hidden mass (called dark matter) in the universe, the physics and mathematics of music (both Indian and Western classical), why different fluids have different viscosities, the frequency of the sound of running water, and the velocity of waves produced by a tsunami. It is clear that the author has thought carefully regarding which phenomena to talk about, making the book a delight to read.

Although the book is not large, the author has presented the most important and beautiful ideas in classical mechanics. These include Newton's laws of motion, circular motion, the principle of least action, work and energy, pendulums, the motion of rigid bodies, friction, collisions, central forces, dimensional analysis, oscillations, waves and fluid mechanics.

The final quarter of the book presents some concepts from the kinetic theory of gases, thermodynamics and statistical mechanics. These are not commonly discussed along with classical mechanics, but the author presents them in a way which looks like a smooth continuation of the material in the earlier parts of the book. Even in these final chapters one finds some unusual topics like the Van't Hoff equation of state which makes a connection between dilute solutions and ideal gases.

The author has a flair for explaining difficult concepts in interesting ways without oversimplifying the mathematics. He has also provided several references which a curious reader can look at to learn about some areas in more detail. In conclusion, this book provides a lovely introduction to classical mechanics. It can be used either by itself or as a supplement to a more detailed textbook for teaching an UG course on this subject. It can also be used for independent study by anyone who wants to learn at his/her own pace.

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This volume begins with a gripping and refreshing narrative by Terje Lømo in an article entitled 'Scientific discoveries: what is required for lasting impact'. Lømo addresses two broad areas of scientific studies with which he was personally involved. First, a discovery, in this case, long-term potentiation, which though initially slow to gain acceptance and publicity has withstood the test of time, particularly in relation to understanding the physiology of learning and memory in the hippocampus. Second, the exploration of a much publicized 'breakthrough', in this case, the neurotrophic hypothesis (1970), which proposed that denervation supersensitivity resulted from a lack of trophic factors rather than from impulse activity. In the case of the latter, while the much heralded hypothesis led to a large body of work that allowed for a better understanding of trophic interactions, the original hypothesis fell by the wayside. The article, however, is more than a personalized update. Lømo discusses his tryst with science including 'experiments that did not work', the issue of 'credit' for discovery and the reception to novel findings, among others. The article will appeal to all those who have had their moments of long periods of struggle and their brief moments in the sun. It will also appeal to all students who search for the path and process behind truly great discoveries.

The special topic in this volume focuses on 'mitochondria' – a feast for, in the words of the Editor, D. Julius, committed 'mitochondriacs'. The article by Pernas and Scorrano entitled 'Mito-morphosis: mitochondrial fusion, fission, and cristae remodeling as key mediators of cellular function' focuses on mitochondrial morphology, and the fact that aberrant alterations in mitochondrial shape and mutations in shaping proteins have profound effects on human health. This is particularly true of ischaemic and atrophic disease states.

There have been an increasing number of epidemiological studies which have demonstrated an association between muscle function, often using a simple measure such as handgrip strength, and cardiovascular risk factors as well as mortality. While there are many intuitive explanations for this, e.g. muscle function as a surrogate for physical activity, the article by Rai and Demontis entitled 'Systemic nutrient stress signalling via myokines and myometabolites', provides a readable and compelling review of how muscle can affect the function of other tissues and the body as a whole. Myokines are muscle-derived growth factors and cytokines, and while not necessarily exclusive to muscle, assume special importance because muscle accounts for about 40% of body weight and is highly vascular. Myometabolites which are muscle derived metabolites are discussed to a somewhat lesser extent. The article highlights another set of potential mechanisms by which behavioural change in the form of physical activity and exercise can beneficially impact human health. In addition, myokines have also emerged as important diagnostic tests for myopathies and age-related diseases, and have the potential in the future to be used therapeutically to mimic the healthy effects of exercise.

The article by Bedrosian *et al*. on 'Endocrine effects of circadian disruption' brought memories of the early work of Jürgen Aschoff, one of the founders of chronobiology. Circadian rhythms are cyclical events in the body of approximately 24 h duration. Aschoff had demonstrated the roughly 24 h cyclical rhythm of body temperature and had constructed an underground bunker to study the effects of free-running cycles in humans in the absence of 'zeitgebers', a term which he coined to describe environmental time cues which could 'entrain' free-running rhythms. Circadian disorders have become increasingly important in the modern world because of shift work, transmeridian travel and jet lag, sleep disorders and enhanced lighting at home. The authors provide an update of the central endocrine mechanisms involving the pineal and pituitary glands, and peripheral events involving the adrenal gland and energy homeostasis. They further outline the consequences of disrupted endocrine rhythms, especially in relation to inflammatory disorders and cancer, and obesity and metabolic disorders.

Obesity and its sequelae, including type-II diabetes, cardiovascular disease, cancer, sleep apnea and others, continue

to be a major bug bear in the field of public health. A polarized view would see the problem as essentially one of poor self-control – a combination of sloth and gluttony. However, as Amy Sutton and her colleagues point out in their article 'The role of PVH circuits in leptin action and energy balance', obesity is biologically encoded, and 'common obesity likely results from alterations in multiple gene products whose effects are unmasked by the ubiquitous availability of calories in modern society'. Classical lesion and stimulation studies have established for a considerable time now that specific parts of the hypothalamus are involved both in feeding and satiety. Research in the area received a boost with the discovery of the *ob* gene product, leptin, and the delineation of its actions on food intake and energy expenditure. Cellular and molecular work in this area was facilitated by the availability of specific animal models such as the *ob*/*ob* and *db*/*db* mice as well as the finding of a spontaneous mouse mutant of the *agouti* locus and its association with obesity. The authors focus on hypothalamic circuitry involved with feeding and energy expenditure. A particular focus is the relationship between the arcuate nucleus (ARC) and the paraventricular hypothalamic (PVH) nucleus. These two areas are particularly important. The ARC functions as a gateway for hormonal signals of energy balance and also contains melanocortinergic neurons. The PVH receives direct melanocortin input along with other integrated signals that affect energy balance. The authors rightly point out that considerable work is yet to be done, but that a clearer identification of neuronal subpopulations may eventually yield novel cell type-specific therapeutic strategies for targeting obesity.

In 1902, Bayliss and Starling opened a whole new area of discovery with the description of the effects of a new chemical secreted in the gut – secretin. This was followed by the description of other hormones and their actions by other researchers. In the 1980s, the world of gut hormones increased further with the discovery of several new hormones described by Steve Bloom and his colleagues at the Imperial College in London. There has been no looking back since. In their lucid and readable article entitled 'Enteroendocrine cells: chemosensors in the intestinal epithelium', Gribble and Reimann focus on the cells that secrete gut hormones along the entire length of the gastrointestinal tract. These cells release hormones in response to meal-related stimuli and exert a variety of actions, including gut motility, insulin release and food intake, among others. An important area of research is the delineation of enteroendocrine cell plasticity – changes in structure and function – and the extent to which these changes occur in response to alterations in dietary intake. The authors point out that enteroendocrine cell plasticity in response to dietary change could be important as such changes could modulate the anorexigenic signalling pathways that normally restrain eating behaviour. Another area of research in this field is the potential interaction of gut microbiota and the hormone-secreting enteroendocrine cells, given that there have been reports indicating that intestinal bacteria may differ in lean and obese individuals, and may influence body weight and feeding behaviour. A longer-term outcome of research in this field could be the development of targeted interventions on the signalling pathways of these cells for the treatment of diabetes and obesity, and the development of 'medical mimic' of gastric bypass surgery.

An interesting article related to the 'Microbiome and the respiratory tract' by Dickson *et al*. debunks the common notion in textbooks that the healthy lung is free from bacteria. The development of culture-independent methods of microbial identification was critical to the understanding of this field. It is now clear that there is considerable variation in lung and mouth microbiota. What is unclear is how persistent this flora is within a subject over time. The authors also describe the microbiota of diseased lungs in a variety of conditions such as asthma, chronic obstructive pulmonary disease, cystic fibrosis, pneumonia, etc. A consistent finding is that the lung microbiome is altered compared to healthy subjects. The question that then follows is one of cause and effect – whether the altered lung microbiome drives the progression of lung disease, or whether it is a consequence of the altered growth environment of the lungs? In an area of enquiry that is relatively new – the bulk of the data emerging in the last six years – the authors rightly end their review with a series of questions to address future issues.

The articles highlighted above are just a few of the many that are in the volume, clustered around specific organ systems. As research methods become more specialized and approaches move away from the whole body to cells and molecules, one of the challenges is pegging the readership of the articles in the *Annual Review*. In this volume, I found articles that were so specific and specialized, that I would imagine the readership would be restricted to those who work in the specific field. There were others which while being specialized, appeared to have been written for a wider audience. Regardless of this, the *Annual Review of Physiology* continues to be an essential buy for any library that serves the needs of researchers and students of biology, and human physiology, in particular.

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