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, psychoneuro-immunology 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 of these ideas would require some kind of affirmative social policies in favour of the genetically disadvantaged. These may include, specially designed educational packages, privacy of genetic information, and non-discriminatory insurance and employment policies. Such policies may be opposed by special interest groups such as taxpayers and company shareholders in a no-holds-barred market economy but resisting such pressures may be more appropriate than demanding a ban on genetic knowledge which can benefit humanity in so many ways. Indeed, a ban on knowledge is against the very spirit of enlightenment.

Finally, it is somewhat ironical (though not very unusual) that a book that celebrates the wide-ranging explanatory powers of modern biology should be called 'The Web of *Life*' (emphasis added). For, as has been argued at many places (for instance, see *The Logic of Life* by Francois Jacos, 1974), one of the major consequences of the growth of modern biology has been that 'life' is no longer regarded as a scientific concept. Biologists today study 'living systems' and 'living processes' but not 'life'. Let me elaborate. The concept of 'life' was introduced into science in early 19th century as a postulated (vital) force, present in every individual living organism which enabled its different parts to function in harmony until death; this force was responsible for the highly ordered structures and processes in living beings and for the special position occupied by the atoms in organic molecules; it (life) was a somewhat magical, transcendental entity associated with the whole organism as long as it lived. Progress in biology, starting with the Cell Theory developed in the middle of the 19th century and ending with the birth of molecular biology in mid-twentieth century, has relentlessly argued against the existence of any such force. Living systems now have flow of information, energy and matter but nothing that can be defined as 'life'.

In conclusion *The Web of Life*, even though somewhat unhappily titled, is mostly a good read. The quality and content of the essays is somewhat uneven but each has useful information and thought-provoking ideas. Some of these are quite original. The editors have done a good job. One can recommend this book to both biologists and non-biologists. I, for one, would eagerly look forward to other volumes in the series.

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Microclimate for Cultural Heritage. D. Camuffo. Consignlio Nazionale delle Ricerche, Instittuo di Chimica e Tenologie, Inorganiche e dei Materiali Avanzati, Corso Stati Uniti 4, 35127, Padova, Italy. 1998. Price: US $ 227. 428 pp.

This is a useful microphysics handbook for conservators and specialists in physics, chemistry, architecture, engineering, geology and biology dealing with the environment and works of art. It gives a rigorous treatment and a background familiarity with the underlying physics behind mathematics, giving a detailed description and interpretation of the main micro-physical phenomena, removing unsound popular beliefs. The bases are given for non-destructive diagnostics to evaluate causes of damage determined by atmospheric factors, as well as negative consequences of the unsound use of technology and mass tourism. To this aim, suggestions are given on the fundamental principles in designing heating, air conditioning, lighting and in reducing the deposition of pollutants on works of art.

Further, theory and experience are coupled to describe the complex condensation mechanisms and the fundamental role played by water in the stone deterioration and the formation of crusts on monuments. Urban meteorology, air–surface interactions, atmospheric stability, dispersion and deposition of airborne pollutants are also key topics of this book, for which the main aim has been to make comprehensible to a wider audience a matter that is only familiar to a few specialists.

This book combines a theoretical background with many years of accurate laboratory research, field surveys and practice. The first part, devoted to applied theory, is a concise treatise on microphysics, which includes a survey on the basic ideas which are necessary for environmental diagnostic and conservation. The second part of the book focuses on the practical utilization and shows in detail how field surveys should be performed, with many suggestions and examples and the indication of some common errors that should be avoided.

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