a number of satellite probes deployed in recent years. For instance, we now know quite accurately the rate of expansion of the universe and the amounts of its three major constituents as mentioned above. B. S. Sathyaprakash deals with the subject of gravitational waves. These are a consequence of the general theory of relativity and they were discussed by Einstein in 1916. However, they have not yet been directly observed due to the extreme weakness of the gravitational force compared with the other forces. Several detectors are currently in operation to try to observe such waves which may be generated by a pair of very compact objects, like neutron stars or black holes, circling around each other.

Amongst all the subjects studied by Einstein, Brownian motion and statistical fluctuations have probably had the widest range of applications in science and engineering. Satya Majumdar discusses a variety of such applications, including some in computer science. N. Kumar addresses the phenomenon of Bose–Einstein condensation and its recent manifestations in weakly interacting systems such as alkali atoms trapped at ultra-low temperatures. T. V. Ramakrishnan discusses a variety of systems of strongly interacting electrons, such as high-temperature superconductors, manganites and heavy fermion systems. A complete understanding of such systems constitutes one of the most important problems in modern condensed matter physics.

Although Einstein played a key role in the development of several aspects of quantum mechanics, he gradually developed misgivings about certain aspects of it, such as its probabilistic and non-local nature. Einstein's contributions to quantum mechanics as well as his objections to it are covered by Virendra Singh. Einstein always stated his objections with precision so that attempts to refute his arguments, by Niels Bohr and others, invariably led to a more refined understanding of the subject. Einstein's arguments helped develop concepts like entanglement, which today play a major role in areas like quantum information theory.

Apart from his scientific achievements, Einstein was also a role model as a pacifist and a democrat. Although he advocated the development of the atomic bomb by USA during the Second World War to counter fascism, Einstein began campaigning against such weapons soon after the war. Unlike many other scientists of his generation, Einstein did not hesitate to speak out on issues of public interest. T. Jayaraman covers this aspect of Einstein's life in the last chapter of the book.

I would strongly recommend this book to libraries and to individuals who have some knowledge of physics and who wish to learn about the continuing influence of Einstein on modern developments in physics.

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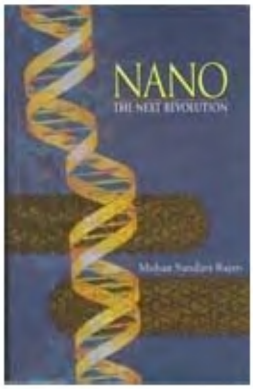

Nano: The Next Revolution. Mohan Sundara Rajan. National Book Trust, A-5 Green Park, New Delhi. 2004. 179 pp. Price: Rs 75.

The explosive growth of science at the nanoscale over the last decade has spurred research activity globally, and has promoted great expectations amongst the general public. Nanoscience and nanotechnology, unlike any other emerging field in the past, cuts across several barriers and is highly interdisciplinary in nature. Consequently, a decade ago, its societal impact could not be envisioned realistically; thereby generating an upsurge in excitement. This led to propositions, both in the scientific and popular literature, such as smart nanoscale submarines that will circulate in a person's bloodstream and cure him/her of molecular diseases, and carbon nanotube-based space elevators. Concomitantly, extreme viewpoints and doomsday scenarios were also espoused in the popular literature regarding the safety aspects of nanotechnology.

Within the scientific community, this initial surge of euphoria is now tempered and estimates of the extent of the societal impact of nanotechnology range from a technological revolution to an evolution. The possible doomsday scenario of 'grey goo' (a kind of runaway self-replication of nanoscale robots) is no longer considered a feasible proposition. Research efforts are currently underway to determine the safety aspects and health-hazard risks posed by nanostructured materials. The initial results suggest that they can be handled safely, although differently from their bulk counterparts, and do not pose extreme health-hazard risks. However, at this juncture, this tempered attitude towards nanotechnology has not percolated into the popular literature. Hence, there is a pressing need for popular literature that can provide a factual introduction to this topic and also allay some of the fears associated with the development of nanotechnology.

The book under review is an effort to fill this need. The author reportedly has experience in writing popular science books and should be commended for attempting such an arduous task. A task that involves comprehending research performed by a wide range of scientists approaching the issues with an equally wide range of perspectives, and conveying it in general and lucid terms to a lay audience. There is a range of possible approaches to write such books. One of them is an approach that is easy on the general reader, but onerous for the author. This would be an attempt to explain the basic principles involved in nanoscience, a rapidly evolving and wide-ranging field, and connect them together under a few universal themes. These should then lead to the technology and the potential societal impact of this field. The other extreme would be to attempt a chronological exposition of events and discoveries that lays the onus of analysis upon the reader. Not surprisingly, considering that there is still a dearth of scientific books written in the former approach, this book is written in the form of a chronological diary of events.

The book has ten chapters, all titled glibly. The author's endeavour to cover the entire spectrum of topics from inorganic to organic nanomaterials is laudable. The book includes details about the scientists involved in conducting the reported research and especially highlights the work done in various research labora-

tories across India. In the first chapter, the author attempts to put in perspective the nanoscale and also to convey the significance of nanostructured materials. It is a pity that a considerable proportion of the statements is unfounded and that quite a few are disconnected. This demands greater perserverance on the part of the reader to continue. Of much greater concern is the frequent occurrence of factual errors (e.g. 'one thousand bacteria could be placed in 1 nm') that can confound the uninitiated. The second chapter highlights the importance of characterization tools in providing insight into nanoscale properties. Here, apart from the factual errors (e.g. 'nanometer-size gold crystals are attached to the tip of a scanning probe in a technique called surface-enhanced Raman spectroscopy'), the various attempts to explain the different principles and mechanisms involved in electron and scanning probe microscopy are quite obtuse (e.g. 'externally visible ultra sharp tip [with a radius of 20 nm]') and would tax an expert scientist's wit to divine the author's intent; the uninitiated layman stands little chance. The next six chapters talk about nanomaterials, nanoelectronics, biomedical technology, genetics and the potential windfalls of nanotechnology. Factual and grammatical errors abound in these chapters too, and the author really lets down his readers with statements such as: '... the capacity to detect extremely small motion of matter [millionths of a nanogram] called the quantum limit'; 'Biosensors to measure blood glucose are under development. A single nanotube can detect glucose. The sensors use gold nanoparticles'. These chapters represent a sort of challenge to people so inclined; however, the average reader would have appreciated a little more substance and coherence. The last two chapters are sensationalized accounts of the enhanced risks attributable to nanotechnology with a caveat that humans will eventually adapt to these risks.

Although efforts to write books explaining nanoscience and technology to the layman are in general commendable, this book leaves a lot to be desired.

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Annual Review of Biomedical Engineering, 2006. Martin L. Yarmush *et al.* (eds). Annual Reviews, 4139, El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 8. 654 pp. Price not mentioned.

Biomedical engineering is an exciting area of research, a forerunner to today's 'mantra' of interdisciplinary research and the trend of prefixing 'bio' to emerging areas. It involves the application of engineering principles to problems in biology and medicine. While its origins can be traced back to Wilhelm Roentgen and his X-ray imaging set-up of the early 1900s, it started to blossom in the post World War II era and came to the fore in the late 1950s. It spans a wide spectrum covering bioimaging, biomechanics, medical electronics, prosthetics, cellular and molecular bioengineering, computational modelling, biomaterials and biosensors. It is a formidable effort to do full justice to the task of spanning the field of biomedical engineering using 19 articles. The *2006 Annual Review of Biomedical Engineering* attempts precisely this and succeeds admirably in painting a bird's-eye view of the field and its vast scope.

Bioimaging uses electromagnetic radiation to non-invasively interrogate cells, tissue, organs and organisms, creating spatial intensity maps of physically relevant parameters. Imaging of cellular and sub-cellular processes has greatly benefited from advances in fluorescence microscopy and the development of novel reporter molecules, notably Green Fluorescent Protein (GFP) and its variants. Gene expression and regulation and its spatial distribution can now be visualized by making the transgene encode the GFP and subsequently imaging the fluorescence generated. Various technologies and reconstruction techniques have been developed for *in vivo* fluorescence imaging from the cellular to the organismal level (macroscopy). At the other end of the spectrum, methods like whole-body computerized tomography (CT) and magnetic resonance imaging (MRI) scans provide a physician powerful diagnostic tools for the detection and characterization of tumours, infection and disease states. Of late, multi-modality imaging has become an attractive strategy for combining complementary information generated by disparate modalities. Typically, structural and functional information for instance, from CT and nuclear or fluorescence imaging, is superimposed to yield composite images which are diagnostically more informative. Emerging modalities include imaging conductance variations in biological tissue using a method called electrical impedance tomography (EIT). Reconstruction algorithms in EIT adapt or modify methods that have been developed earlier for electron microscopy, nuclear imaging and X-ray CT. The basic principles of these novel imaging methodologies are covered in three papers and illustrated with exemplary images taken from animal and human subjects.

Phenomenal advances in molecular and cell biology are being used by molecular bioengineering to enhance our understanding of cellular-level signalling and transduction, cellular and molecular responses to inflammation, infection and cancer, and are opening new avenues. The cascade of microvascular and molecular processes that constitute inflammation along with a new hypothesis for generation of inflammatory mediators is analysed. With the explosion in drug discovery, the problem often faced is targetting these drugs both spatially and temporally. These are challenging problems that bring together chemical engineers, chemists and biologists to create new classes of smart drugs and drug-delivery vehicles. New classes of molecules – polymersomes, which are self-assembled amphiphilic polymer shells, small double-stranded RNAs called small interfering RNAs (siRNA), pH-sensitive and immuno-liposomes are discussed in three papers along with their action mechanisms and challenges in intracellular targetted drug delivery. The more recent fields of genomics and proteomics are represented by papers that discuss, using an integrated systems approach, the structure–functional relationships of a class of polysaccharides called glycosaminoglycans, that play an active role in cell surface-level interactions and influence cell growth and development.

Physiological modelling is critical in enhancing our understanding of biochemical and biophysical processes. An interesting paper from a mathematics group presents a computational model of angiogenesis (new blood vessel formation) using differential equations and fluid mechanics to model the effects of blood flow on vessel growth and proliferation. This has important implications in the