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Articular cartilage: Lamellar-repulsive lubrication of natural joints

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Abstract

This monograph attempts to explain a new joint lubrication mechanism with surface active phospholipids as a lubricant. It provides studies of the principles of cartilage (smart material) of biological micro-and nanotribology.

Book review

This monograph presents a comprehensive approach to articular surface physics and biochemistry with an emphasis laid on the lamellar-repulsive mechanism of lubrication. Frictionless mechanical interaction of the charged positively, charged negatively and neutral surfaces (cartilage/cartilage; (+/+); (-/-); neutral (±)/(±)) is strictly educational for biomechanical engineering.

The first part of the book reviews the results of structure, composition and function of the cartilage phospholipid (PL) bilayers as a potential solid lubricant. The authors' original contributions, focused on interfacial energy of PL bilayers with the emphasis lay on amphoteric character of fixed charged cartilage surfaces, are quite original.

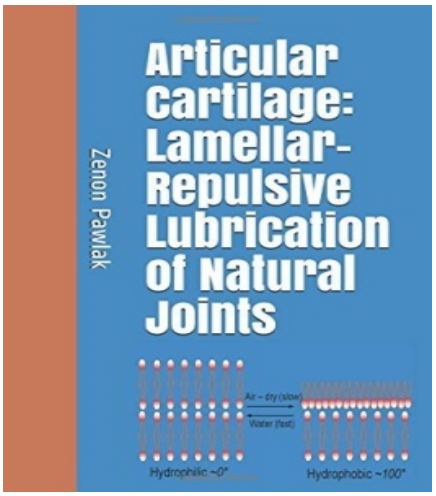
The second part of the book deals with the friction vs wettability and presents the condition of cartilage surface correlated with surface wettability (contact angle). A change in natural cartilage surface energy leads to conformational changes in the surface of bovine patella from bilayer (super hydrophilic, ~0° contact angle wettability) to monolayer (hydrophobic 104° contact angle wettability) during the process of air-drying. The biological tissue of the cartilage in its natural condition, transforming from the hydrophilic to hydrophobic condition, can be named a "smart material".

The third part of the book consists of chapters covering regeneration, resurfacing and restoration of the degraded surfaces, as well as the challenges and possibilities of achieving a biological knee repair for human patients.

All these experimental facts including surface energy, wettability, friction measurements were performed by the author when studying the boundary-layered friction supporting the lamellar—repulsive mechanism of lubrication of natural joints.

The biotribological model described in the monograph provides a new approach to the lubrication of natural joints and it certainly deserves to be learned by students. In the opinion of the Reviewer, investigations of the lamellar-electrostatic lubrication mechanism are very useful and innovative and deserve to be at the library.

This monograph is intended for advanced undergraduate and graduate students and researches active in the area of biomechanics and with biological systems, and engineers interested and involved in the sciences of nanomaterials (Glimpse of Book in Figure 1).



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Reference

1. Pawlak, Zenon (2018) Articular Cartilage: Lamellar-Repulsive Lubrication of Natural Joints, Kindle Direct Publishing, 171pp. Print-book: https://www.amazon.com/dp/B07B42P1JY, e- book: https://www.amazon.com/dp/1976760283.