Biomechanics of Motion, CISM International Center for Mechanical Sciences Courses and Lectures No. 263, ed. by A. Morecki, Technical University of Warsaw. 74 figures (1 colored) 217 pages, soft cover, $18.50. Springer-Verlag, Wien, New York, 1980.

This book contains 6 papers presented at a course held at CISM in Udine, Italy, on September 18-22, 1978. The Editor states that “all language corrections and alterations have been reduced to the necessary minimum”; and it shows some articles could stand some improvement in language.

I find the articles by Necip Berme, entitled “Control and Movement of Lower Limbs” (pp. 185-217) very lucid and informative. It discusses movement and force patterns, measurement techniques, EMG activities, joint loads, and control.

A paper by Robert McGhee, entitled “Computer Simulation of Human Movements,” (pp. 41-78), is also lucid. It presents modeling of human body as an inverted pendulum. Various ways of writing down equations of motion and improving the accuracy by increasing the degrees of freedom are shown in some detail. Applications of the method to posture studies, gait, and vestibular mechanism are discussed very well.

A paper by Antonio Pedotti, entitled “Motor Coordination and Neuromuscular Activities in Human Locomotion” (pp. 79-129) analyzed a model of the leg and foot, and compared theories with EMG activity measurements. A table presents data on various muscles of the leg: their mean length, fiber length, cross-sectional area, maximum velocity, maximum isometric forces, and constants in Hill’s equations (p. 113). Methods used in clinical practice are presented.

Hannes Schmidl’s short paper on “Improved Functions due to Progress in Upper Limb Prostheses” (pp. 169-183) presents the current state of the art. The focus is on exploitation of muscle potential as the means of control of the movement of the upper-limb prostheses, and on the future use of nerve potential for the control of prosthesis.

Richard C. Nelson’s paper on “Sport Mechanics” (pp. 131-167) described a laboratory computer system and its use in applied research in sport. Many examples are given.

The article by the editor, Adam Morecki, “Identification, Modeling, and Rehabilitation Problems in Modern Biomechanics,” is rather sophisticated. Perhaps because it touches on many topics, it is not very easy to understand.

The CISM course was attended by only 22 persons. I am glad that the lecturers took the time to write up this book for wider dissemination.

Reviewed by
Y. C. Fung, UCSD, La Jolla, Calif.


This is a translation of a classic in biomechanics. It is a collection of 22 original papers by Pauwels. The first paper was published in 1935, the second in 1940, . . . , the last seven in 1965-1976. In this series, one can see the author’s penetrating analysis of biomechanics from a surgeon’s point of view, and the gradual changes in his thoughts about the basic biomechanical factors affecting the healing of bone fractures and the functional remodeling of bone.

On pp. 1-105, (original work published in 1935), Pauwels used the puzzling fractures in the femoral neck to demonstrate the importance of biomechanical considerations. He showed that the fractures of the femoral neck may be classified into three types on the basis of the stresses acting on the surface of fracture imposed by the muscles and the weight of the body. Let $a_s$ denote the normal stress acting on the fracture surface, and $\tau$ denote the shear stress. Let $f$ be defined as the shear stress due to static friction when $a_s$ is compressive, $f = \mu a_s$, $\mu$ being the coefficient of friction. Then Pauwels three types of fractures are:

- Type 1: $a_s < 0$ (in compression), $\tau < f$
- Type 2: $a_s < 0$ (in compression), $\tau > f$
- Type 3: $a_s > 0$ (in tension).

In a fracture of type 1, the stress acting on the fracture surface is compressive and the shear stress is small. If the stress state is of this type over the entire surface of the fracture, the fracture usually heals by itself into a bony union without treatment.

Fractures of type 3 usually will not form a bony union. Apparently healed fractures of this type often progressively evolve into a pseudoarthrosis (like a joint) after being loaded.

A fracture of type 2 is one of generally pessimistic prognosis with respect to healing.

The healing of a fracture in the femoral neck is very different from that of a long bone (such as a diaphyseal fracture). In the latter, a collagenous periosteal callous will develop first to take up any tensile stress if it exists. In the femoral neck, no such periosteal callous will form. The healing of the femoral neck relies on the medullary healing tissue.

The question is how does the medullary healing tissue develop. It is known that the new tissue can develop into either a connective tissue, or a cartilage, or a bone. If it chooses to become a connective tissue or a cartilage, then the fracture will become a false joint. If it chooses to become bone, then the fracture will be healed.

It is the contribution of Roux and Pauwels to recognize that the guiding principle for the determination of the direction of development of the healing tissue is the stress acting on it. Roux (1895) formulated the following hypotheses: tensile and shear stresses provoke the formation of connective tissue. Friction or shearing movement leads to the formation of cartilage. “Functional” compression (defined as a periodically varying compressive stress) provokes bone formation.

Pauwels (1980, pp. 1-105) at first believed in Roux’s hypotheses. Then he expressed doubts (1980, pp. 106-137) about Roux’s theory because of an observation made by St. Krompecher (1937). Finally he presented a theory (1980, pp. 375-407) based on the following hypothesis: elongation and hydrostatic “pressure” are the two specific stimuli for the...

Interest in "enzyme engineering" has grown continuously over the past decade. This somewhat nebulous term has come to mean the use of enzymes, cellular organelles, or intact whole cells that have been immobilized by attachment to supports as specific catalysts in certain chemical processes. The range of applications of enzyme engineering has become quite broad, including such areas as biology, medicine, energy, agriculture, food and beverage processing, and the chemical industry. The term was originally proposed at the First International Enzyme Engineering Conference held at Henniker, New Hampshire in the Summer of 1971. As a new graduate student, this reviewer was present at that meeting and shared a sense of excitement about the potential of this technology. This volume containing the work of 170 individual authors is based on papers presented at the Fifth International Enzyme Engineering Conference and is evidence of the partial fulfillment of this potential. A keynote paper by E. Katchalski-Katzir outlines some of the past achievements in enzyme engineering and prophesies about future developments and trends. The rest of the book is a compilation of 84 short papers (average length, four pages), divided under the subsections of enzyme production, energy, biomass conversion, biomedical and analytical applications, large-scale reactor systems, immobilized cells and organelles, and enzyme engineering in the synthesis of fine chemicals. This book imparts an appreciation for the diversity of the applications of enzyme engineering and the ingenuity of some of the workers in the field. Although the reader will have to turn elsewhere for a deeper understanding of most of the subjects, a text of this sort written at the appropriate time is of value and deserves a place on the practitioner's bookshelf.

Reviewed by
Y. C. Fung, UCSD, La Jolla, Calif.

Cell Motility, ed., Robert D. Allen, Dartmouth College; Hanover, N.H., published by Alan R. Liss, Inc., Vol. 1, 1980/81; price: $60.00 personal; $80.00 Institutional subscription, U.S.

This new quarterly journal is devoted to publication of original investigations on the spontaneous motion of single cells and all its related phenomena. The editor invites contributions made by cell structural, biochemical, biophysical, and theoretical approaches. In addition to original research reports the journal will also publish invited reviews, brief communications, book and film and meeting reports.

It is the objective of the editor to provide with this journal, a center forum for the discussion to cell motion which in previous years, has been scattered in several other biological journals. What use can this journal be to the Bioengineer? Although the bioengineering discipline has made important contributions to the understanding of the swimming motion of micro-organisms or muscle contraction, other important fields related to cell motility have been given little attention. These include the amoeboid movement, tissue cell movements, movement during mitosis, cell cytoplasm rheology, axoplasmic transport, or cytoplasmic streaming, to name a few phenomena which this new journal hopes to address. The variety of experimental approaches and multitude of cellular systems which are listed in the first volume is impressive. These are a multitude of problems that require an engineering analysis. Bioengineers may find the contributions in Cell Motility stimulating, suggesting new areas of research, and a source for the current understanding of its biochemistry and biophysics.

The quality of the research publications and reviews in Cell Motility is excellent. The photographic reproductions are first-rate and the outlay of the individual contributions is well structured and clear.

Reviewed by
Geert W. Schmid-Schoenbein, Ph.D., A.S.L.S.A.
Assistant Professor
Applied Mechanics, Engineering Sciences
and Bioengineering
UCSD, La Jolla, Calif.


Substantial advances in our knowledge of the microcirculation in recent years have led to the publication of a number of detailed treatises directed in the main to specialists in the field. The compact volume by Wiedeman, Tuma and Mayrovitz is intended to serve as a primer to bridge the gap between the overly simplified treatment of the subject in textbooks of physiology and the in-depth coverage of selected aspects in monographs. As such, the book meets a real need, in view of the increasing importance of an understanding of microcirculatory behavior in modern concepts of medicine and pathology.