**Annual Review of Biophysics, 2008.** Douglas C. Rees, Michael P. Sheetz and James R. Williamson (eds). Annual Reviews, 4139, El Camino Way, P.O. Box 10139, Palo Alto, California, USA. Vol. 37. 513 pp. Price not mentioned.

The subject of biophysics originated with the blending of physics and biology. It is the application of physical laws to biological systems. Is there any biological entity that does not abide by these laws? Perhaps no! This is the reason why biophysics is playing an important role in increasing our knowledge about the biological systems. Studies in electrophysiology, nerve–muscle transmission and muscle contractile forces once comprised the tenets of biophysics. But the first half of the 20th century saw a phenomenal increase in the usage of technologies like electron microscopy, ultracentrifugation, X-ray crystallography and other spectroscopic techniques in solving protein structure. Biophysics is now no longer confined to electrophysiology or bioenergetics. Indeed, the elucidation of the structure of the DNA and of several enzymes and proteins in the second half of the 20th century helped biophysics to delve beyond the obvious. Thus, the roles of these proteins within the cell began to be understood. Slowly, biophysics of macromolecules became a hot pursuit in our quest of understanding the cellular architecture in life and disease state.

This volume of *Annual Review of Biophysics* chronicles the latest advancements in the field of biomolecular structure and functions. The basic theme may be divided into three aspects: (a) technological advancement to study intracellular events; (b) biomolecular structure and biological function thereof and (c) application of these advancements. The review series opens with an excellent personal account of protein folding research by Baldwin. He shares a lifetime of research experience seeking answers to the protein-folding problem. His initial interaction with stalwarts like Jacob, Monod and Kornberg and his career at Stanford make an interesting reading for a young scientist, who is aspiring to make a mark in the scientific world.

Has it really become possible to understand what each individual molecule is doing inside the cell? If yes, then how do we examine the activity of a protein at the molecular level? A part of the book answers these questions. The chapter on nanobiotechnology and cell biology (Torres *et al.*, p. 265) reviews how nanosurfaces are patterned and modified to mimic extracellular matrix. It further provides many examples where this technique has been used to understand how several molecules interact with surfaces to spatially regulate cellular processes. Particularly interesting is the chapter on single-molecule imaging in living bacteria to show the intracellular operations of replication, transcription and translation vividly (Sunney Xie *et al.*, p. 417). As described in the review, with the help of fluorescent proteins and techniques like total internal reflection and stroboscopic excitation, it is now possible to see events like binding of a transcription factor/repressor to the target DNA and the ensuing protein synthesis without the need of fixing the cells, generally required for microscopy. The chapter by Kerpolla (p. 465) provides detailed insights into the technique of bimolecular fluorescence complementation analysis, used for visualizing the interaction between two proteins. The author has meticulously elucidated the basics, design, analysis, applications and scope of this technique.

Apart from describing the technological advancements, the present series of reviews rigorously exemplifies how several biophysical techniques have amalgamated to reveal structure, function and regulation mechanisms of biomolecules. Structure of biomolecules, especially proteins and what makes them fold, the way they do, has still remained a mystery. The profundity of the problem can be ascertained from the fact that several chapters of this series endeavour to unfold the protein-folding mystery. The article by Udgaonkar (p. 489) enlightens how with the help of techniques like time-resolved fluorescence resonance energy transfer, nuclear magnetic resonance and mass spectrometry, researchers have found multiple pathways for protein folding. Several heterogeneous structures have been detected during the folding process. Baldwin has discussed these intermediate structures at length. The review on protein folding problem by Ken Dill *et al.* also provides valuable insights into how a protein folds correctly into its native conformation within microseconds. In addition, it shows the usage of computational technique like CASP (Critical Assessment of Techniques for Protein Structure Prediction) to predict a three-dimensional structure of a protein based on its primary structure.

Nature has evolved biomolecules to perform specific functions. Although a great deal of progress has been made in understanding the relationship between structure and function, a lot remains to be understood about the role of each fold, cleft and crevice of these molecules. This volume is enriched with examples of this facet of several proteins like rotary ATP synthase (p. 43), eukaryotic epidermal growth factor receptor (p. 353), eukaryotic RNA polymerase (p. 337) and the volume continues this journey by presenting insights into the emerging structural and functional features of Riboswitches (Montange and Batey, p. 117). Several articles further illustrate the mechanism and consequence of interaction and communication between specific proteins and their counterparts like plasma-membrane (p. 65), metal ions (p. 97) and cofactors (p. 175).

The true impact of scientific discoveries is deemed when they are applied to improve human life. There is an interesting review by Jackell *et al.*, where it is shown how a novel protein hitherto absent in nature can be designed using molecular biology techniques. The chapter emphasizes how scientists have not only come closer to the solution of Levinthal's paradox, but have also been introducing artificial folds in existing proteins, which was unthinkable 40 years ago. Such artificial proteins can one day be used to do things, which nature could not do. Another noteworthy chapter by Chaires describes how calorimetry and thermodynamics, which have been at the core of biophysics since early days, are playing an important role in drug design, an important activity of this era.

From the days of Pauling, Bernal and Kendrew, biophysics of macromolecules has come a long way. Bigger PDB, widening internet, increasing knowledge of genetic engineering and nanotechnology are helping biophysics to march in rapid strides. The present series is a testimony to those spectacular advances. The subject has progressed and expanded so much that it cannot be justified fully even in a voluminous book. Yet this volume overwhelms the readers by providing an authoritative overview of the latest happenings. Short side notes of information

inside the chapters greatly assist in understanding the complex subject matter. Not only the students of biophysics, but professionals dealing with biochemistry, cell biology and molecular biology will find this book eminently readable and highly informative due to its lucid explanation and easy organization of the huge amount of data from diverse fields of biophysics.

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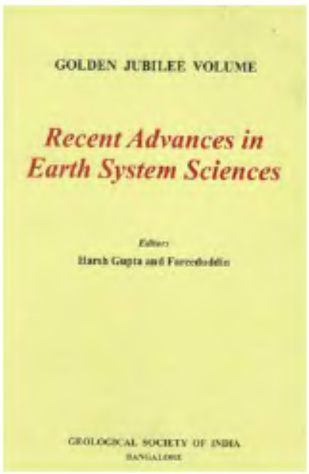


**Recent Advances in Earth System Sciences – Golden Jubilee Volume.** Harsh Gupta and Fareeduddin (eds). Memoir No. 66, Geological Society of India, P.B. 1922, Gavipuram P.O., Bangalore 560 019. 2008. 674 pp. Price: Rs 1800/ $ 180.

The golden jubilee volume on *Recent Advances in Earth System Sciences* commemorating the 50th year of the Geological Society of India, attempts to showcase the progress made in geosciences over the last fifty years. One might as well call this as the 'progress made in earth sciences'. However, the editors of the volume, Harsh Gupta and Fareeduddin, in their introduction make a case for a system approach to link the disparate fields in earth sciences (and planetary sciences) and therefore, justify the title of the volume. The volume deals with wide ranging topics and many of them are India-centric articles. The authors of each of the articles, apparently chosen on the basis of their significant contributions to each field, discuss the current level of understanding of the individual topics and also highlight the gaps in our knowledge.

The first article in this volume is a contribution on lunar research, in which the author (Taylor, Australian National University) modestly states that it is intended as a commentary on the lunar science from an historical perspective rather than an in-depth review. However, the article most ably evaluates the origin of the moon on the basis of the compositional characteristics of its crust and mantle. The compositional difference between the moon and the earth suggests the involvement of an external body colliding with the early earth. The moon is believed to have been evolved from the mantle of this impactor while its core was subsumed by the earth. What is evocative in this discussion is the fact that hundreds of years of speculation about the moon was laid to rest merely by the 'classical' geological examination of a few samples brought down by lunar expeditions. The power of geology, I am sure, will be further tested in future manned missions to the moon and Mars which would certainly consist of a few geologists–astronauts or to be wistful, during an ultimate adventure when geologists land on an asteroid in a distant future, literally realizing Schumaker's dream of hitting it with a geological hammer. In a companion article, J. L. Carter discusses the efforts in artificially producing the lunar regolith, which would duplicate the real material. These materials are indispensable for the projects that aim at establishing a permanent manned station on the lunar surface sometime in the second decade of the 21st century, so that we get a grip on how the lunar dust interacts with humans and machines in the longer term. This is completely new information for me. The article discusses the problems of duplicating lunar materials using earth's materials as well as some successes. Here is a field that could attract both geologists and material scientists.

Since the plate tectonic revolution, a sort of monotony had set in amongst the practitioners of earth sciences, only to be rudely shaken by the discovery of yet another process that had been overlooked. The high-energy physicist and Nobelist Luis Alvarez together with his geologist son Walter, developed the theory that a giant asteroid hit the earth around 60 million years ago, killing all the dinosaurs, and wrote up a paper in 1980. I consider this as a momentous development in the history of post plate tectonic geological research, which galvanized the scientific community to look outward and see the earth's process from a planetary vantage point. When Fred Hoyle, perhaps in one of his whimsical moods, first suggested that the life was seeded on earth externally (known now as 'panspermia'), he was almost hooted down. Now, scientists do realize that the impact cratering by the extraterrestrial objects has implications for the life on earth and evolution and also on climate. W. Uwe Reimold and C. Koeberl chronicle the history of this field and discuss the current status and point to the future directions. The impact cratering science has ramifications for the entire planetary bodies as a major process that affects their evolution and survival. We have already read this in the case of the moon. Here again, classical geology is a major tool that can be used profitably to distinguish the impact structures, mainly by identifying shock metamorphic features.

The last fifty years also saw rapid strides in space technology, and earth scientists used this development to their greatest advantage, mainly to monitor the earth processes on a global scale from a vantage point. The satellite facilities have resulted in generating vast amounts of spatial data. A. Cazenave reviews progress in this area that has contributed to a better understanding of the earth's gravity field, sea-floor topography, plate motions, crustal deformation, water-balance estimates, ocean dynamics, sea-level changes (for example, we can now say conclusively that sea level is not rising uniformly), to quote a few. The author in her article has most appropriately included a water-level time series of the River Ganga over the period of 1993–2006, obtained from Topex/Poseidon satellite tracks. Such inputs are useful in predicting the hydrological variability and river discharges. It would have been useful to add a companion article from the Indian space researchers to inform us what they have been doing with such data in the Indian context. This volume also contains an article by R. H. Mitchell, a foremost specialist in the field, who provides the riveting story of the Kimberlite studies and explains how