tant role in determining the benthic fauna. Chapter 9 is devoted to the importance of iron and manganese. However, the measurements have not revealed any clear pattern, except that they tend to be slightly larger in the middle of the estuaries. It is left to the reader to examine whether these distributions are consistent with the arguments made in the previous chapters and to check how the reported levels compare with other estuaries.

Chapters 10 and 11 examine the pollution levels in Mandovi and Zuari estuaries. The tributyltin levels appear to be high owing to the operation and maintenance of ships and barges. The reported concentration levels are damaging and there needs to be a legislation that stops the release of tributyltin into these estuaries. Sewage pollution levels as indicated by coliform bacteria are also high in these estuaries, making the water unsuitable for human use unless treated appropriately. Both these chapters call for measures, primarily legislative, to be taken to check pollution levels and to protect these estuaries. Chapter 12, which is somewhat different from the rest of the book, but nevertheless interesting, deals with the 'khaznam' (low-lying lands along the banks of rivers protected from inundation by bundhs used traditionally for agriculture and fishing). The author of this chapter is irate about the fact that the khaznams are not being used primarily for what they were intended. It is rather curious to note that a well-balanced agriculture–fishery system could exist in this environment.

The book is intended to be a compilation of the existing information and knowledge about the Mandovi and Zuari estuaries, and this has been done excellently. The information available, particularly with respect to the chemistry and biology are meagre and much remains to be done. However, a consistency analysis across chapters would have made it easier for the readers to understand the distributions with respect to the processes. Nevertheless, the book offers an excellent guideline on what could be planned for the many estuaries that string both coastlines of India.

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Molecular Biotechnology: Principles and Practices. Channarayappa. Universities Press (India) Private Ltd, 3-5-819, Hyderguda, Hyderabad 500 029, India. 2006. 1217 pp. Price: Rs 735.

Biotechnology is an upcoming area and many universities have started undergraduate and Master's programmes, attracting young graduates in large numbers. A basic understanding of this interdisciplinary area is thus much desired and the authors have tried to fill this void. The present book balances both the founding principles and the practices followed in biotechnology. Concise and simplified presentation of facts, coupled with a generous dose of illustrations makes the book reader-friendly.

The book is divided into nine sections covering important tools and techniques essential for a student of biotechnology. Individual chapters dwell into further detail. The introductory part has a chapter on 'Good laboratory practices', giving the readers some insight into biosafety aspects. Techniques are divided into three parts: one on advanced techniques in molecular biology, another on working with nucleic acids, and yet another on recombinant DNA and genetic engineering. However, it would have been better to deal with the advanced techniques (Part II) after the basic techniques (described in Parts III and IV). Nonetheless, in the text, lucid illustrations are followed by a rather comprehensive detail of the subject, without confusing the reader. The chapter on bioinformatics in biotechnology is well dealt with. The section on working with nucleic acids has a good amalgamation of theory and practical details, and thus should keep the reader engrossed. The chapter on working with proteins is also well conceived and deals in detail with various protein purification, detection, estimation, fractionation and immuno-techniques, and their modifications. Part VII is on bacterial and mammalian cell cultures, while Part VIII deals with *in vitro* plant cell culture and crop improvement.

While techniques have been given emphasis, the application aspects presented in Part V are somewhat outdated. Whereas there is extensive coverage of *in vitro* plant cell culture techniques in nine chapters (Part VIII), only one chapter (22) is devoted to plant biotechnology (i.e. genetic engineering). Looking carefully into the chapters and contents of Part V, it is surprising that it precedes Parts VI–VIII. The last chapter deals with environmental biotechnology and how biotechnological intervention can help in genetic conservation and pollution control. More appropriately, it also touches upon the regulatory aspects, intellectual property rights and discusses ethical issues.

Despite some shortcomings, the book is a good and concise collation of information on practical and theoretical aspects of biotechnology. It is reasonably priced for undergraduate and postgraduate students from diverse backgrounds, who are in a hurry to gain information on the tools and techniques employed in this emerging area of life sciences.

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Quantum Computing Back Action 2006, AIP Conference Proceedings Vol. 864. Debabrata Goswami (ed.). American Institute of Physics, AIP Office of Rights and Permission, Suite INO1, 2 Auntington Quadrangle, Melville, NY 11747-4502, USA. 2006. 332 pp. Price not mentioned.

The possibility of using quantum mechanical systems to provide a new paradigm for computation has opened up new areas of research in quantum information theory in the last decade. Logical operations in quantum computation are implemented on qubits, the basic units of quantum information. A qubit can be visualized as the state of a two-level quantum system, with the two eigenstates being mapped onto logical 0 and 1. The fact that a qubit can exist in a general coherent superposition of the eigenstates leads to new possibilities for computation. Furthermore, it has been postulated that quantum computation can exploit inherently quantum features such as entanglement and quantum superposition, to solve problems hitherto deemed intractable on any classical computer. Shor's quantum algorithm for factoring is one such example. This fusion of ideas from

quantum physics and classical information theory has led to exciting developments in quantum computation, quantum cryptography and communication, teleportation and error correction.

The book under review is a compilation of the proceedings of a conference with the same name, held in March 2006 at the Indian Institute of Technology, Kanpur. The collection is fairly eclectic in character and covers a broad range of research directions. Although not done explicitly in the book, the articles can be broadly divided into three categories: those dealing with entanglement (and its scaling, transfer and decoherence), accounts of experimental forays into quantum computation and quantum control, and discussions about more esoteric ideas such as quantum neural networks and pseudo-telepathy games. This broad range also reflects the status of the field of quantum information processing (QIP) today, with researchers in the field ranging from mathematicians, computer scientists to theoretical physicists and the spectroscopy and optics community, each having gained his/her own unique perspective on QIP over the last decade since its inception. The connotation of the phrase 'back action' in the title of the book is quite intriguing, and as explained in the preface, specifically denotes that the conference focuses on the issue of the impact of quantum computing on other areas of research, rather than its future progress. This is indeed amply demonstrated by the breadth of research topics covered and the diversity in the background of the researchers who presented papers at the conference.

The book begins with Gruska's article on 'Quantum informatics paradigms and tools for quantum information processing and computing' (QIPC), which is an encouraging note to physics-oriented researchers in QIPC, detailing the paradigms and tools of theoretical informatics that have been extensively used for QIP, and can now be used by physicists to explore the quantum world. The article also has a nice discussion about the power of randomness as an information processing resource, and the new insights gained into the laws of information processing as a consequence. Bennett's article raises interesting questions (though he does not attempt to answer them!) about the role of quantum superposition and entanglement in understanding the nature of information. The author suggests three hierarchies of privacy of information: quantum, classically private and public, and by comparing entropy flows into and out of earth with estimates of the planet's storage capacity, concludes that most macroscopic information is impermanent. An interesting counterpoint to the above-mentioned positive visions of QIP, is the article by Warren on 'Coherence, correlation and entanglement: have we learned anything from NMR quantum computing', whose Cassandra-like predictions about NMR quantum computing (NMRQC) have over the years proved largely unfounded. However, the article contains useful insights into the differences between correlation and coherence, and between entanglement and correlation provided by NMRQC.

There are a number of thought-provoking articles on multi-partite entanglement, for the curious researcher interested in tackling this strange beast. Articles by Parthasarthy *et al.* focus on constructing completely entangled subspaces and states by analysing the properties of extreme points in the set of all states of a coupled bipartite quantum system, on investigating a new class of entangled bipartite states that remains positive under partial transposition and occupies a finite volume in the bipartite state space, and on the problems of distinguishability of multipartite orthogonal entangled states by local operation and classical communication (LOCC). Plenio *et al.* study the scaling behaviour of the entanglement between a region and its environment, and discover that the degree of entanglement is asymptotically proportional to the boundary surface area between the regions, while Agarwal's article discusses some initial ideas on how cavity quantum electrodynamics could be used to produce multipartite entanglement. There are a few articles that address the problem of decoherence, notable being the one by Subrahmanyam *et al.*, which models the decoherence of a qubit interacting with a nuclear spin bath in quantum dots, and another by Arvind *et al.*, which discusses the surviving entanglement of two-mode Gaussian states under a dissipative environment. The article by Ashwin Nayak addresses an interesting problem in quantum cryptography, namely that of constructing approximately randomizing maps that preserve the number of qubits in the encrypted message, which can then be transmitted over an insecure channel.

For a conference on quantum computing, there are unfortunately only a few articles on the experimental progress made in the field. Pichler *et al.* report on an interesting experimental study using femtosecond pulse trains to resonantly excite rubidium and cesium atoms and map the optical frequency comb to the atom velocity comb. The article by Gershenfeld *et al.* also discusses issues in quantum control, namely that of using shaped ultrafast pulses to enhance the rate of inter-system crossing in metalloporphyrins, with the possibility of application to polarization enhancement in NMR. The article by Goswami discusses the use of adiabatic coherent control methods to reduce decoherence in optical approaches to quantum computing. The article by Anil Kumar reports the use of a dipolar-coupled an eight-qubit system for NMRQC and is the only one that discusses an experimental implementation of quantum gates using such systems. Overall, the book makes an interesting reading and will be useful as a quick compendium of current research directions for serious researchers in the field of quantum information and quantum computing.

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