Interactive Software for the study of membrane biology: lipid composition, solubilization and liposome reconstitution and characterization

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Biological membranes define cellular boundaries, divide cells into discrete compartments, organize complex reaction sequences, and act in signal reception and energy transformations. This topic is studied in all undergraduate biochemistry courses. Visualization of structures generally facilitates the understanding of many related topics of membrane composition, structures, and protein interactions but they lack in many events that occurs in membranes. Also, at the present time, animations exploring solubilization and reconstitution of membrane proteins in vesicular systems are not available.

Thus, we have developed a software named AnimaBio, in Macromedia Flash 7.0, whose principal objective was the animation of some processes used in the study of membrane biology and it was didactically divided in: (1) composition and physics properties; (2) construction of systems mimetically to natural membranes and (3) characterization of these biomimetic systems using experimental examples.

The topics explained in each section were: (1) Membranes composition; lipids and proteins distribution; fluid mosaic model; the basic structural unit of lipid bilayer; peripheral proteins; anchored proteins; integral proteins; covalently attached oligosaccharides; solubilization of proteins and hemolytic effects; (2) construction of biomimetical systems using different techniques; sonication followed by direct insertion of proteins and co-solubilization methods; (3) Kinetic properties of the enzyme, reconstituted in the vesicular system, using examples of actions of different agents such as: inhibitors, detergents, ionophores and photosensitive dyes. All topics were illustrated in the animation using some examples such as: erythrocytes membranes; alkaline phosphatase (which have a GPI anchor) and integral proteins such as Na,K-ATPase.

AnimaBio has many animations exploring some fragile concepts and each part was also explained in a text. Some items were enriched with glossary definitions, compound structures and technical terminology. This approach allows the student to have a non-fragmented view of membrane biology and to understand the importance of a given interaction of lipid and protein as a whole. Thus, the software provides a non-passive study facilitating the comprehension of this important topic in the biochemistry course and also motivating the student to search the literature for similar examples. Supported by: FAPESP, CNPq and CAPES