Comparative Biomechanics: Lifes Physical World by Steven Vogel

Why do you shift from walking to running at a particular speed? How can we predict transition speeds for animals of different sizes? Why must the flexible elastic of arterial walls behave differently than a rubber tube or balloon? How do leaves manage to expose a broad expanse of surface while suffering only a small fraction of the drag of flags in high winds? The field of biomechanics--how living things move and work--hasn't seen a new general textbook in more than two decades. Here a leading investigator and teacher lays out the key concepts of biomechanics using examples drawn from throughout the plant and animal kingdoms. Up-to-date and comprehensive, this is also the only book to give thorough coverage to both major subfields of biomechanics: fluid and solid mechanics. Steven Vogel explains how biomechanics makes use of models and methods drawn from physics and mechanical engineering to investigate a wide range of general questions--from how animals swim and fly and the modes of terrestrial locomotion to the way organisms respond to wind and water currents and the operation of circulatory and suspension-feeding systems. He looks also at the relationships between the properties of biological materials--spider silk, jellyfish jelly, muscle, and more--and their various structural and functional roles. While written primarily for biology majors and graduate students in biology, this text will be useful for physical scientists and engineers seeking a sense of the state of the art of biomechanics and a guide to its rather scattered literature. For a still wider audience, it establishes the basic biological context for such applied areas as ergonomics, orthopedics, mechanical prosthetics, kinesiology, sports medicine, and biomimetics.

My Personal Review:
I had read one of the author's previous books, 'Life in moving fluids,' several years ago as part of a biomechanics course. I liked it, so when I saw this book I had high expectations. After reading it, I was not disappointed.
There is a very nice mix of developing basic concepts (e.g. buoyancy or fluid flow) and how living organisms use these in their daily lives (e.g. a fish's swim bladder or a bird's wing).

These general arguments are obviously important for addressing a great number of questions. From paleobiology, could pterosaurs fly or just glide? How fast could a T-Rex run? Why are there so few surface swimming animals? Some other interesting facts he presented were: how spiders use hydraulic force to extend their legs, why gliders tend to have long thin wings, how cell metabolism rate varies with organism size (I was aware of the mouse-elephant curve, but was quite surprised to hear this), hearts have self-triggering muscles and that some fish have their eyes located in a position such that the pressure does not vary with swimming speed (important so that the focal point does not change).

Some of the physics presented was interesting even outside of its use in biology. In my experience fluid dynamics is not covered much in physics, mainly just Bernoulli's equations and Reynolds number. I think most physicists would improve their understanding and intuition of fluid dynamics by reading this book. The materials topics, like crack propagation, were also interesting.

The book covers the basics of Newtonian mechanics (and things like units and dimensional analysis) used throughout the book. I skipped these chapters so I cannot comment on whether they provided an adequate background for the remainder of the book.

Needless to say, I liked this book a lot. I liked both coverage of the general principles and the specific cases used to illustrate them.

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