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Editorial

Biomechanics: Mechanical Aspects of Biological Systems

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EDITORIAL

Biomechanics is the application of mechanics to the study of the structure, function, and motion of mechanical aspects of biological systems at any level, from whole organisms to organs, cells, and cell organelles. Biomechanics is a subfield of biophysics concerned with the mechanics of living things. The study of both gas and liquid fluid flows in or around biological organisms is known as biological fluid mechanics, or biofluid mechanics. Blood flow in the human circulatory system is a well-studied liquid biofluid problem. The Navier–Stokes equations can be used to represent blood flow in specific mathematical situations. Whole blood is thought to be an incompressible Newtonian fluid un vivo. When examining forward flow within arterioles, however, this assumption fails. Individual red blood cells have major impacts at the microscopic scale, and total blood can no longer be described as a continuum. The Fahraeus–Lindquist effect occurs when the diameter of the blood artery is only slightly greater than the diameter of the red blood cell, resulting in a reduction in wall shear stress. However, as the blood vessel's width shrinks more, red blood cells are forced to squeeze through it and can only flow in a single file. The inverse Fahraeus–Lindquist effect happens in this scenario, and the wall shear stress rises. Human respiration is an example of a gaseous biofluids problem. Insect respiratory systems have recently been explored for bioinspiration in order to create better microfluidic devices.

The study of friction, wear, and lubrication in biological systems, particularly human joints such as hips and knees, is known as biotribology. These processes are generally investigated in the context of contact mechanics and tribology. The effect of rubbing two surfaces against each other on either surface is determined by friction, wear, and lubrication at the point of contact. During daily activities like walking or stair climbing, the femoral and tibial components of knee implants, for example, rub against each other. If the tibial component's performance needs to be evaluated, contact mechanics and tribology concepts are employed to determine the implant's wear performance as well as the lubricating effects of synovial fluid. Analysis of subsurface damage caused by two surfaces coming into contact during motion, i.e. rubbing against each other, is another part of biotribology, as seen in the evaluation of tissue-engineered cartilage. Comparative biomechanics is the study of non-human species using biomechanics, whether to learn more about people (as in physical anthropology) or to learn more about the roles, ecology, and adaptations of the species themselves. Animal movement and feeding are common research topics because they have strong links to an organism's fitness and impose substantial mechanical demands. Running, jumping, and flying are only a few examples of animal movement.

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