Biomimetics

Biomimetics or biomimicry is the emulation of the models, systems, and elements of nature for the purpose of solving complex human problems.

The terms “biomimetics” and “biomimicry” are derived from Ancient Greek: βίος (bios), life, and μίμησις (mīmēsis), imitation, from μιμεῖσθαι (mīmeisthai), to imitate, from μῖμος (mimos), actor. A closely related field is bionics.

Dura mater defect and subsequent Cerebrospinal fluid fistula usually appear in trauma or neurosurgical procedures and are followed by a series of serious complications and even death. The use of a qualified dural substitute with multifunction of leakage blockade, adhesion prevention, and dura reconstruction is one of the promising treatment methods. However, even though some products have been used in the clinic, none of the substitutes achieved the required multifunction. In a study, Liao et al. aimed to design and fabricate a dura repair composite with the ideal multifunction. By biomimicking the structure and component of natural dura, they applied L-polylactic acid (PLLA), chitosan (CS), gelatin, and acellular small intestinal submucosa (SIS) powders to successfully prepare a triple-layered composite. Then, a series of specific devices and techniques were developed to investigate the performance. The results revealed that satisfactory structural stability could be realized under good synergistic interactions among the components. In addition, all the findings suggested that the bionic triple-layered composite showed satisfactory multifunction of leakage blockade, adhesion prevention, antibacterial property, and dura reconstruction potential, and thus, it might be a promising candidate for dura repair. STATEMENT OF SIGNIFICANCE: : Developing qualified dura mater substitutes with multifunction of leakage blockade, adhesion prevention, and dura reconstruction is crucial for treating dura mater defect and subsequent cerebrospinal fluid (CSF) leakage that appear in trauma or neurosurgical procedures. In this study, we designed and fabricated a triple-layered dura repair biocomposite with satisfactory structural stability and desired multifunction based on biomimicking of the structure and component of natural dura. Moreover, a series of specific devices and techniques were developed to investigate the relevant performance. Overall, the developed hydrogel electrospinning system exhibited excellent advantages in achieving multifunction and could be applied widely in the future to achieve multifunctional tissue repair materials [1)].

1)
Liao J, Li X, He W, Guo Q, Fan Y. A biomimetic triple-layered biocomposite with effective multifunction for dura repair. Acta Biomater. 2021 Jun 9:S1742-7061(21)00370-6. doi: 10.1016/j.actbio.2021.06.003. Epub ahead of print. PMID: 34118449.