat. Chem. Biol.*, 2014, 10, 266-272.
[2] V. Agmo Hernández, E. Eriksson, K. Edwards, *BBA-Biomembranes*, 2015, 1848, 2233-2243.