

Ciclo di incontri – Tavolo di discussione

THE VOLTAGE SENSOR OF THE NERVE SIGNAL: A DEVICE IN THE HIERARCHY OF LIFE

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Biological channels are often proteins with a specific piece of machinery that responds to voltage, called the voltage sensor. The voltage sensor moves charges through an electric field creating a polarization (i.e., dielectric) current that is an essential part of the hierarchy of structures that produce signal of nerve cells. We have built an electromechanical model of the voltage sensor based on its atomic scale structure that fits a wide range of experimental data.

A crucial role in the hierarchy is the link between atomic scale motions of the voltage sensor and the voltage across a membrane some 10^{21} atoms away from the channel. This voltage can never be simulated in atomic detail by molecular dynamics because it involves too many atoms and too many interactions to ever be calculated. Maxwell's equations provide the link between atoms and axon. They enforce the perfect conservation of current entirely independent of the dielectric or material properties of the axon or its components or contents.

Physical scientists designing voltage sensors might want to start with devices that mimic what has evolved in living systems.

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