Murat–Tartar–Lurie–Cherkaev (MTLC) theorem stated in sections 2.6 and 2.7. In particular, given a macroscopic behaviour, it is easy to see whether microstructure can be manipulated to achieve it. This is indeed an exceptional result and there are not many such results in the literature. This constitutes what is known as the G-closure problem of homogenization. The MTLC theorem is the only point at which the book makes contact with inverse problems of homogenization, a topic which has seen tremendous developments in physics (optics) and engineering (materials science) in recent years. Some of the keywords in this topic of research are metamaterials, transformation optics, cloaking, superlenses, negative refractive index materials, etc.

There are often surprises at the end of the homogenization process. The resulting model may possess properties very different from the original one. For instance, it may be nonlocal, although the initial model is a local one. In other words, nonlocality may arise because of small scales. Anisotropy results when isotropic phases are arranged in laminate microstructure. Other surprises include: a composite with negative Poisson ratio while individual phases have positive ratios and a composite with negative thermal conducting coefficients made up of individual phases with positive coefficients. Also bubbly microstructure in a fluid attenuates the acoustic waves in it. All these surprising behaviours are of course due to the microstructure inside the composite. Similarly, this book describes its share of surprises. One of them is the so-called Taylor dispersion in a pipe flow: it represents the enhanced diffusion of a passive scalar in the longitudinal direction which is due to the shear microstructure in the velocity field in the transverse directions.

The MTCL theorem is presented in sections 2.6 and 2.7 by following a procedure and a language accessible to many scientists. In fact, this is the strategy followed by the authors throughout the book. Mathematical theory of homogenization is dominated by various sophisticated concepts of convergence, which are totally avoided by the authors. One of the aims of the book is to make some subtle ideas of the theory accessible to a larger community of scientists and the aim is largely fulfilled.

Quite often, the unknown field in the problem is characterized by an optimization principle in mechanics. Constraints may also be present in the optimization process. Such problems are of wide interest in mechanics. But unfortunately, such models are not treated in this book. Equations which are not in divergence form may not be of much relevance in continuum mechanics because its equations are based on conservation laws. But homogenization theory of non divergence form equations is a fascinating story in applied mathematics. Models containing weak randomness, weak nonlinearity and Bloch wave method are merely touched upon in the text. Maybe, each one of these topics deserves separate texts for more elaboration.

The book is written in a style useful and accessible to engineers and scientists. One finds various physical and mechanical interpretations useful to them. Abstraction is absent, but concrete examples are found in plenty. Language of appropriate convergence concept (a dominant theme in applied mathematics) is totally avoided. One original aspect of the book: in each example, the authors perform nondimensionalization on the model to find the relative importance of various terms of an equation under the considered physical situation. This is an important step usually avoided in other texts. This step is important to see how and where small parameter appears in the equation. In applied mathematics texts, this step is usually taken for granted and one starts directly with the equation with small parameter.

Described above are some of the highlights of the book as well as some of its drawbacks. In the existing literature on homogenization, one sees texts of completely mathematical nature or completely meant for engineering use. There are not many which lie in between and the present book is one of them. Consequently, it is a welcome addition which may be fruitfully used by all communities of scientists: applied mathematicians, physicists and engineers.

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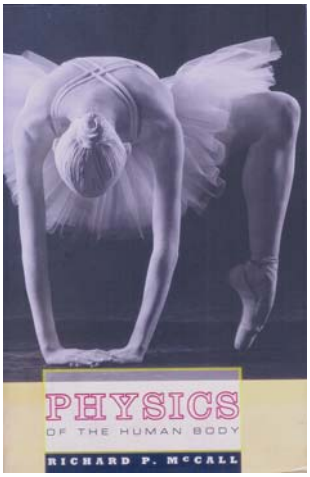

Physics of the Human Body. Richard P. McCall. The Johns Hopkins University Press, 27/5 North Charles Street, Baltimore, Maryland 21218, USA. 2010. xvi + 153 pp. Price: US$ 25.00. Paper back; US$ 75.00 hard cover.

Understanding the human body in terms of physical processes is as old as ideas about modern medicine. And yet, it is only recently that the old problems have begun to be re-examined, in the light of material science, biomechanics, rheology and bioelectricity. In that regard the book under review is a timely one. The author, Richard McCall, attempts to cover a huge amount of ground – from classical and fluid mechanics, through energetics, sound, light and electricity and even radiation, ending with pharmaco-kinetics. The author states at the outset that he has not written a textbook, although the book does attempt to cover a wide variety of topics. Each chapter is structured to begin with an introduction to the basic physics concepts, assuming only high-school physics, followed by a section on the human physiology associated and ending with associated medical conditions and diseases. The emphasis, as stated by the author, is on concepts and not so much on mathematical treatment of a topic.

On the topic of classical mechanics, the author attempts to connect everyday mechanical processes by the body to illustrate concepts. Blood, the heart and circulation form the bulk of the chapter on fluid mechanics, while briefly touching on other systems – the flow of air through the lungs, humors of the eye and fluids in the bladder and brain. The production and dissipation of energy in terms of heat begins with ideas from

kinetic gas theory and ends with body temperature. The human auditory system considers some basic concepts of sound, ending with defects in hearing. The treatment of electricity extends from Coulomb's law to neuronal action potentials. The nature of light and a geometric optics approach to vision is followed by a basic treatment of radioactive decay and its use in diagnostics and therapy. The book concludes with a chapter on pharmacodynamics based on compartment models. Here the mathematical aspect of differential equations is a bit more fleshed out. A notes section provides some cross-references for further reading in a chapter-wise manner.

If you have not read anything about the topic before, this book might whet your appetite. On the other hand, the reader may find many of the new and exciting results missing, such as the mechanics of barefoot versus shoe running (toe-first versus heel-first)[1] and non-Newtonian flows of blood[2]. Other books by the same name exist, and one of them by Irving P. Herman[3] deals with the subject in greater depth.

The book by McCall will serve well as an introductory source book on physics concepts and how they apply in normal and diseased functioning of the human body. The detailed chapter on pharmacodynamics will probably be an attractive and useful aspect of the book for referring to the various modes of modelling drug delivery and kinetics in the body. The target audience could well be interested high school and college students of pharmacy and biology as well as a interested layperson who wants to know 'how things work'[4] in the machine that is the human body.

1. Lieberman, D. E. *et al.*, *Nature*, 2010, **463**, 531–535.
2. Fedosov, D. A. *et al.*, *Proc. Natl. Acad. Sci. USA*, 2011, **108**, 11772–11777.
3. Herman, I. P., *Physics of the Human Body*, Springer Verlag, 2007.
4. Selagat, R.-J., *How Things Work [Wie funktioniert das?]*, George Allen & Unwin Ltd, London, 1968.

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Annual Review of Biophysics, 2012. Douglas C. Rees, Ken A. Dill and James R. Williamson (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. 2012. Vol. 1. 613 pp. Price: US$ 89.

This volume effectively summarizes the excitement in the area of biophysics and structural biology in the past year. The choice of topics in this review is succinctly summarized in the first chapter by Peter Moore. In his essay entitled 'How should we think about the ribosome?', Moore makes a passionate case to re-examine dynamics in biological systems. Influenced, no doubt, by his sustained efforts to characterize the ribosome, he is forthright in making the case for visualizing the ribosome in action – a relevant observation for other large molecular machines as well. Most practitioners in this area of biophysics depict these mechanistic features as movies. He sounds a note of caution about this oversimplification based on static crystal structures, suggesting that this approach could lull researchers into believing these elegant visuals as factual data. He then goes on to predict that the post-structural era of the ribosome field could see more excitement and insight from kinetic measurements, thermodynamic analysis and computing than high-resolution crystal structures.

Cooperativity and allostery are two terms that link several topics in this review. From the chemo-mechanical coupling in the DEAD box helicases to the actin-binding protein, the focus, inevitably, is to understand the detached (weak) and attached (strong) binding events in these systems. This aspect is of critical importance in the case of the cyto-skeletal motors where strongly bound states are force-generating, whereas weakly bound (load-bearing) states represent intermediates that do work. Another noteworthy theme in this context is molecular machines that utilize ATP for their activity. In these systems, the ATP-hydrolysis competent and ADP-bound states are likely to be similar both functionally and structurally, but differ in their chemical states.

A significant number of articles in this volume focus on new methodologies for studies on biomolecules. These include zero-mode waveguides for single-molecule analysis by Zhu and Craighead, and a review of single-molecule enzymatics by Puchner and Gaub. These topics could well be viewed as an indicator of an evolution in structural biology with a pronounced emphasis on the characterization of biomolecules in their entire dynamic splendour. Another chapter enticingly entitled 'Biomolecular simulation: a computational microscope for molecular biology' by Dror and colleagues is particularly revealing. The authors make a compelling case for the role of molecular dynamics (MD) simulations in structural analysis. In particular, researchers new to this area would find one figure on spatiotemporal resolution very informative (reproduced here as Figure 1). Figure 1 describes different techniques demonstrating the overlap in terms of information content. Indeed, the complementarity of techniques seen in Figure 1 is the gist of studies on biomolecular structure and function at the start of this decade.

Despite changes in techniques, and modern trends to emphasize the biological relevance of structural studies and other *in vitro* analysis, some topics and research themes still retain their charm. This is exemplified by the article 'Radical use of Rossmann and TIM barrel architectures for controlling coenzyme B12 chemistry' by Dowling, Croft and Drennan. This review succinctly describes another distinct step forward in protein engineering with the goal of embedding a new function into the versatile TIM barrel fold. Another fascination that appears to have sustained biophysicists over the ages is symmetry. The article on 'Allostery and Monod–Wyman–Changeux model after 50 years' by Jean-Pierre Changeux emphasizes this by the connection he draws between symmetry and regulation. Symmetry is also the theme that governs the chapter on 'Racemic protein crystallography' by Yeates and Kent. In this review, the thesis that racemic mixtures of proteins crystallize more readily has been discussed at length. The authors also comment on the choice of crystallographic symmetry that such systems could adopt vis-á-vis conventional protein crystals. This article would appeal to latter-day macromolecular crystallographers as it describes the theory regarding space-group preferences for small-molecule crystals in comparison to those preferred by macromolecules. After reading this article, one cannot help but wonder about