produce change not only in the health system, but also in the social fabric of our society.

Though this book is primarily aimed at health system professionals, managers and policy advocates, the lucidity of the writing style and its well-structured layout ensure that it can act as an able guide to any person hoping to gain an in-depth understanding of the major challenges and influences facing health systems today in LMICs. The authors frequently enrich the content with real-life illustrations of health system problems and also success stories in different LMICs. These examples not only help bring greater clarity to the well-researched text, but also help to bridge the divide between the theoretical content of the book and the practical realities of health system functioning.

The book is particularly significant for India. The country has one of the lowest health budgets in the world, with just 1.04% of the total gross domestic product being spent on healthcare by the Government[1]. The country, already dubbed a dormant state by the book for its long-standing inattention to the health sector, is in the midst of further reducing financial allocation to it[2]. Poor state of public health institutions from years of neglect has led to the private sector gaining ground. Rao[3] states that 80% of all outpatient care is provided by the private sector. Extensive dependence upon the private sector has resulted in high out-of-pocket (OOP) expenditure, with 71% of the total expenditure incurred on healthcare being in the form of OOP expenditure. This in turn has led to an increasing impoverishment of the poorest sections of the population[4]. It has been estimated in 2004 that 6.2% of the total households in the country fell below the poverty line (BPL) due to high healthcare-related OOP payments[5]. Thus the contention by the authors that a commercialized healthcare sector is inherently inequitable is unmistakeably evident in the Indian context.

The worrying scenario of financial constraints hindering healthcare access prompted the national government to implement the Rashtriya Swasthya Bima Yojana (RSBY) or the national health insurance scheme in 2008 for the BPL population of the country. Both the public and private sector were tasked with service provision under this government-funded programme. Yet as different studies report, OOP expenditure continues and there is also an increase in catastrophic expenditure among BPL families despite the implementation of RSBY[6,7]. As forewarned by the authors, problems of inequitable access, corruption and lack of accountability will continue to plague the healthcare system of a country if private sector contracting is allowed without the existence of a proper regulatory framework and a strong public healthcare infrastructure which best serves the healthcare needs of the country. India would thus be well-served if some of the country's politicians and health service planners paid heed to the values propounded by the book for the creation of an equitable health system.

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Annual Review of Analytical Chemistry, 2014. R. Graham Cooks and Jeanne E. Pemberton (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA94303-0139, USA. Vol. 7. ix + 575 pp. Price: US$ 101.

Analytical chemistry occupies a central place among almost all branches of chemical sciences. Development of newer and better analytical methods paves the way for better understanding of the chemical processes in smaller and more complex systems. A compilation of almost all the latest techniques of modern analytical chemistry in one volume provides the readers with a comprehensive landscape of the wide horizon of this rapidly expanding area of science. Analytical chemistry indeed has become a truly interdisciplinary subject bringing together sophisticated, high-precision, high throughput technology for the detection and characterization of species in complex materials, in biological systems and at a single-molecule level, or at a high spatial resolution in the presence of a large number of interfering factors.

Electrochemistry is recognized as a major tool of analytical chemistry. Modern electrochemical techniques go beyond the conventional methods to depict molecular-level understanding of the outer and inner sphere electron transfer processes in organic as well as inorganic molecules, and develop specific sensors and actuators to characterize ultra-low concentrations of compounds in a complex milieu such as in a biological environment. The novel electrochemical processes such as electro-generated chemiluminescence, photoelectrochemistry and electrochemical imaging techniques have taken this technique to a new dimension. The contributions of Alan J. Bard in modern electrochemistry are well recognized, and an autobiographic sketch by him provides a brief history of the recent developments of modern electroanalytical techniques, which is extremely informative and interesting for persons working in this area. Development of novel electrode systems is essential for achieving newer dimensions of electroanalytical chemistry. O'Riordan and Dawson describe the development of state-of-the-art silicon chip-based nanoelectrochemical devices. The on-chip nanoelectrodes could provide a method for designing biosensors at nano-scale

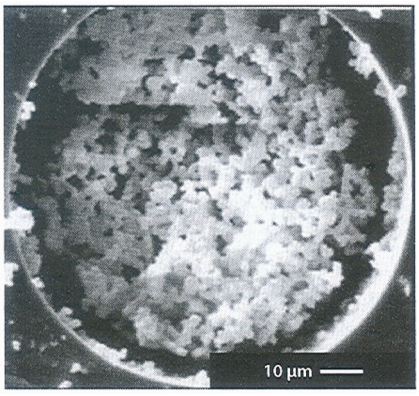
with significantly improved sensitivity and specificity. Amperometric detection of catalytic current has been used in nano-electrochemical sensors containing the enzyme on the nanoelectrodes for estimation of metabolites such as glucose, cholesterol, etc. Impedance spectroscopy as well as voltammetric transduction have been demonstrated for electrochemical immunoassays using antibody immobilized at the nano-electrode surface. Development of specific biosensors using electroactive proteins and enzymes has attracted attention owing to the high specificity and selectivity of the method, and efforts are being made to achieve high sensitivity using this technique. Suitably engineered proteins and enzymes as redox catalysts are used by combining nanofabrication and electronics in designing suitable interfaces with novel electrode materials. The protein engineering methods are used to achieve efficient electrocatalytic activity of the enzyme by optimizing the distance between the electrode and the redox active centre of the enzyme, by minimizing the reorganization energies and by suitably tuning the redox potential of the active centre of the enzyme. The choice and design of electrode system used for these studies play an important role in improving the efficiency of the enzyme electrode. Carbon nanotubes and graphene-based nano-materials are attracting attention in these studies. Apart from development of nano-electrodes, the carbon-based materials have also attracted interest in several other bioanalytical applications. The article by Elizabeth Hall and coworkers provides an informative outline of the recent developments in this area. Nanofibres made using electrospinning techniques with various polymeric materials were used to fabricate polymer based novel biomimetic scaffolds with suitable chemical functionalization for biosensors and also for other bioanalytical purposes. Biocompatible fibres made by electrospinning of polycaprolactone with collagen could be used for *in vivo* or cell-culture sensors. It has been shown that immobilization of protein or enzyme in the electrospun fibres not only enhances the effective surface accessibility, but also provides better long-term stability to the biomolecule under ambient and harsh conditions. Baeumner and Matlock-Colangelo have presented an overview of development of biosensors that incorporate these nanofibres. Electrochemical methods are also being used probing redox processes in the single-molecule level. Klaus Mathwig *et al*. describe various nanoscale methods for single-molecule electrochemistry. Combining the electrochemical methods with other spectroscopic methods has been used for detecting redox-induced changes in the optical properties in a single molecule. New methods, including imaging microscopic and microfluidic techniques are also combined with single-molecule electrochemistry to probe the molecular-level properties associated with the redox processes.

Mass spectrometry has seen enormous developments in recent years and newer techniques are being developed to achieve high sensitivity and resolution to study novel materials as well as to analyse complex biomolecular assemblies. Various aspects of analytical applications of mass spectrometry-based techniques have been described in different articles in this volume. Electrospray ionization (ESI) mass spectrometry being a soft ionization technique, has become popular in the analysis of the mass as well as size of large protein complexes and other biological nanoparticles. The review of the emerging techniques of mass spectrometry for analysis of large protein assemblies by Snijder and Heck, demonstrates the power of this technique in the study in structural biology as well as in nanotechnology research. One of the most important benefits of mass spectrometric study of large biomolecules is the ability to detect post-translational modifications. High-throughput mass spectrometric analyses of histone proteoforms have been described by Yuan *et al*., highlighting the strategies and challenges of this technique in the study of histones. Large-scale protein characterization by high-throughput mass spectrometric techniques has revolutionized modern proteomics research. Zhang *et al*. have described applications of various tandem mass spectrometric methods in achieving large coverage of identification of protein fragments using high-throughput techniques. Both top-down and bottom-up approaches to proteomics for identification and quantitation of proteins are possible with the development of Orbitrap and Q-TOF technologies. Mass spectrometric methods have also been exploited to unravel thermodynamic and kinetic properties of protein stability. Geer and Fitzerald have reviewed studies of H/D exchange for determination of the protein folding and stability of proteins. Since the discovery of the MALDI and ESI techniques of mass spectrometry, efforts are being made to achieve higher sensitivity and develop newer methods for preparation of charged ions in the gaseous phase for detection by mass spectrometry. Desorption electrospray ionization that uses a combination of ESI and desorption ionization methods for generation of charged ions can be used to study tissues and materials without any further processing; this can provide a spatially resolved analysis of compounds by mass spectrometry. Atmospheric pressure MALDI using IR laser was developed to analyse tissue samples without the requirement of any matrix compound. Flanigan and Levis have reviewed recent developments of laser-based techniques for the preparation of charged gaseous molecules from condensed phase at atmospheric pressure for mass spectrometric analyses. Femtosecond laser vaporization with a 70 fs laser operating at 800 nm (at 0.4–2.5 mJ pulse energy) coupled with ESI helped achieve 250 μm spatial resolution of a biological sample, which is significant. They have also described various other laser-based mass spectrometric techniques that could achieve high spatial resolution as well as high detection limits up to as low as a few atto-moles. Several applications of newer methods of mass spectrometry have been highlighted by different authors, which emphasize the importance of these emergent techniques in analytical chemistry.

Several microfluidics-based techniques have been developed for analytical chemistry applications, such as pH actuation, molecular separations and sensing, etc. These techniques have also been used for protein profiling from a single cell for proteomic and biomedical applications. Slouka *et al*. provide an interesting review of microfluidic systems with ion-selective nano-porous membranes for the development of efficient point-of-care biochips for detection and characterization of biomolecules. Yu *et al*. describe simultaneous assay of functional proteins from single cells that could be correlated with cell motility and cell–cell interactions using microfluidics-based toolkits for single-cell functional proteomics with potential biomedical applications. Nanoparticle-based sensors have found applications in food industry

as well as in human health to detect pathogens. Cho *et al*. have described various spectroscopic approaches for the detection of food pathogens using nano/micro devices and sensors. Luo and co-workers have highlighted various methods for fabrication of nanoporous materials elaborating upon various aspects of resistive-pulse methods for the study of single nanoparticles as well as for that of thermal and electrical responses of the ensemble of nanoparticles.

Optical sensors require a robost referencing strategy and the article by Mistlberger *et al*., highlights the power of photoresponsive ion-sensing methods in dynamically switchable ionophore-based sensors and analogous devices. Various imaging techniques have recently been developed for the detection of individual particles in biological samples. The development of microscopic imaging of plasmonic nanoparticles has been described by Xiao and Yeung, in view of achieving positional and orientational tracking at a single-particle level in complex biological systems. The optical methods of detection and analyses have increasingly started using light emitting diodes (LEDs). Dasgupta and co-workers have reviewed the use of LEDs in optical detection and measurements in analytical chemistry. They have described development of novel LED-based detector for simultaneous absorbance, fluorescence and contactless conductance detection, where LED has been used for fluorescence excitation and absorbance measurements. They also describe capillary-scale fluorescence and chemiluminescence detectors based on LEDs. The biosensors and disease biomarkers are being developed for clinical diagnostics and medical emergency. Gauglitz has given an overview of recent progresses in the detection methods and evaluation strategies of biosensors for point-of-care diagnostics and disease assessments. Modern analytical techniques for protein microarrays, bioaffinity columns and other methods for screening of small molecules are exploited to achieve high-throughput discovery of drug leads using solid-phase assays that are particularly useful for detection of labile targets, such as kinases and membrane-bound receptors. Forsberg *et al*. have highlighted the modern approaches of drug discovery and discussed the advantages and disadvantages of the solid-phase biological assay techniques. Targeted delivery of drugs or other analytes to specific cell types is an important issue of modern pharmaceutical research. Specific aptamers are designed and screened as 'chemical antibodies' for binding and recognition of specific receptors at the cell surface for bioanalytical applications. The review by Xiong *et al*. describes recent developments in the area of designing nucleic acid aptamers for cell membrane analysis, cell detection and isolation, real-time monitoring of cell secretion, and intracellular delivery and analysis with living cell models. The authors have highlighted the applications of aptamers in biomarker discovery and discussed the methods of detection of protein–aptamer complexes by mass-spectrometry and other techniques.



Scanning electron microscope image of a nanoporous silica membrane in a glass capillary. Image by Wang *et al.*

The contributions of nuclear magnetic resonance (NMR) to analytical chemistry is well recognized. New techniques are being developed to improve the speed and sensitivity of NMR methods. Giraudeau and Frydman have described recent developments of the ultrafast 2D NMR techniques to achieve real-time monitoring of chemical and biochemical processes, and for quantitative analyses of metabolites in complex biological milieu. Coupling of the ultrafast NMR technique with liquid chromatography (LC-NMR) has enormous potential for pharmaceutical applications. The authors have also highlighted the enormous possibility of ultrafast NMR techniques in *in vivo* studies.

Overall, the present volume of *Annual Review of Analytical Chemistry* consists of several important articles highlighting recent developments and challenges in this area outlining the applications to biological and materials science. Most of the articles are of high quality and describe the latest developments in the area. Considering the wide range of important topics covered in the issue, and the high quality of the articles highlighting the frontier areas of modern analytical chemistry, it would be a priced collection for any science library, and would provide a useful reference to the latest developments in the subject.

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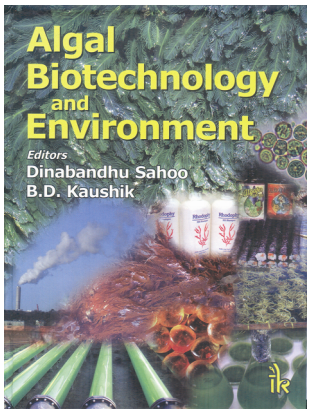

Algal Biotechnology and Environment. Dinabandhu Sahoo and B. D. Kaushik (eds). I. K. International Publishing House Pvt Ltd, S-25, Green Park Extension, Uphaar Cinema Market, New Delhi 110 016. 2012. x + 332 pp. Price: Rs 1595.

Algal biotechnology for food, feed, specialty chemicals, fuels and wastewater treatment, and ecological considerations is receiving attention worldwide. There has been a great deal of research in India on basic and applied algology encompassing algal taxonomy, habitat colonizational studies, biotechnological and environmental applications. This has been possible with the support to academics and also S&T activities by various universities, governmental institutions and industrial houses. This book provides a blend of assorted studies in the abovementioned areas of R&D carried out