Animal Mechanics

R. McNeil Alexander
Univ. of Wash. Press, Seattle 1968.
$9.50

With the increasing interest in biophysics on the part of physicists comes the need for appropriate review books for those who wish to move into biophysics. I have taught an introductory biophysics course twice, and have thereby become painfully aware of the dearth of good general biophysics books that both physicists and biologists can respect. R. McNeil Alexander's book essentially stands alone as such a book in the field of biomechanics.

The arrangement of the material into subject areas (force and energy; joints and mechanisms; elasticity and viscosity; strength; pressure, density and surface tension; motion in fluids; vibrations and changing forces) is especially well suited for physicists. For each area the author briefly reviews the relevant background physics at appropriate points and then proceeds to apply the physics to relevant and diverse biological situations. The mathematics used is mostly algebra and trigonometry, although some calculus is used. I have found that the few parts using calculus can be skipped by a biology student who is weak in calculus without impairing his ability to proceed through the rest of the book.

Some interesting representative applications covered in detail are why a pinnate muscle can exert more force than a parallel-fiber muscle of equal mass, how the human arm muscles are utilized in various arm motions, how kinematic chains are involved in wing rotations as a fly flaps its wings, how a catfish utilizes friction to keep its dorsal spine in an erect position, why bones are hollow, how bracing is used to reduce stress in bones, how swim bladders are used for both swimming and enhancing hearing in fish, how surface tension enables some insects to live under water, how various birds and insects fly, and how bats variously use sound for navigation. The author has done original research in many of these areas and there are copious references to the research literature and many diagrams illustrating the applications, although greater attention to labeling and explanation of the diagrams would be helpful.

The major deficiency of the book is its almost complete neglect of blood flow. Many of my students have expressed a desire for more applications to the human body. Some minor points of improvement would be to separate out more of the equations from the textual material, to box in the equations that are used most extensively in the applications, and to have appendices that derive or discuss some of the more difficult theory; for example, the second moments of area, birefringence, the aerodynamic equations and forced vibrations.

Animal Mechanics is the most interesting mechanics book I have seen. I have used this book in a Keller Plan biophysics course and have found the students to be highly satisfied with it as a text. The biological applications of mechanics in this book could be used to great advantage in spicing the usual introductory or intermediate mechanics courses.

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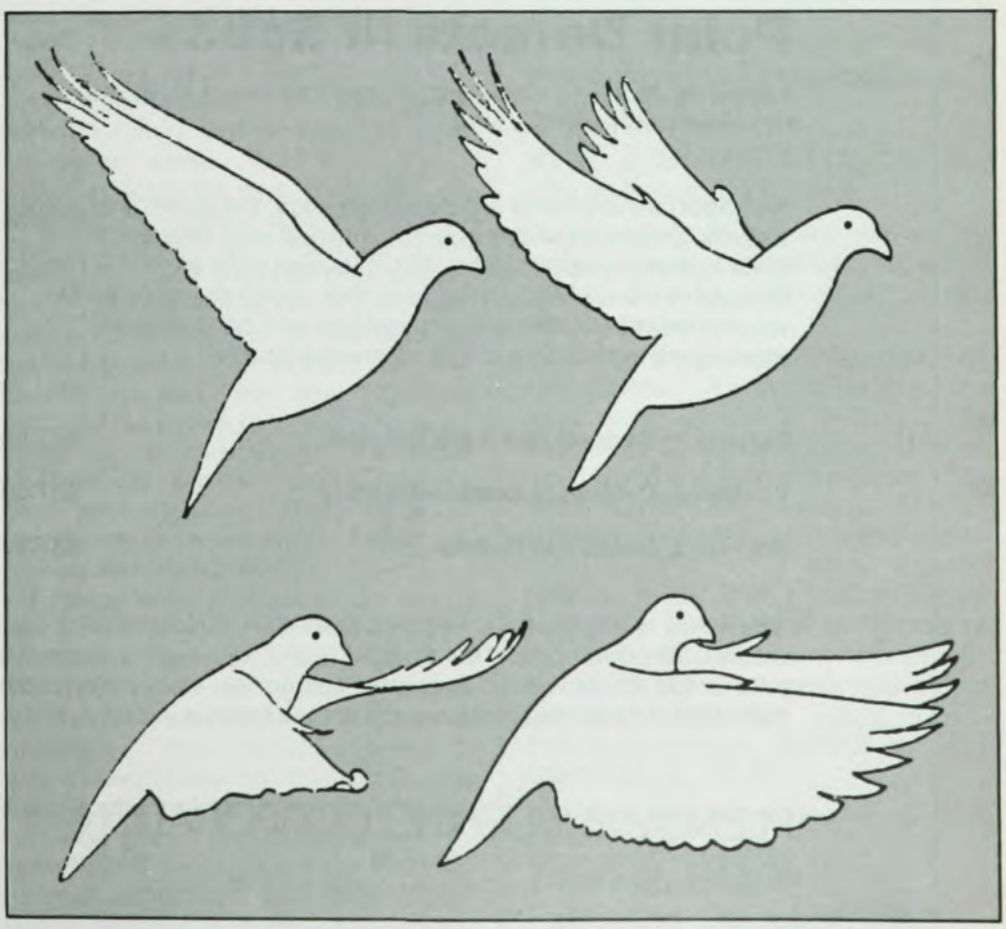
Introduction to High Energy Physics

Donald H. Perkins
353 pp. Addison-Wesley, Reading, Mass., 1972. $12.95

As high-energy physics is the concern of a large fraction of working physicists (and the sink of an even larger fraction of money invested in physics research) it is doubtless appropriate that advanced undergraduate or beginning graduate physics students receive some introduction to the subject. There is, unfortunately, a dearth of textbooks suitable for this task. By its very existence, then, Donald H. Perkins's *Introduction to High Energy Physics* is one of the most useful texts in the field.

The book is adapted from lectures delivered by the author at Oxford University and, indeed, reads much as a sequence of lectures. As a lecturer Perkins must be commended for his selection of topics and organization of material. The book delves into aspects of the weak, electromagnetic and strong interactions after prefatory chapters on conservation laws and symmetries and experimental technique. A happy product of the author's bias as a working experimental physicist is a strong emphasis on the phenomenological approach. It is possible in this fashion to cover a vast amount of material with a minimum of mathematical formalism. The discussion is generally clear and accurate, and—for a book on a rapidly evolving field—there are a minimum of obsolescent remarks. As an aid to the student, problems are given at the end of each chapter with a discussion of their solutions provided in an appendix.

The range of topics covered is really remarkable for a text of 300-odd pages. There is hardly a topic of current interest that does not receive some dis-



Outlines of the stages of motion of a pigeon flying slowly. The illustration, used in a discussion of the physics of bird flight, is from *Animal Mechanics* by R. McNeil Alexander.