bottom photographs on page 48 and top photographs on page 49). The term normally means neomorphism of micrite to spar.

There are shortcomings in the bibliography too. In the first place, unpublished ONGC reports should not have been cited since these are not normally available to the general readers other than ONGC scientists. Many of the citations do not contain page numbers. Peter Scholle's book was not published in 1998 but 1978.

It appears that the authors were in a hurry for its publication without giving much thought and care that publication of a book deserves. On the whole, the book is useful and instructive for students in their practical classes on carbonate petrography and the teachers too will find it handy for classroom instructions and illustrations.

1. Horowitz, D. H. and Potter, P. E., *Introductory Petrography of Fossils*, Springer-Verlag, New York, 1971, p. 302.
2. Scholle, P. A., *A Color Illustrated Guide to Carbonate Rock Constituents, Textures, Cements, and Porosities*, Am. Assoc. Petrol. Geologists, 1978, Memoir 27, p. 241.
3. Bathurst, R. G. C., *Carbonate Sediments and Their Diagenesis*, 2nd edition, Elsevier, Amsterdam, 1975, p. 658.
4. Folk, R. L., *Petrology of Sedimentary Rocks*, Hemphill's, Texas, 1968, p. 170.

AJIT BHATTACHARYYA

H2/176, Sarsuna Satellite Township,
Shakuntala Park,
Calcutta 700 061, India

Annual Review of Microbiology 1998. Nicholas Ornston (ed.), Annual Reviews Inc., 4139, El Camino Way, P.O. Box 10139, Palo Alto, California. Volume 52. Price: Individuals $75; Institutions $150, 847 pp.

Modern biology is multidisciplinary by necessity. The *Annual Review of Microbiology* are an excellent resource series for readers interested not only in microbiology but also in genetics, molecular biology, cell biology and biochemistry. Since micro-organisms serve as excellent experimental organisms to understand basic biological phenomena, this review series occupies an important place. The current volume contains 21 wide-ranging reviews prefaced by Adelberg.

Living cells face varying environmental and nutritional conditions during their life cycle and for nutrient absorption, cell–cell interactions, etc. they form polarized cell structures. The yeast, *Saccharomyces cerevisiae* also exhibits polarized growth during starvation or mating and, therefore, serves as an excellent model system to understand these phenomena. It grows mainly as rounded cells but its pseudohyphal form allows yeast to adopt an invasive growth pathway in search of food under starvation conditions. The molecules involved in establishment of polarity and projections in response to pheromones, coordination of these events with cell cycle and cell fate determination by mother cell-specific expression of HO endonuclease mediated by specific localization of the *HO* gene repressor ASH1, are fascinating examples of differentiation mechanisms reviewed by Madden and Snyder.

Similarly, in the important area of aging research, yeast has shown the way. The mother cell buds to produce a smaller daughter cell but a given cell divides only for a finite number of times (25–30) before dying, exhibiting an age-related slowdown of cell cycle, onset of sterility and breakdown of nucleoli. Mutations that impart longevity to yeast are involved in cAMP metabolism, epigenetic silencing and genome stability. The common denominator in aging has been identified as accumulation of circular rDNA molecules. An understanding of the molecular basis may help in devising strategies to delay aging in humans. The advancements in this field are reviewed by Sinclair, Mills and Guarente.

Lantibiotics are the antimicrobial peptides made from modified building blocks like thioesters and thiazoles or unsaturated and stereoinverted amino acids and their post-translational modifications. The genes involved in their biosyntheses are organized in clusters. Sahl and Bierbaum describe how these novel antibiotics have dual functions of cell–cell signalling and immunity as well as antimicrobial activity. The last effect is exerted mainly through pore formation. Their properties can lend themselves to important applications.

The general view that bacteria exist solely as unicellular organisms needs revision as recent studies show that they do form highly differentiated multicellular structures through highly sophisticated signal transduction networks. Integration of intercellular signals leads to decisions about gene expression and cellular differentiation, in a manner similar to multicellular organisms. In three reviews the authors (Shapiro; Andrews; and Jacob, Cohen and Gutnick) discuss how the unicellular organisms can also adopt the multicellular state coupled with division of labour and harnessing of resources that cannot be effectively utilized by single cells, and for defense.

How cells adapt to environmental conditions is best exemplified by the glyoxylate bypass mechanism in enteric bacteria like *Escherichia coli*. This pathway is used to divert isocitrate from the TCA cycle when bacteria are grown in acetate rather than glucose to prevent the quantitative loss of acetate carbon as carbohydrate. It is governed by regulation of activity of isocitrate dehydrogenase by phosphorylation/deposphorylation reactions, which helps to channel isocitrate through TCA cycle or glyoxylate bypass. This important mechanism is well reviewed by Cozzone.

A similar paradigm emerges from metabolic regulatory mechanisms of *B. subtilis*. Earlier considered a strict anaerobe, this soil organism is now known to adapt to anaerobic conditions, like water-logged soil, by turning on regulatory cascades (modifying a two-component signal transduction system) that allow the use of nitrate and nitrite as terminal electron acceptors. This is achieved by inducing the expression of fnr which, in turn, activates the genes involved in anaerobic metabolism. This interesting metabolic adaptation system is reviewed by Nakano and Zuber.

Most plants fix CO_2 by photosynthesis with the help of chlorophyll. However, the chemoautotrophic bacteria (mostly found under extreme environments and utilize sulphur, nitrogen, metals or carbon as electron donors) utilize the Calvin cycle for carbon fixation, in which one of the 13 main enzymes, ribulose 1,5-bisphosphate carboxylase/oxygenase (RuBiSCO), is found in unique polygonal organelles called

carboxysomes. The regulation of genes involved in Calvin cycle and carboxysomes is well described by Shively, van Keulen and Meijer.

Micro-organisms also produce some novel enzymes that can be exploited for useful biotransformation reactions. Patel describes the novel approach of synthesis of paclitaxel, an anticancer drug (normally extracted from bark of Pacific yew trees at a very high cost) by biocatalysis with three novel enzymes obtained from the same plant species *Taxus*.

Modern world faces a serious problem of waste water treatment to remove several natural and man-made organochlorine compounds, that are causing severe and potentially irreversible ecological and environmental damage. Scientists are exploring ways of dealing with them. Lee, Odom and Buchanan review the normal measures involving microbial pathways of dechlorinating the toxic chlorinated aromatic compounds and converting them to nontoxic or metabolizable compounds. Other approaches to deal with the bottlenecks in microbial conversion of chloroaromatics involve genetic engineering of hybrid pathways, whereby genes for enzymes that degrade the toxic intermediates further, into the organism. These novel approaches and their mechanisms are reviewed by Reineke.

The specificity of transcription activation in prokaryotes is regulated by sigma (σ) factor that in turn controls the transcription of several housekeeping genes. In addition, several bacterial species undergo developmental changes like sporulation, flagellar secretion, stress response, etc. These developmental switches require new sets of genes to be expressed, which require specific σ factors. To achieve this, different bacterial species possess the anti-sigma factors, which abolish the function of the housekeeping σ factor and allow the stage-specific σ factors to express specific genes. The mechanisms of action of different anti-sigma factors from microorganisms like *E. coli*, *S. typhimurium*, *B. subtilis*, etc. is reviewed by Hughes and Mathee.

The unusual phenomenon of thymine less death (TLD) exhibited by bacteria, yeast and mammalian cells, involving cell death of thymine auxotrophs in response to thymine starvation, is reviewed by Ahmad, Kirk and Eisenstark. This exceptional phenotype is in contrast to biostatic effect of deprivation of other nutritional requirements and is caused mainly by loss of thymidylate synthase. It is accompanied by DNA damage in the form of single and double-strand breaks, which lead to cell death. The phenotype is exacerbated by mutations in recBCD pathway while recF repair counteracts it. This phenomenon is especially interesting since several anticancer drugs and antibiotics inhibit thymidylate metabolism and, therefore, understanding of TLD should help in devising better anticancer approaches.

Clostridium perfringens, the bacterium that causes human gas gangrene and food poisoning, produces several enterotoxins some of which are located on large extrachromosomal plasmids and transposons. Rood reviews the molecular biology of regulation of expression of enterotoxin by a two-component signal transduction system and the structure–function studies of enterotoxins.

Viruses exploit the cellular machinery for DNA replication, protein and RNA synthesis to propagate themselves. In addition, by a clever mechanism called virocrine transformation, viral gene products can activate the host cells' growth factor receptors (like erythropoietin) independently of their normal growth factor ligand, leading to host cell proliferation. Alternatively, their gene products may mimic the growth factor receptor thereby stimulating the host cell proliferation. This interesting phenomenon is reviewed by DiMaio, Lai and Klein.

The HIV retrovirus, the causative agent of AIDS, the most serious disease of epidemic proportions in the modern times, executes complex temporal programme of expression of late genes. This is mainly accomplished by the virus-encoded RNA-binding protein rev, which shuttles between nucleus and cytoplasm and plays an important role in transport of late viral mRNA from nucleus to cytoplasm. Because of its central role in regulation of HIV growth, rev also serves as a potential drug target. Mechanisms of regulation of rev and its role in RNA export are reviewed by Pollard and Malim.

The malarial parasite *T. brucei* has evolved intricate strategies for evading the defense mechanisms of the insect and human hosts, such that the parasite is able to extract its food from diverse hosts with the help of cell surface receptors (like transferrin receptors) and transporters (e.g. for LDL, HDL, etc.); however, these molecules are either not easily accessible to the host immune defence mechanisms or the organism can change its receptor and antigen receptors in a very small population, before the host can build up its defense mechanisms. These molecular strategies, as described by Borst and Fairlamb, should facilitate knowledge-based approaches for identifying new drugs and drug targets.

In conclusion, this volume covers several interesting areas like morphogenesis in prokaryotes, molecular biology of malarial parasite, viral gene regulatory mechanisms and excellent articles on morphogenesis control and aging control mechanisms in yeast. However some repetitions, like as many as three reviews on multicellularity in unicellular micro-organisms, could have been avoided.

JAGMOHAN SINGH

Institute of Microbial Technology,
Sector 39A,
Chandigarh 160 036, India

Annual Review of Earth and Planetary Sciences 1998. Raymond Jeanloz, Arden L. Albee and Kevin C. Burke (eds). Annual Reviews Inc., 4139 El Camino Way, P.O. Box 10139, Palo Alto, California. Volume 26. Price: US $75, 771 pp.

The present volume of the *Annual Review of Earth and Planetary Sciences* (*AREPS*) which contains nineteen articles, spans a broad array of research fields, from protoplanetary astronomy, marine geodesy, and metamorphic petrology to paleoecology, rock mechanics, and volcanology, the research fields which have made significant progress in the recent years.

Some of the greatest contributions to the geological sciences in the recent past came from geochronologists. They transformed the classical geology and freed it from its 'descriptive' mooring.