5. Electrochemistry of proteins and of biomimetics

- Protein electrochemistry

Protein electrochemistry field is obviously the foundation of the GFB, and progresses thanks to the complementary nature of electrochemists and biologists bringing together. Thus, not more than a decade ago, bioelectrochemistry only consisted in the study of about ten kDa redox proteins with one active site. Nowadays, intra and intermolecular electron transfers are resolved within redox proteins more than hundred kDa, and harboring more than one cofactor.

This domain is currently fully blossoming as a result of the necessity, before any biotechnological development, of a better understanding and control of the kinetics of the intra and intermolecular electron transfers, and the structural parameters of proteins and enzymes governing their immobilization on solid supports such as electrodes. This domain takes profit from fundamental and technological progresses in the fields of biology and materials, allowing mastering and modifying the protein and the electrode at the same time. The knowledge advance in protein electrochemistry has and will have great spin-offs in fields as various as biosensors (health, environment, food…), biofuel cells and bioreactors.

- Biomimetics

Biomimetics is fully complementary to electrochemistry of proteins. Building a biomimetic model can allow validating the hypothesis on a biological system functioning, on one hand, and developing catalysts which performances are close to those of enzymes, on the other hand, with occasionaly the advantage of stability and easier production. In particular noticeable advances were obtained with models inspired from hydrogenase, the key enzyme of hydrogen conversion. These models are likely to be used as biocatalysts in H_2/O_2 biofuel cells. The synthesis of models of the active site of the Center of Release of Oxygen in plants, for the electrolysis of water, is also to be quoted. Besides many oxygenases inspire the synthesis of biomimetic molecules suited for eniantoselective catalysis.