Special Issue *"TRP channels: their functional roles in medical sciences"*
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Preface

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Preface of Special Issue "TRP channels: their functional roles in medical sciences"

Etsuro Ito[1,*]

[1]*Kagawa School of Pharmaceutical Sciences, Tokushima Bunri University, Sanuki 769-2193, Japan*

Transient receptor potential (TRP) channels are nonselective cation channels (mainly Ca^{2+}) that play critical roles as cellular sensors, including contributions to vision, taste, olfaction, hearing, touch, and thermo-, chemo- and osmosensation. The activation of a TRP channel changes the membrane potential, translocates important signaling ions cross the cell membrane, alters enzyme activity and so on. Thus, from the viewpoint of physical chemistry, studies on TRP channels have gained widespread attention for the past three decades. In fact, many review papers on TRP channels can be found in databases (e.g., see [1] as a recent review).

TRP channels are also important for human health, because some of them are involved in the pathophysiology of human diseases. To introduce the roles of TRP channels in medical sciences to biophysicists, who have known the molecular and structural biology of TRP channels very well, we have planned to publish this special issue in BIOPHYSICS. For example, the involvement of TRP channels in pain is a very hot topic in the field of medical sciences [2], as reported in an original paper by Lin and Chen in this special issue [3].

We have four papers in this special issue. The first paper was contributed by Lin and Chen [3]. They applied whole-cell patch clamp recording to understand the electrophysiological properties of TRPV1-expressing muscle afferent neurons. They showed that isolectin B4-negative TRPV1-expressing muscle afferent neurons in the dorsal root ganglia are heterogeneous and divided into two groups, one having an acid-induced sustained inward current and the other an acid-induced biphasic inward current that can be inhibited by salicylic acid. They demonstrated that the former type of neurons are distinguishable from the latter in several biophysical parameters. These properties might explain the roles of TRP channels in the development and maintenance of chronic muscle pain.

The second paper was contributed by Ho and Lee [4]. Their paper outlined the TRP channels in skin cells and described the pathophysiological importance and implications of TRP channels in human diseases. TRP channels are involved in epidermal differentiation, proliferation, barrier integration, regeneration and cutaneous immune response in the skin. In addition, the involvement of TRP channels in several diseases, such as actinic keratosis, psoriasis, Darier's disease and melanoma, was introduced.

The third paper was contributed by Hsu and Yoshioka [5]. They introduced a new concept for the relationship between the activation of TRP channels and the production of heat shock proteins, which act as molecular chaperones, in skin cells. Heat shock proteins are believed to take care of proteins from cradle to grave for the protection of cells. Thus, those authors proposed a new scheme explaining that infrared and near-infrared irradiation activates TRP channels, producing effectively heat shock proteins in living skin cells.

The fourth paper was contributed by Ito, Ikemoto and Yoshioka [6]. Their paper interpreted the thermodynamic implications of high Q_{10} of thermo-TRP channels. A high Q_{10} of thermo-TRPs requires high values of both enthalpy and entropy. This means that the activation process of thermo-TRPs resembles an unfolding process of globular proteins, suggesting that the channel structure would demonstrate a large conformational change during activation. Finally, they speculated on a role of TRP channels in cancer treatment.

We hope that these four papers offer a chance to general readers of BIOPHYSICS to gain interest in interdisciplinary studies of TRP channels in the field of medical sciences.

* Editor-in-Charge of this special issue
Corresponding author: Etsuro Ito, Kagawa School of Pharmaceutical Sciences, Tokushima Bunri University, 1314-1 Shido, Sanuki, Kagawa 769-2193, Japan.
e-mail: eito@kph.bunri-u.ac.jp

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