Christmas Lecture

December 17, 2009

19.00 h

Conference Room of Building C,
Technology Park, San Sebastian

Invited Speaker:

Oscar Millet, PhD

"Structural basis for the enzyme adaptation to hypersaline environments. Proteins with a pinch of salt."

Life on earth exhibits an enormous adaptive capacity and living organisms can be found even in extreme environments. The halophilic archaea are a group of microorganisms that grow best in highly salted lakes (with KCl concentrations between 2 and 6 molar). To avoid osmotic shock, halophilic archaea have the same ionic strength inside their cells as outside. All their macromolecules, including the proteins, have therefore adapted to remain folded and functional under such ionic strength conditions. As a result, the amino acid composition of proteins adapted to a hypersaline environment is very characteristic: they have an abundance of negatively charged residues combined with a low frequency of lysines (1). We are interested in the relationship between this biased amino-acid composition and protein stability as well as in enzyme activity. First, using extensive mutational studies on the protein surfaces, we show that it is possible to decrease the salt dependence of a typical halophilic protein to the level of a mesophilic form and engineer a protein from a mesophilic organism into an obligate halophilic form (2). NMR studies demonstrate complete preservation of the three-dimensional structure of extreme mutants and confirm that salt dependency is conferred exclusively by surface residues.