A special issue on physiological aspects of mechanosensing

Patrick Delmas · Bertrand Coste · Eric Honoré

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Perception of mechanical stimuli is critically important for sensing the surrounding environment. As Aristotle pointed out in 350 BC (*De Anima* 3.12, 434b—1ff), all living organisms, from bacteria to mammals, rely on mechanosensation for their survival. A unicellular paramecium, navigating its way through a chaotic environment, relies on mechanosensitive proteins to avoid obstacles. The cricket escapes the spider by possessing incredibly sensitive hairs, which are able to pick up the faintest change in air flows. Crocodiles are dotted of thousands of highly sensitive mechanosensory receptors that enable them to sense the movement of their preys through vibrations in the water. Examples are endless in the animal kingdom. In humans, mechanosensation constitutes the physiological foundation for the senses of touch, pain, and hearing for regulation of multiple autonomic functions and for social exchange [4, 8–11].

Mechanosensation is ubiquitous in biological systems. Primary mechanosensitive processes have probably evolved as backup mechanisms for cell protection during osmotic swelling. Through evolutionary pressure, a number of mechanosensory structures have then emerged to accomplish a wide array of specialized tasks, ranging from cellular homeostasis to our ability of hearing and discriminative touch. Thus, mechanosensory structures exhibit some sort of homoplasy, all being specialized in the detection of force-related stimuli but arising from different evolutionary origins.

The importance of mechanosensory inputs for the existence of life justifies the effort made to understand its molecular origin(s). The basis for cell mechanosensation is a coupling of external mechanical forces to the chemical reactions that occur within the cell. This process is called mechanotransduction. The primary mechanism has been linked to activation of ion channels, which is required for sensing mechanical signals in bacteria and sensory cells of vertebrates and invertebrates [2, 6, 14, 16, 17]. However, it is now widely accepted that mechanotransduction is more than merely mediated by ion channels and mobilizes a wide spectrum of protein-protein and protein-lipid interactions that can regulate cell functions and fate [5, 15].

With the accumulation of new knowledge pertaining to the effects of external mechanical loads on a variety of cells and organs, our understanding of the fundamental principles of mechanosensation is rapidly improving. Accordingly, we have focused this special issue of *Pflügers Archiv, European Journal of Physiology* on mechanosensing to provide an update on the current status of knowledge in the field. We have invited world leaders and experts to discuss on the many aspects of mechanosensation. As evidenced by the contributions in this special issue, significant progress has recently been made in identifying molecular mechanisms underlying mechanotransduction in different cell types. Essential force-transducing channels have been identified in bacteria and invertebrate organisms [2, 4, 17]. Multiple mechanosensory protein complexes have also been described in cardiac myocytes [7], skeletal muscles [1], and vascular cells [12]. Although, the sensations of touch and hearing remain without a clear understanding of their molecular basis, we are now beginning to uncover molecular players that govern the mechanosensory functions of these receptors [3, 4, 6, 8, 10, 11, 13, 16]. We hope that these new insights into mechanosensation will be helpful to all those interested in understanding how we interact with our physical environment.

P. Delmas · B. Coste
Ion Channels & Sensory Transduction, Aix-Marseille-Université,
CNRS, CRN2M-UMR 7286, 13344 Marseille, France

E. Honoré
Institut de Pharmacologie Moléculaire et Cellulaire, LabEx ICST,
UMR 7275 CNRS, Université de Nice Sophia Antipolis, Valbonne,
France
e-mail: patrick.delmas@univ-amu.fr

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