high-school student. However, the treatment here is not as systematic as in *Space-Time Physics*, for example. The problem seems to be the verbose digressions that disturb the attention of the student, at the cost of systematic unfolding of the physics of relativity. Since the book was written at a time when many applications of relativistic physics became common in particle accelerators, atomic clocks and satellite-based navigational systems like the GPS, there were ample examples to present the subject attractively to the eager student. Mermin was not alert to such a pedagogic opportunity.

Apart from the topic of time, another central quantity in relativistic physics is 'mass'. Every student is familiar with the Einstein relation $E = mc^2$ and its manifestations. Mermin asserts that the 'correct' definition of mass is as 'inertia'. 'Here, finally, is a qualitative formulation of the correct definition: The mass of an object is a measure of how hard it resists attempts to change its velocity'. This assertion on the 'correct' definition would be misleading for a student, because Mermin does not discuss the 'mass' as the source of gravity. In fact, this concerns the central point that allowed Einstein to take his next step in relativity, to the general theory, leaping from the empirically supported equivalence of the mass as the inertia and also as the source of gravity. In the chapter that mentions the general theory of relativity, the presentation of the equivalence principle is haphazard and historically deficient.

Finally, I may mention a sociological issue. Many students come into science both for its thrill and its lofty ideals. In actual practice, however, there are large and unfair imbalances. Mermin writes, 'This process of discovering that one's former beliefs are wrong, and the painstaking search to identify the old errors, enabling one to construct better founded beliefs to replace them, is what makes the pursuit of science so engrossing. *The world would be a far better place for all of us if this joy in exposing one's own misconceptions were more common in other areas of human endeavor*' (emphasis is mine). Mermin assumes that the scientist follows this dictum of self-correction, while it is absent in other human endeavours. His recipe for universal joy is not based on what is factual in the practice of science, with all its biases and some hardened beliefs. Sure, on a long term, science is self-correcting, but that duration could be longer than a lifetime, which is not a fair situation.

Reading this book to learn Einstein's relativity needs more stamina and patience than what a high-school student can source. And for an advanced student, more effective and engrossing texts are available in plenty. I think in the days of excellent lectures with graphics and animations available on the internet, the weak pedagogic elements in Mermin's book are unlikely to elicit a keen interest from its intended readers.

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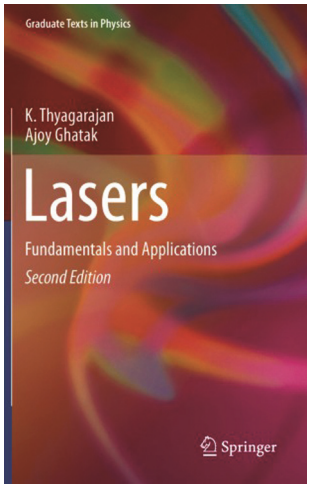

Lasers: Fundamentals and Applications (Second edition). K. Thyagarajan and Ajoy Ghatak. Springer Science + Business Media, LLC, 233 Spring Street, New York, NY 10013, USA. 2011, 659 pages. Price: € 79.42. ISBN: 978-1-4419-6441-0.

The book under review is an up-to-date textbook that surveys applied or engineering optics, including lasers and certain other areas that might be called modern optics. This book also is a useful handbook for the practising physicist or engineer who works from time to time with optics. The book gives an intuitive understanding of the fundamental concepts of optics, in detail with the important experimental advances and discusses various applications including semiconductor lasers. It is therefore an essential purchase for any graduate student entering the research area. Indeed, the book begins with an introduction to the laws of optics and optical interactions with matter using both classical physics and quantum mechanics.

The main topics of the book discuss the working principle of a laser; the parts of a laser-like the laser resonator and the active medium; beams of radiation generated by a laser; femtosecond laser pulses; different types of lasers and their advanced applications. Additional topics deepen our understanding of more specific questions concerning, in particular, origin of semi-classical and quantum mechanical theory to gain pumping process to elaborately explain the applications of radiation in doped lasers and fibres.

The authors emphasize this subject and provided enough mathematics for easy understanding. They use an elementary quantum mechanical basis, of the Einstein coefficients of absorption, spontaneous and stimulated emission of radiation to characterize the interaction of radiation with an atomic system. After covering the basic optics and basic quantum mechanics, the authors discuss the basic physics behind laser operation, some important laser types and the special properties of laser beams. The formulation of the working principle of a laser is done by using rate equations, yielding the condition of laser oscillation and other properties of a laser (chapters 5–9).

Chapters 1 and 2 discuss the basic concepts of optics including wave equations, interference, diffraction and linearly, circularly and elliptically polarized waves. Chapter 4 consists of Einstein coefficients derived from elements of quantum mechanics which is discussed in chapter 3 using Schrödinger equations. Chapters 10–14 deal with physical properties of lasers, some solid, liquid and gaseous, semiconductor laser systems, doped fibre amplifiers and lasers optical parametric oscillators including their construction working principle and lasing actions.

The second part (chapters 15–19) of the book discusses some of the most important applications of lasers in spatial frequency filtering, holography, laser-induced fusion, light wave communications, and in science and industry.

The book also covers basic wave propagation theories for beginners, but can be useful for the readers with little knowledge in ray and physical optics. The subject matter is useful for graduates. Although

there are many more applications that are not included in the book, I feel that the authors have covered some of the most important applications.

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Annual Review of Physiology, 2021. Mark T. Nelson and Kenneth Walsh (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 83. Price: US$ 118.00.

Jane Goodall, the famed naturalist who is known for her work on chimpanzees, was recently awarded the prestigious Templeton Prize for 2021. Her work has brought into focus our role in maintaining the immense variety of life on this interconnected planet. As a medical physiologist, I have been dismayed at how comparative physiology has all but disappeared in courses that teach human physiology. This anthropocentric view of physiology is certainly detrimental to our broader understanding of life. Comparative physiology allows us to understand bodily function in an evolutionary context. It also brings to bear the scale of adaptation of physiological function. Thus, my interest was immediately drawn to the first article of this review on 'The remarkable cardiovascular system of giraffes'. The long neck of the giraffe presents a functional problem since blood pressures need to be maintained at the cranial end of the neck to allow for perfusion of the brain. At the same time, major haemodynamic shifts occur when giraffes stoop to drink water and then raise their heads soon after. Aalkjaer and Wang present an extremely lucid account of the noteworthy experiments that have been conducted to elucidate a better understanding of the cardiovascular physiology of the giraffe and the remarkable structural and functional adaptations in this animal.

The relationship between the kidney and cardiovascular function has been recognized for over 150 years, although the mechanisms involved were not initially known. The physiologists, Robert Tigerstedt and Per Bergman injected kidney extracts into rabbits and demonstrated a dramatic rise in blood pressure. In 1934, Harry Goldblatt established the first animal model of hypertension by constricting the renal artery in one or both kidneys. Subsequent research identified the role of renin and of the renal sympathetic nerves. Studying the renal sympathetic nerves in humans is particularly challenging, but has been extensively evaluated by Murray Esler and his colleagues in Australia by means of a radiotracer technique with labelled norepinephrine and regional blood vessel sampling using central venous catheterization. These studies have highlighted, among many others, the role of the renal sympathetic nerves in hypertension and heart failure. It is always exciting when research can be translated to improve human function and treat disease. In recent years, methods have evolved to denervate renal nerves. Sharp and Lefer, in their article on 'Renal denervation to treat heart failure' discuss the historical evolution of renal denervation and the current physiological understanding of its therapeutic role in heart failure with and without reduced ejection fractions. This is a topic of current and evolving interest, which should appeal to physiologists and clinicians.

Compared to other functional tissues, brown adipose tissue (BAT) has had a relatively recent history. It was identified as a thermogenic organ only in the early 1960s. Since then, the basis of its thermogenic effect and the role of uncoupling protein has been elucidated. The existence of BAT in adults was demonstrated in the 1980s and subsequent research has demonstrated that BAT can exist in dormant or competent states, that 'browning' of white adipose tissue can occur, and that BAT has effects on metabolic rate, insulin sensitivity and fat metabolism. Till date, however, BAT activity has not been conclusively linked to weight loss. Henningsen and Scheele in their interesting conceptual article 'Brown adipose tissue: a metabolic regulator in hypothalamic cross talk?' discuss the multiple interactions between the hypothalamus and BAT. This cross talk may provide an understanding of how the body weight set point is reset and could lead to the development of pharmacological targets against metabolic disorders and obesity. In another article 'Cellular heterogeneity in adipose tissue', Silvia Corvera describes how adipose cells even when structurally similar can have remarkably different functional characteristics, as for instance in their adipogenic capacity. This article raises more questions than it answers at this stage of our understanding – to what extent is the heterogeneity in adipocytes regulatable, and by what? What are the implications of this heterogeneity in health and disease?

Atrial fibrillation (AF) is a cardiac arrythmia, the occurrence of which increases with age. More than 20% of strokes are attributable to atrial fibrillation which also increases cardiovascular morbidity and mortality by over twofold. While AF is associated with a range of comorbidities and risk factors such as advanced age, heart failure, hypertension, valvular heart disease, cardiac surgery, obesity, alcohol consumption and even exercise, these act through relatively constrained pathways including the autonomic nervous system, the renin–angiotensin–aldosterone system, inflammation, and volume-pressure changes in the heart. The article 'Dynamics of atrial fibrillation. Mechanisms and comorbidities' reviews the understanding of the cellular physiological mechanisms of AF in these various comorbidities to better delineate the dynamic nature of AF risk factors and subsequent AF risk. This is clearly an important area of research given the scale of this clinical problem.

Tamm-Horsfall protein, the most abundant urinary protein in physiological conditions, was rediscovered in the 1980s, as uromodulin. Produced by the epithelial cells of the thick ascending limb of the Loop of Henle and the Distal Convoluted Tubule the last few decades have revealed a wide range of functions including protection against urinary tract infections and kidney stones, renal sodium, calcium and magnesium transport, and immunomodulation. The article 'Uromodulin: roles in health and disease' is a very well written paper of a story in evolution. For, while the putative functions of uromodulin have been extensively described, the clinical use of uromodulin (in urine and serum) as a biomarker of renal function and in the prognosis of disease, especially chronic kidney disease, continues to be explored and refined.

Ever since Hans Selye proposed three stages of a general adaptation syndrome to stress and Cannon's earlier work on the role of the 'symapthicoadrenal' system, physiologists have sought to understand the biology of stress and its implications in disease. Regarding this aspect, a welcome shift is an article entitled 'Sestrins in physiological