Description for the general public

Anion transport through lipid bilayers is essential for life. For example, cellular respiration – a complex biochemical process through which every living cell produces energy, involves the facilitated transport of various carboxylates, phosphates and bicarbonate anions from one side of the lipid bilayer to the other. Accordingly, the development of artificial transmembrane anion transporters (anionophores) is a current "hot topic" in supramolecular chemistry. Surprisingly however, most of the previous studies in this field focused on chloride transport only, despite the importance of transporting other ions in Nature. This is most probably due to the lack of direct and convenient methods to follow the transport of other anions. **This project aims to develop new, direct methods of measuring anion transport for a broad range of biologically important anions and to use these methods to develop selective artificial anion transporters.**

In order to develop these new methods, we plan to adapt one of the more popular chloride transport assays in such a way that it could be used for other biologically active anions too. The original method uses a chloride sensitive fluorescent dye lucigenin, to monitor the concentration of chloride anions transported through the lipid bilayer of synthetic vesicles. Our modification will consist in substituting lucigenin for other fluorescent dyes, sensitive towards many biologically relevant anions, such as deprotonated amino acids, nucleotides and drugs. With this aim, we plan to systematically screen several known fluorescent dyes and to identify those which possess the widest sensitivity range towards biologically relevant anions.

Once this new method is developed, we will investigate anion transport selectivity of various artificial carriers and demonstrate that this selectivity may be altered by proper chemical modification. This could, in principle, allow selective transport of only the desired anions from a mixture.

A particularly ambitious goal of this project involves the possibility of enantioselective transport through a lipid bilayer, that is selective transport of one of the two anions, which are related to each other like mirror images. This has never been achieved before with synthetic carriers.

The development of the first direct and easily applicable assays for the detection and quantification of the transmembrane transport of a variety of biologically important anions will open new perspectives for scientific investigations. Thus far, scientists have been focused on the quest for more and more active chloride transporters regardless of whether they transport other anions or not. Owing to the new methods to study their selectivity developed within this project, it should be possible to develop ion selective transporters – highly active towards chosen anions. Such compounds could have interesting biological activity and find applications in medicine, sensor technology and separations, including the separation of mixtures of enantiomers.