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The Principles of Organization of Calcium Signal in Eukaryotic Cells

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Ionized calcium (Ca²⁺) is a universal signaling element that transmits an extracellular stimulus from the surface of cells to intracellular structures and molecules. Ca²⁺ regulates many cellular processes, including gene transcription, proliferation, differentiation, secretion and apoptosis. The key to this pleiotropic activity is the complex spatiotemporal organization of the rise of intracellular Ca²⁺ (Ca²⁺ signal), which, acting on certain effectors, initiates specific signaling events in the cell. Violation of the mechanisms responsible for the regulation of cellular Ca²⁺ or exceeding stimulation of receptors leads to cell death. The review article addresses the main mechanisms underlying the cellular organization of Ca²⁺ signals. A brief retrospective of the development of modern concept of Ca²⁺ signaling and its role in the vital functions of the organism is presented. Special attention is given to the basic intracellular systems that provide the organization, spatio-temporal regulation and encoding of Ca²⁺ signals.

Keywords: Ca²⁺ signaling, Ca²⁺ microdomains, InsP3R, RyR, and NAADP receptors, Ca²⁺ channels of VOCs, TRP, CRAC