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Short Commentary

Recent trends and future challenges in the biomechanics of soft active materials

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Contemporary research in Mechanics involves profound crosstalk among historically different disciplines such as Biology, Medicine other than more traditional ones, e.g. Mathematics and Engineering. Such an interaction emerged as a novel, vigorous and highly productive discipline, namely Biomechanics [1]. In the last twenty year, theoretical and computational foundations in Biomechanics have been posed starting from cornerstone experimental campaigns [2]. Interestingly, as our understanding of the behavior of biological tissues increased, novel and more challenging questions arise [3–7]. In particular, the today challenge faces the theoretical and computational modeling of soft active materials, which inherently involve a sophisticated multiphysics setting [4–19]. To further complicate the scenario, state-of-the-art experimental imaging allowed us to understand the microstructural organization of soft media better at different scales [20–23]. As a consequence, scientific attention is needed for the quantitative characterization of spatio-temporal multiscale features implicated in the behavior of active biomaterials [24–26].

The present short commentary aims at stimulating a vast and variegate community to enforce more scientific energies towards such a challenging arena involving a quantitative understanding of complex materials. The prerequisite is a multi-and cross-disciplinary attitude implementing the interaction among different communities that must mutually influence each other. New groundbreaking ideas are expected to arise from these interactions finally resulting in significant advances in both theoretical, computational and applied science. A profound understanding of soft active materials represents a unique opportunity to introduce novel methodologies in urgent social contexts. Renewable energies [27], recycling processes [28], biocompatible and miniaturized sensors for next-generation biomedical devices [29], innovative pharmaceutical products and therapies [30] are only a few examples. Future human-related sustainability is tightly linked to our understanding of complex biological phenomena to be imitated in intelligent engineering applications.

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