plicity of the hypotheses, the generality with which the analysis can be carried out so effortlessly ... seem to make it highly probable that these are basic traits of a future theoretical representation.' Indeed that is just what happened with Dirac's quantum theory of emission and absorption of radiation in 1927.

Document 42 is a full-scale translation of a book on both special and general relativity which Einstein wrote in German in 1917 for the lay public. It runs into 178 pages, and what we have here is the 1961 translation by Robert W. Lawson. How seriously Einstein took the task of carrying science to the intelligent if non-expert reader is seen in these words from his Preface: 'The author has spared himself no pains in his endeavour to present the main ideas in the simplest and most intelligible form, and on the whole, in the sequence and connection in which they actually originated.' Sadly, such noble traditions are the hardest to maintain!

Any listing of the jewels in this Volume would include these: the derivation of the perihelion shift of Mercury (Document 24); the final 25 November 1915 formulation of the gravitational field equations (Document 25); the A and B coefficients in the matter–radiation problem (Documents 34 and 38); the concept of gravitational waves (Document 32); and the first application to cosmology (Document 43). On political matters there is the October 1914 'Manifesto to the Europeans' (Document 8) arguing for a united Europe – '... the time has come where Europe must act as one in order to protect her soil, her inhabitants, and her culture' – which one cannot resist comparing with later historical developments and even with the situation today. And Document 20 from late 1915 titled 'My opinion on the war' has this telling sentence '... I consider so called aims and causes of war as rather meaningless, because they are always found when passion needs them.'

One piece unfortunately omitted is the set of lecture notes of the Winter 1914–1915 course on relativity Einstein gave at the University of Berlin. But with a book so full of riches, one should not complain at all!

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Gearing for Patents: The Indian Scenario. Prabuddha Ganguli. University Press, Hyderabad. 1998. pp. xvi + 288. ISBN: 81 7371 105 4. Price Rs 205.00; outside India $ 17.50 + $ 2.50 (s&h).

The first of the several quotations used by the author is from Eric Hoffer: 'In a time of change it is the learners who inherit the future. The learned find themselves in a world that no longer exists.' Sounds similar to the basic lesson in evolution that those species which were slow in adapting to change just vanished. As I have pointed out often, most Third World countries remain Third World not because they are poor (well, it is one of the reasons, let me admit), but because they are unable to adapt to change. Now times are achanging and changing rapidly. Within a short decade, we saw the disappearance of the Soviet empire leaving the world unipolar, and the emergence of new trade regimes. The economies around the world suddenly became global and Narasimha Rao and Manmohan Singh had no option but to fall in line, and now Vajpayee and Yashwant Sinha cannot change course. In the globalized economy, Indian industry can no longer live in a protected cocoon. It has to survive open market competition with far more resourceful players from the industrialized countries. The WTO and TRIPS have come to stay.

Survival in the WTO and TRIPS led world depends largely on our ability to patent our inventions both here and abroad and exploit patents and intellectual property rights (IPR) of others. How well are we geared to meet the challenge? Let me quote from the Foreword to this book by Raghunath Mashelkar, the CSIR chief: 'It is no exaggeration to say that there has been no culture of patenting in India, and even the awareness about the need and significance of patenting has been abysmally low, not only in the lay public but even among the researchers and technologists who create intellectual property, and the law professionals who would be drafting, defending and challenging patents.' Not very encouraging. We need to launch a patents literacy mission with a sense of urgency, says Mashelkar. No one can disagree with him.

In such a mission, Prabuddha Ganguli will be in the vanguard. He has the knowledge – almost entirely self-taught – and more than that the willingness to share it. He has been on the faculty in many workshops conducted by organizations such as the Administrative Staff College of India (where he teams up with B. Bowonder), TIFAC and the CSIR, and he has handled many cases. Working for a highly patent-conscious transnational company, he has acquired rich experience. And in this primer, especially written for the Indian audience, he has made a clear and coherent presentation of the subject, interspersed with examples and real cases. He has made some online searches, with the help of Makarand Waikar, especially for this book. Needless to say, even novices can go through the book and learn the basics.

Apart from the main text, divided into 17 chapters, there are nine appendices. The last appendix is an annotated reading list prepared by John Peter of ASCI, Hyderabad. There is a glossary and a list of countries which are signatories of WTO. Examples of complete patent specifications, selection patent, main patent, patent addition and how a patent appears in the Gazette of India are given. The author emphasizes the need for acquiring skills for searching patents and draws attention to the role patents play in competitiveness. In general, the book owes its strength to the many examples and practical suggestions. I wish the author had drawn attention to Francis Narin's work on patent-based indicators, which had been reported more than once in the *New York Times* and *Business Week International*. A chapter on international patenting would have greatly enhanced the value of the book.

There are some minor lapses. For example, Amaco, an American oil major, is spelt Amco (an Indian battery manufacturer) and Abbott is spelt with a b short. Boxes which could have been printed in a single page are split into two parts and appear in two pages. The text in the boxes could have been set in a font different from that of the main text. Surely these will be taken care of in the next edition, which I expect to come out soon. In bringing out the second edition, the publishers will have enough time for an editor to go through the text to remove the few problems that would remain in the first edition of any book with a deadline to meet. Let me assure the readers that these lapses in no way detract the tremendous relevance of the

book. I urge all academic, research and industrial and even public libraries in India to order a copy straightaway. At this price it is a cinch of a buy.

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The Web of Life. G. Padmanaban, M. Biswas, M. S. Shaila and S. Vishveshwara (eds). Harwood Academic Publishers, Rijswijkstraat 175, 1062, E. V. Amsterdam, The Netherlands. 1997. Price: $ 57. 161 pp.

The point is that 'all' known material processes and explanatory principles apply to organisms, while only a limited number of them apply to non-living systems.... Biology then is the science that stands at the centre of all science.... And it is here, in the field where all the principles of all the sciences are embodied that science can truly become unified.

G. G. Simpson,
This View of Life, 1964

In 1964, the above rather audacious assertion would have been appreciated by some biologists but stunned the vast majority of non-biologists into total disbelief. Today the picture is considerably different and the vastness and centrality of the scientific space occupied by modern biology is much more widely recognized, thanks largely to the post-1964 developments in molecular and cellular biology which have tremendously broadened the scope of detailed analysis and manipulation of genomes, and given rise to a host of new ethical, legal and social issues and anxieties concerning the future course of human civilization.

It is not very surprising, therefore, that a series of anthologies entitled, 'Perspectives in Science and Engineering', which would seek to explore the relationship of science and engineering with human civilization, and which is to be edited by an engineer (S. K. Biswas) and an astrophysicist (C. V. Vishveshwara), has *The Web of Life* as its first volume. This book explores and celebrates the pivotal role of modern biology in providing inter-connection and inter-relations among widely separated fields of knowledge ranging from virology to immunology, from stress biology to thermodynamics, from the unifying triumphs of reductionist molecular biology to the political economy of sciences and the limitation of reductionist biology, from the necessity of biodiversity for human welfare to the implication of human molecular genetics concerning liberty and equality. Each of the ten essays in the book makes many an interesting, often provocative, point which merits further discussion. I shall comment on only two – reductionism and human rights in the context of biology.

At least three essays (Mackay, Padmanaban & Shaila, and Anita & Suresh Rattan) have felt it necessary to adversely comment on reductionism in biology. This is rather surprising considering that most of the conceptual as well as technological triumphs of modern biology are based on the knowledge gained through the implementation of the reductionist agenda. This knowledge has given rise to the concept of a self-replicating and evolvable genetic programme encoded in the nucleotide sequence of DNA and implemented through the expression of individual genes. This concept has unified functional and evolutionary biology. Recent developments in comparative genomics can hardly leave any reasonable doubt that all biological diversity is traceable to evolutionary changes in a common ancestral programme. Similarly, recent progress in such areas as developmental biology, neurogenetics, psychoneuroimmunology and signal transduction should explain those aspects of functional biology (such as the coordinated, goal-oriented functioning of the different parts of a living organism, and the so-called emergent properties) which arise at higher levels of organization and which are often believed to require special explanatory principles beyond the reach of the reductionist knowledge. At least in the case of simple model organisms like bacteria, where the nucleotide sequence of the entire genome is now known in several cases, the prospects of determining the functions of each gene and the regulatory circuits based on a variety of interaction between these genes, their products and the environments, and synthesizing this knowledge to explain the functioning of the entire cell, are not negligible, in spite of the enormity of the task because of complexity of the systems. The whole is certainly more than the arithmetic sum of its parts but once the nonlinear interactions between the parts and the various feedback loops are elucidated and added to the sum, there remains no conceptual problem in explaining the whole in terms of the parts. If that conflicts with one's political or religious beliefs, or with an exaggerated belief in the efficacy of mathematics, then, may be, there is a need to re-examine the bases of these beliefs. That may help in forming a more coherent world view.

Marliere and Mutzel have pointed out that the application of modern biology to certain sensitive areas of society may make the nature of man appear incompatible with the democratic ideals of liberty, equality and solidarity among human beings, as formulated in the eighteenth century Europe. This is a legitimate and serious concern. However, there is nothing in modern biology in general, and human genetics in particular, that is incompatible with the ideals of liberty and solidarity. Even the ideals of equality before law and equality of opportunity are quite consistent with genetic knowledge and would, in fact, be suggested as imperatives for maintaining social harmony required for long-term survival and well-being of humanity. The difficulty arises only when it comes to the assertion that *all humans are created equal*. This goes against the *fact* of genetic uniqueness of every human being. As Ernst Mayr has argued (*The Growth of Biological Thought*, 1982, p. 79) the 'enlightenment' ideal of 'equality' of all men developed in the West at a time when the thinking of Western man was largely dominated by the ideas of the physics-based scientific revolution which included *essentialistic* thinking (a belief in the essential *identity* of all members of a class, as in the case of particles in a classical ensemble). This dichotomy between *physical identicism* and *biological uniqueness* had been recognized by biologists even earlier. Haldane and Dobzhansnky (cited by Mayr) had pointed out that the ideals of 'equality before law' and 'equality of opportunity' could help resolve this dilemma. Achievement