Symmetry breaking in biological tissues using bioelectricity

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Abstract

Directed cell migration plays an important role in fundamental multicellular processes such as morphogenesis, healing, and cancer progression. Understanding the details of migratory system in cells would provide us with a huge potential for further investigations. In such phenomena, we observe collective cell migration with electrotactic bias, highlighting the importance of cell–cell junctions. We take advantage of a specialized bioreactor with computer-controlled electrodes to investigate electrotaxis, guiding cells along electric field gradients. While biochemical cues offer insights into electric field sensing, a clear physical portrait of collective cell response remains elusive. Notably, a distinctive electric field-induced reorientation of cell bodies perpendicular to the field is observed across diverse cell types. Our research extends to explore intercellular stresses under electrotaxis, unraveling the intricate dynamics of collective cell migration within a concise framework. These findings promise valuable contributions to our understanding of motility machinery role in morphogenesis and wound healing.

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