

## BOOK REVIEWS

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**NANOPARTICLES for Catalysis, Energy and Drug Delivery.** Ramesh S. Chaughule and Anant R. Kapdi (eds). American Scientific Publishers, 26650 The Old Road, Suite 208, Valencia, California 91381-0751, USA. 2015. 300 pages. Price: US\$ 399.00. ISBN: 1-58883-183-3.

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It is a well-established fact that ultra small-sized particles have special physical and chemical properties that can be exploited for various uses like catalysis, energy, medicine, etc. In this wider and highly stimulating context, the book under review bridges the gap between three methodologies, viz. catalysis, energy and drug delivery.

Nanoparticles are used increasingly in catalysis to boost chemical reactions. This reduces the quantity of catalytic material necessary to produce the desired results. Two of the major applications of nanocatalysis are in petroleum refining and automotive catalytic converters. There is therefore the need to develop clean, affordable and renewable energy sources along with the means to reduce energy consumption and lessen toxicity burden on the environment. Nanotechnology is improving the efficiency of fuel production from low-grade petroleum materials through better catalysis. Nanostructured materials improve storage capacity and catalysts are needed to realize the development of efficient fuel cells at reduced cost. Nanotechnology also has the potential to revolutionize a wide array of medical and biotechnology tools and procedures. Since the advent of analytical techniques and capabilities to measure particle sizes in nanometre ranges, there has been tremendous interest in the use of nanoparticles for more efficient methods of drug delivery. The application of nanotechnology to drug delivery highlights several areas of opportunity where current and emerging nanotechnologies could enable novel classes of therapeutics. We look at challenges and general trends in pharmaceutical nanotechnology, and also explore nanotechnology strategies to overcome limitations in drug delivery. The book provides a glimpse into this rapidly evolving field, both now and what may be expected in the future.

About half of the chapters describe the development of carbon-based platinum nanocomposites, nanosized ZnO in the field of catalysis, study in catalysis using

gold nanoparticles and the use of silica aerogels in catalysis. The chapter emphasizing the need for greener routes for synthesis as well as efficient catalytic processes performed in green solvents such as water completes a line-up of well-written reports on the catalysis aspect of nanotechnology.

Chapters devoted to energy cover a wide range of research areas from renewable energy to fuel cells through hydrogen generation. For improved durability development of carbon nanotube/Nafion membrane is a new technique in fuel cells and has been described adequately in this section.

Reviews on clinical applications and nucleic acid delivery using nanoparticles give insight regarding their medical uses. Delivery of therapeutics and applications in brain disorder using nanomaterials will be extremely useful to scientists working in multidisciplinary areas of research and with keen interest in enlarging the areas of applications in nanotechnology.

Overall, the book makes an interesting and inspiring read. It will be useful for materials scientists, chemists, physicists and biologists for their further research in nanotechnology.

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**Annual Review of Cell and Developmental Biology, 2014.** Randy Schekman, Larry Goldstein and Ruth Lehmann (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139, USA. Vol. 30. xv + 756 pages. Price: US\$ 101.

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This volume has reviews that cover several areas of cell and developmental biology. These include extensively researched topics and emerging themes. There are several interesting aspects that are different from earlier volumes. The Introduction is an important highlight that is globally relevant today. It begins with an excerpt from the Nobel banquet speech by Randy Schekman, who is one of the editors of this volume. I reproduce two quotes from the speech: 'Freedom of inquiry must be preserved under any plan

for government support of science' (from a report entitled 'Science: endless frontiers' written by Vannevar Bush, the science advisor to two US presidents), and 'There does not exist a category of science to which one can give the name applied science' (by Louis Pasteur). To prove the point, Schekman mentions that during investigations on the molecular basis of protein secretion in yeast, there was no notion of any practical application. Extensive knowledge gained on the secretion pathway in yeast led to its use in producing human proteins commercially. Schekman strongly argues for government support (to NIH, USA) in favour of basic investigator-initiated research. While this appeal is to NIH, USA, it is highly relevant to all government funding to research institutes globally.

This volume begins with a perspective from Shirley Tilghman, who recounts her scientific career of over 40 years. Apart from a chronological description of her scientific investigations, the article highlights the importance of good mentorship in advancing the scientific career of researchers. This is evident from the Tilghman laboratory photograph in the article. Her deep interest in the career prospects of young investigators is particularly noteworthy.

There are 26 chapters in this volume. Unlike several of the earlier issues, the first chapter is on basic statistics in cell biology. Although the author Vaux quotes Ernest Rutherford, 'If your experiments need statistics, you ought to have done a better experiment', statistical analysis of data is a must, practically in all areas of biology, including cell biology. The article describes for the non-specialist, statistics relevant to cell biology with applications. It should sensitize those who shy away from quantitative analysis of data. Another novel feature in this volume is the highlighting of physics and chemistry behind several biological phenomena. The reviews on liquid-liquid phase separation in biology by Hyman *et al.* and physical models for plant morphogenesis from sub-cellular to whole tissues by Ali *et al.*, highlight the importance of physics in understanding biological phenomena. The physics of liquid, solid and gel states as well as terms like entropy, diffusion, elasticity, viscosity, plasticity, mechanics of energy and mechanical equilibrium are described in boxes for clarity and appreciation by biologists. Chang and Minc discuss

the relevance of electrochemistry in cell polarity with particular reference to electric field effects in *Dictyostelium*, fish keratocytes and fungi. These reviews highlight how physics and chemistry play a role in cell development and can provide deeper insights into the process.

Several reviews revisit areas that have been extensively investigated over the years and also reviewed extensively. The topics reviewed include viruses and cell-fusion mechanisms, bacterial pathogen manipulation of host-membrane trafficking, protein sorting, various aspects of secretion, cell death, proteases involved in development, cell adhesion, immunology and mitochondria. The different strategies used by extracellular and intracellular bacteria in manipulating host-membrane trafficking machinery are the subject of the review by Asrat *et al.* Fusion of biological membranes has been extensively investigated as several crucial biological processes depend on membrane fusion. Viruses have provided important insights into how diverse proteins bring about membrane fusion. The review by Podbilewicz highlights these aspects extensively and indicates what remains to be solved. Guo *et al.* review protein sorting at the trans golgi network, highlighting the importance of the network in disease conditions. Freeman describes rhomboid proteases that are a family of conserved intramembrane serine proteases. Their participation in diverse biological functions is highlighted. Their possible use in medicine in the future is discussed. Colombo *et al.* review various aspects of exosomes and other extracellular vesicles. Their possible applications in the development of therapeutics, biomarkers and vaccines are mentioned. Ashkenazi and Salvesen highlight the current status of signalling mechanisms involved in regulated cell death. Labbé *et al.* review various aspects of mitochondrial behaviour and their roles in healthy and disease states. Though an area of extensive investigation, several unsolved issues are highlighted by the authors. Leckband and de Rooij review various aspects of the adhesion protein the cadherin. They also address unsolved problems in the area. Qi *et al.* describe cell dynamics and spatial organization of lymph nodes in relation to innate and adaptive immunity in secondary lymphoid tissue.

As with previous issues of the *Annual Reviews of Cell and Developmental Bio-*

*logy*, there are focused reviews on neurobiology. Molecular mechanisms of synaptic specificity are reviewed by Yogeve and Shen. Allen describes astrocyte regulation of synaptic behaviour. The cell biology of neurogenesis in relation to development of the neocortex is reviewed by Taverna *et al.* Myelination of the nervous system is discussed by Nave and Werner, highlighting various aspects of mechanism and function.

Topics related to epigenetics and gene regulation are featured in five reviews. Gallagher reviews intercellular movement of key transcription factors and transcriptional regulators in *Arabidopsis thaliana*. Non-coding RNAs and epigenetic mechanisms during X-chromosome inactivation are reviewed by Gendrel and Heard. Zygotic genome activation during maternal to zygotic transition is described by Lee *et al.* The authors address future issues in the area. Filipescu *et al.* review histone H3 variants and their chaperones during development and disease. Ivshina *et al.* discuss the action of cytoplasmic polyadenylation element binding (CPEB) proteins and their importance in neurological disease.

Considering the current interest in stem cells, particularly from a therapeutic point of view, three reviews deal with 'Mesenchymal' stem cells (MSCs) and embryonic stem cells. Aspects of embryonic stem cells and future issues are addressed by Martello and Smith. Various aspects of mesenchymal stem cells and their application in cell therapy are discussed by Bianco. Haploid mouse embryonic stem cells with reference to genetic screening and germline transmission are reviewed by Wutz.

Another interesting review is one on the dog genome, which often does not get featured in such volumes. The review would interest cell biologists and veterinarians. The dog is the subject of review by Schoenebeck and Ostrander. Considering that dogs are popular pets world over, the review would be of interest to those interested in dog genetics as well as dog-lovers. The review dwells on genetic approaches to various aspects of dog physiology such as body size, leg length, tail length as well as diseases. The issues that need to be addressed in the future are summarized at the end of the review.

The titles of the articles from volumes 26 to 30 of this series, at the end, indicate vast areas of cell and developmental

biology that have been covered over the years with hardly any repetition. The tables and schematic sketches provide updates which would be useful to those who would like to undertake research in these areas. Some of them also indicate problems that are yet to be solved. The review would be of interest to young investigators who are starting their research career as well as established researchers.

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#### **Annual Review of Public Health 2015.**

Jonathan E. Fielding, Ross C. Brownson and Lawrence W. Green (eds). *Annual Reviews*, 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139, USA. Vol. 36. xv + 627 pages. Price US\$ 93.

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The *Annual Reviews* traditionally have a thematic 'symposium' which I look forward to. I was a bit disappointed this year with the theme 'Strategies to prevent gun violence'. In previous years, the symposium has spoken to a wider global audience. While the issue of gun violence is no doubt topical and relevant for the United States where firearm-related deaths compete with those from motor vehicles in absolute numbers, and in other countries where this is a problem, I can imagine that it will be section that many will give a skip. Fortunately, the rest of the volume is filled with interesting chapters that cater to the varied needs of individuals involved with, or interested in public health.

My bias for the history of medicine led me to read the chapter by Alfredo Morabia first. The chapter is entitled 'Has epidemiology become infatuated with methods? A historical perspective on the place of methods during the classical (1945–1965) phase of epidemiology'. A chapter like this would appeal to anyone with a sense of the history of science, particularly in a rapidly changing discipline. Morabia starts off by highlighting the close connect that epidemiology has traditionally had with public health