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Structure and function of MS channels in bacterial cells: From biophysics to applications in medicine

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Mechanosensitive (MS) channels detect and transduce mechanical stimuli into specific electrical and/or chemical intracellular signals. Since the first report on the discovery of MS channels in bacteria, multiple types of MS channels have been identified in *E. coli*. Based on their primary structures they can be separated into two different subfamilies – the mechanosensitive channel of large conductance (MscL) subfamily - and the mechanosensitive channel of small conductance (MscS) subfamily. Physiological function of MscL and MscS can be clearly correlated with their structural and electrophysiological properties. Bacteria exposed to hypo-osmotic shock rapidly release cytoplasmic contents into the surrounding medium via MscL and MscS, indicating that they function as osmotically activated emergency valves. Multidisciplinary approaches used in experimentaland theoretical studies following the cloning and crystallographic determination of the MscL and MscS 3D structureinclude electronparamagnetic resonance (EPR), NMR and Förster resonance energy transfer (FRET) spectroscopy aided by computational modelling, which significantly advanced the understanding of structural determinants of the gating and conduction properties of these MS channels. These extensive multidisciplinary studies of MscL and MscS have greatly contributed to our understanding of basic physical principles and evolutionary origins of the mechanosensory transduction in living organisms. In addition, the studies of bacterial MS channels opened novel opportunities to applying the acquired knowledge in medicine by developing novel types of antibiotics targeting MscL- and MscS-like channels in bacterial pathogens.

Biography

Boris Martinac is an experimental biophysicist. He majored in physics from the RWTH Aachen University in Germany where he also received his Ph.D. degree in biophysics. He has been internationally known for his pioneering studies of ion channels in microbes, particularly the discovery, cloning and structural and functional characterization of mechanosensitive ion channels in bacteria. He has received numerous honors and awards including his recent election to the Fellowship of the Australian Academy of Science. He has published over 130 papers in reputed journals and has served as an editorial board member of five international journals.

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