Buckled Cell-Graphene Hybrid for Electrophysiology and Therapy of Muscle

조경원[1,2], 김석주[1,2], 김대형[1,2,†]
[1]서울대학교; [2]IBS 나노입자 연구단
(dkim97@snu.ac.kr[†])

Implantable medical device for recording electrophysiological signals and for stimulating muscle have been used throughout clinical medicine. However, mechanical mismatch between conventional rigid implantable device and soft muscle tissue has caused mechanical fatigue and scarring on muscle tissue. Here, we report a stretchable medical device using cell-graphene hybrid that is composed of C2C12 myoblasts and transparent mesh-patterned graphene electrodes on a buckled elastomer substrate. The graphene electrodes stimulate and monitor electrophysiological behavior of C2C12 myoblasts *in vitro* while act as an enhanced substrate for cellular proliferation and differentiation. The buckled topology aligns C2C12 myoblasts and provide stretchability of the hybrid. This transparent buckled cell-graphene hybrid records electromyography and stimulates target site electrically and optically *in vivo*. The biotic/abiotic interface between muscle tissue and the hybrid is enhanced by the integrated C2C12 myoblasts, and their proliferation within the implanted site also provide cellular therapeutic effect. Additionally, no immune response and angiogenesis are observed on the implantation site