

Evolution – and Involution – of Calcium Signaling

Claudio Luchinat

Magnetic Resonance Center – CERM – University of Florence, Via L. Sacconi, 6 – 50019 Sesto Fiorentino, Italy

A true understanding of life processes will imply not only knowing the identity of all the molecules involved (e.g., the complete genome of the organism, if we limit ourselves to proteins), their 3-dimensional structure, the identity of the partner molecules with which they interact, but also the dynamics of such interactions and possibly the time frame in which the interaction takes place. Tremendous progress has been made in the last few years in understanding the function of many proteins at the molecular level, but the progress has been faster where the key to understand the function is the structure of a single protein, and slower where the key lies in the structural and dynamic features of the interaction with the physiological partner. Calcium signaling is a good example of the latter challenge. In all cases signaling requires the dynamic interplay between calcium ions and their receptor molecules, and the interaction of the latter with one or more partners.

The recent progresses made by us at CERM in the structural and dynamic characterization of proteins involved in calcium signaling will be reviewed, and some implications of these findings in the broader frame of the evolution of calcium signaling will be highlighted. Some of the methodological developments necessary to tackle this task have also been exploited to help understanding the dynamics of other metalloproteins and their functional implications.