take a realistic view in presenting the material so as not to promise the moon, but uncover the intricacies involved. The two organs that we take for granted when they work are incredibly complex when a biomedical engineer tries to make substitutes for them. Mechanical circulatory systems, as discussed in a chapter of this book, present the advances in design, prototyping and clinical trials that combine the knowledge base of sophisticated pump technology, advanced manufacturing, epidemiology and physiology. The chapter notes that these devices are now available for advanced stages of heart failure, but efforts are underway to make them available for patients who have the disease in the initial stages. Prosthetic vision is a much a more complex problem, as can be understood from the chapter that deals with it. The authors make justifiable comparisons to cochlear implants to show that this problem is a few orders of magnitude more complex. A simple argument is to compare the number of hair cells in the cochlea and acoustic nerve fibres (both about 15,000) with the number of photoreceptors (120 million) and optical nerve fibres (about 1.2 million) in the human eye. So, while a cochlear implant is fine with about 20 electrodes, a retinal prosthesis would require 1000 such electrodes. The best retinal prosthesis in the market today has about 60 electrodes. The chapter proceeds to explain the issues involved by first presenting the types of visual disabilities and then discussing how electrode-based visual-assist devices can enable partial perception of vision. Of necessity, this line of work needs an understanding of optics, physiology and psychophysics. The complexities notwithstanding, the authors of both chapters end on an optimistic note that better things are possible and are on the way.

Drug delivery is a fast-growing branch of biomedical engineering. Like the other aspects, this too has microscopic as well as molecular approaches. Two chapters individually address each of them. Aerosol-based drug delivery for treating lung diseases shows the interplay between physiology, fluid mechanics and particle transport. Viral gene delivery vehicles, as described in an informative chapter, show that molecular engineering has promise to exploit nature's well-evolved 'courier' molecules – the viruses – to deliver specific genetic payloads to particular cells.

Communication and processing of information is integral to living things and hence it is equally important for engineered biomedical devices and systems. Three chapters of the book are devoted to highlight this aspect. The chapters are well sampled: one deals with the cell-to-cell communication and quorum sensing in bacteria to understand the mechanisms of film formation and spreading of an infection; the other deals with the technology of microelectrodes used for stimulation and recording of signals for hearing, vision and motor abilities, and the third deals with ways to keep the power consumption low in processing electronics in biomedical devices because the battery is often the bottleneck in determining the life of a device.

The sixth aspect highlighted in this book is imaging. Biology research thrives using a microscope. This continues today in the biomedical engineering field as newer and more sophisticated imaging techniques are being developed and used. Four chapters present these advances and cover fluorescence and magnetic resonance imaging technique in depth, and show how fast 3D imaging is being developed and used. Image processing, an equally important and sophisticated research topic, is also discussed to highlight the importance of the interpretation of a captured image.

In summary, this book succeeds in capturing the pulse of current biomedical engineering in its 15 chapters. There are of course many more topics not covered here. This is only the tenth volume of the *Annual Review Biomedical Engineering*. A glance at the cumulative index of all the ten volumes at the end of this book shows that covering the breadth and depth of the field is a continuing process. The extensive bibliography given in each chapter is a treasure for those aspiring to work in those areas even in today's knowledge-at-the-finger-tips era, because we save time as someone has already done the hard work of collecting and collating the references for ready use. The formatting of this book also needs a special mention. The book is a visual treat: a software professional sitting next to this reviewer during a train ride commented that she would want to read this book just because 'it looks beautiful'. Crisp fonts, pleasant colours, cleanly annotated figures, well-organized tables, a reference list with authors' comments on selected papers, and wide margins with text to explain the jargon of the field make this book appealing to the eye and the mind. It would have been nice if all the authors had used the last two formatting features to help the reader a little more.

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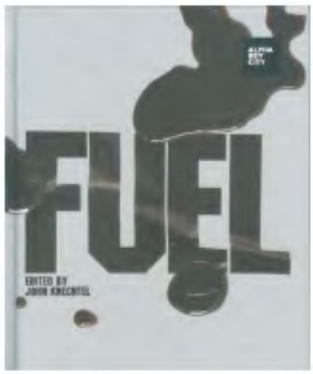

Fuel. John Knechtel (ed.). Massachusetts Institute of Technology and Alphabet City Media, Inc., The MIT Press, 55 Hayward Street, Cambridge, MA 02142, USA. 2009. 351 pp. Price: US$ 15.95.

This book is essentially a collection of articles and theme-based photo-features by writers and artists, which conveys perspectives on the impending fuel and energy crisis, some alternatives for the post-carbon world, and the ecological impact caused by dependence on a single energy source for over a century. It is neither a technical publication on the topic of fuel, nor a book wholly devoted to scientific policy on fuel and energy. Rather, the objective of the book in the words of the publisher is to challenge the reader to rethink conventional ideas and offer fresh perspectives from artists, designers and writers on the central theme of fuel. This book does achieve the said objective to a great extent. There are a few articles that stand out more than others, such as the one by Imre Szeman which presents a critique of the current responses to tackle the fuel and energy crisis. He classifies them into three main types which he calls 'Strategic Realism',

'Techno-Utopian' and 'Eco-Apocalyptic'. The 'Strategic Realism' approach implies that every country has a right to exercise its political and military might to secure energy reserves, even at the cost of annihilation of another country. The world is already seeing the disastrous consequences of this approach which is followed by some Western countries. The 'Techno-Utopian' approach attempts to provide sweeping scientific solutions to the crisis. This approach is prevalent today among the scientific community. A typical example is the frequent reference to the term 'hydrogen economy', which is considered by many scientists to be the panacea for all energy-related problems. Such a stand indicates a lack of understanding of ground realities, especially in the developing world. The 'Eco-Apocalyptic' approach suggests that there is no way out of the energy crisis, in a way suggesting the end of the world. Szeman rightly points out how the three approaches are flawed in their own ways. He then makes a case for a new approach which he calls 'Rational Futurism', based on a practical and planned system. Unfortunately, he does not elaborate much on this balanced approach.

There are various photo-features that are interspersed with the articles, but one that stands out provides a rather dramatic view of the ecological devastation caused by oil production and drilling in Nigeria. The photographs show the stark contrast between the level of impoverishment of the people of Nigeria and the oil abundance. The article by Mason White draws an interesting parallel between the large-scale infrastructure being created to tap natural gas in Russia and the man-made islands being created in Dubai to promote tourism in a post-oil economy. The article shows how the landscape is being altered in the quest for new energy sources on the one hand, and at the other extreme, land is being created from the sea using oil wealth to promote tourism. In another article, Chris Hardwicke proposes a dedicated infrastructure for bicycles as a sustainable transportation option for cities. The design of an elevated, dedicated roadway for bicycles and the integration of this network with existing rail/road transport in the city are presented well. This is certainly a promising idea for any large city. Maya Przybylski and Kelly Doran propose ways to mitigate the ecological impact of oil-drilling infrastructure and lands used for mining tar sands in the aftermath of oil recovery. These range from converting abandoned oil platforms as resting points for migratory birds and artificial reefs for holding plant life, to converting exhausted mining pit lakes into farms for growing crops. All of these do offer interesting perspectives on the central theme of fuel. However, these are Western in character. A perspective from the developing world, where historically significant work has been done in the area of renewable energy, is missing. Inclusion of such an article would have made the book more complete and truly global in character. In summary, the book does convey one important theme, which the author mentions in the Foreword, that the future is 'energy pluralism'. There is a need to consider several options simultaneously, renewable fuels in both short and long term, and possibly other fossil-based fuels in the short-term transition period.

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W_5H of Technology; W_5H of Sciences. Rakesh Mohan Hallen. Vigyan Prasar, A50, Institutional Area, Sector-62, Noida 201 307. 2008. 184 and 176 pp respectively. Price: Rs 200 each.

Before the days of the internet, a popular reference book on science and technology (S&T) was Isaac Asimov's *Chronology of Science and Discovery*, which vividly explained all areas of the scientific world, covering discoveries and inventions in astronomy, biology, physics, mathematics, etc. It was described as the History of Science from 4,000,000 BC to the present (1988). The famous science writer deciphered each event in his own inimitable style. He explained scientific discoveries of each year, showing how science influenced the world and how the world responded to scientific advances.

After the internet and the emergence of Google and other search engines of enormous reach and content, the focus of S&T reference books turned to most commonly asked questions with simple answers, not easily found on the internet. Two books can be cited as examples of this trend: *How Did They Do That And Scores of Other Questions You've Never Been Able to Answer*, and *How Do They Do That?* Both the books, written by Caroline Sutton (Quill New York Hill-town Press) posed questions that are likely to trigger curiosity in the common reader. Here are some examples: how do homing pigeons find their way? How do glasses correct near-sightedness or far-sightedness? How did they discover DNA? The very wording of the questions invariably leads to an appreciation of the wonders of science and the ingenious ways of their discovery by scientists rather than produce a mere list of names, places or bare facts. This is best illustrated by the following question: 'How does a polaroid picture develop in broad daylight' rather than 'Who invented polaroid and when and where?'. The names and other such facts can be downloaded or found out from standard reference tomes.