technique to asses stress distribution of a loaded structure and it makes use of polarized light. The later part of the chapter on polarization deals with this technique. The stress–optic relation which governs this technique is described for both two and three dimensions.

This book has a sizeable chapter on lasers. It starts with properties of lasers such as directionality, monochromaticity and coherence. Laser is obtained as photons emitted when atoms go down from higher energy level to lower energy level through stimulated emission. This has been well-explained using a bit of probability theory. Different types of lasers based on the way they are generated are presented. It includes solid state lasers, semiconductor laser and gas laser. The last part of the chapter deals with various applications of laser. Prominent among them are: Light detection and Ranging (LIDAR), Laser–Doppler velocimetry to measure velocity, material processing such as welding and cutting, laser-eye surgery, compact-disc reader, laser bar code scanner, laser printer and use of laser to separate different isotopes of an element. The chapter on holography starts with the principle of holography and its mathematical theory. The figure used to illustrate the principle requires improvement. It would be helpful if the last part in the mathematical theory concerning reconstruction of image from hologram explains how waves corresponding to three terms in an equation are made to travel in different directions. Probably this will make clear why one wave produces a virtual image of the object whereas the other produces a real image. The latter part of the chapter deals with different types of holograms and their applications.

The chapter on 'Fibre Optics' starts with a brief description of Tyndall's experiment demonstrating guidance of light through a curved water jet. Basic aspects of fibre-optics, total internal reflection and acceptance angle are explained. Problems associated with fibre-optics such as dispersion and attenuation are discussed. Fabrication aspects of optical fibres are described. The latter part of the chapter gives a brief account on communication systems and goes on to describe in detail use of the fibre-optics in communication systems.

The remaining portion of the book is dedicated to modern physics. The chapters here include: duality between particle nature and wave nature, X-rays and basics of quantum mechanics. The chapter on dual nature starts with classical as well as Planck's quantum model for black body radiation. Einstein's photoelectric effect brings about particle nature of light waves. de Broglie's hypothesis on matter waves is illustrated through electron diffraction and other examples. Heisenberg's uncertainty principle, which is a consequence of the dual nature of matter and waves, is illustrated in various situations including giving up of the notion of the orbit of an electron around nucleus to electron orbitals. The chapter on X-rays starts with generation of X-rays, its typical spectrum and associated Moseley's law. Some applications of X-rays including computerized axial tomography (or CT scan) are presented. The latter part of the chapter gives an account on crystal structure and its determination using X-rays. Few other applications are also discussed.

The author has made a good effort to introduce basic quantum mechanics with appropriate level of mathematics (for first-year engineering students). Various results are well-illustrated with graphs. The topics covered include Schrödinger wave equation in both time-dependent and time-independent form, solutions of the wave equation for a particle in simple situations, and significance of the solutions. Tunneling across a potential barrier and its applications are also presented. The presentation of the band theory of solids often tends to be story-like in many textbooks. However, by using the concepts presented in the earlier part of this chapter, the author has described the band theory in a refreshingly different manner.

The last two chapters concern two of the hot research areas: quantum computation and nanotechnology. These chapters could stimulate interest of students towards these areas.

Overall this is a well-compiled book. From the perspective of undergraduate engineering students, I believe, this book has a good balance between analytical and descriptive details.

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Annual Review of Genetics, 2008. Allan Campbell, Elizabeth W. Jones and Gertrud Schupbach (eds). Annual Reviews Inc., 4139 El Camino Way, Palo Alto, CA 94306, USA. Vol. 42. 772 pp.

Annual review series are known for their up-to-date review articles written by the peers in their respective subject area. This volume of the *Annual Review of Genetics* (2008) is no exception. Altogether, there are 30 chapters covering almost all the facets of genetics with organisms ranging from bacteria to human. Most of the chapters provide a summary and future direction and/or problems to be tackled. The first chapter (pp. 1–16) is an introductory personal anecdote by James F. Crow, a renowned population geneticist. He sets the tone of the book by discussing how four theories in population genetics became controversial theories during the mid-20th century. All the four theories: the shifting balance theory, heterosis-dominance vs overdominance, the classical vs the balance hypothesis of population structure, and the neutral theory of molecular evolution became controversial owing to the lack of clear-cut experimental evidences due to techniques involved and the indifferent approach of researchers who concentrated only on observable traits. He also brings out that many of these theories became controversial because of personalities of the main protagonists involved. Though these theories remain more or less unresolved even with advances in molecular tools, he is of the opinion that controversies have their own advantages for the science. However, one should seek cooperativeness to gain deeper insights. In the second article, Herzenberg *et al.* (pp. 19–25) present a bibliographical sketch of the Nobel Laureate Joshua Lederberg's tenure at the Department of Genetics, Standford University. He believed in an interdisciplinary approach and made the department a place where the best brains (specialists) from different fields could interact on a daily basis. He encouraged collaborations between clinical and basic science faculty members, which laid the foundation for what we now call 'translational research'. He foresaw the roles of technology in research, particularly the computer. He was instrumental for the development of many instruments and hardwares/softwares that we still use for our research

(of course with improvization), including fluorescent activated cell sorter (FACS), which is a 'bread and butter' instrument for many laboratories. He was also instrumental in laying the foundation for genetic concepts in immunology with Macfarlane Burnett. A visionary leader, whether as a departmental or institute head, can make a difference in how the department/institute does cutting edge research. Joshua Lederberg set the example by leading from the front and making the Standford genetics department a world class research department.

The remaining 28 articles can be roughly grouped into genetic sub-themes dealing with physiology and adaptation, gene regulation and function, genome organization including chromosomal dynamics, development, evolution, behaviour and multi-level of the interaction among the organisms.

Ability of the organisms to adapt (physiologically and genetically) to different adverse conditions is required for survival and evolution. Yeast as a simple eukaryotic model organism has been a favourite organism for studying adaptations to the availability of nutrients. Zaman *et al.* (pp. 27–81) comprehensively discuss how different pathways, which are highly conserved across multiple phyla (TOR-pathway), involved in cell cycle progression, growth, development and stress are affected in response to availability of nutrients, i.e. glucose and amino acids. Calorie restriction affects many genetic pathways that control the cellular states of the yeast like budding, diploid–haploid formation and replicative ageing. Similarly, an article by Eberhard *et al.* (pp. 463–515) discusses how solving the structures of key proteins involved in photosynthesis has helped in resolving and dissecting molecular pathways responsible for the light energy conversion in plants and microalgae. Photosynthesis is a molecularly flexible process and four main retrograde signaling pathways are involved in sensing environmental stimuli. Expression patterns of many of these genes change in response to environmental changes and it becomes important to understand the mechanisms in view of increasing CO_2 and global warming.

Many articles have been attributed to genome and genome-related problems. Parker *et al.* (pp. 619–645) review how comparative analyses of genomes of marine microalgae are unraveling the mechanism of genome evolution of these organisms through endosymbiotic and lateral gene transfer, particularly of those genes which are involved in metabolism for better adaptation and to sustain in different ocean environments. Whereas, Rocha (pp. 211–233) revisits the evolutionary dynamics that drive the organization and shaping of the prokaryotic genome, Rao and Feiss (pp. 647–681) discuss the importance of a powerful nanoscale motor packaging enzyme terminase, which is responsible for efficient bacteriophage DNA assembly. The review by Hunter and Crawford (pp. 131–141) covers the importance of the availability of multiple sequence information, genome-wide arrays and powerful computer tools for quantitative trait locus mapping in mouse. Comparative analyses of the burgeoning genome data will allow one to comprehensively nail down complex diseases to a few possible factors (genes) and cut down false positive data. There are multiple ways in which the genome organization of an organism can be affected. Jern and Coffin (pp. 709–732) discuss how retroviruses have been responsible for shaping the genomes of many host organisms including humans. How protein–DNA interaction is responsible for integration of transposon Tn5 DNA has been reviewed extensively by Reznikoff (pp. 269–286). Understanding the molecular mechanisms of Tn5 integration will help in developing the transposon as a genetic tool. Besides, it could herald its use as surrogate for studying HIV-1 integrase. Along a similar theme, Beauregard *et al.* (pp. 587–617) discuss the co-evolution of retro-elements and host factors.

In 'genome and evolution', Moran *et al.* (pp. 165–190) give an insight into shaping of genomes of symbiotic bacteria. The importance of host ecology, physiology and adaptation during evolution has been discussed in length with exhaustive lists of examples. Davidson and Surrette (pp. 253–268) discuss why many bacterial species maintain individuality in a population. Individuality helps in developing population level diversity which will help in overcoming environmental and ecological stresses to increase evolutionary fitness. Doyle *et al.* (pp. 443–461) discuss the consequences of genome merger and doubling during plant evolution. Interesting aspects of preferential retention of genes, epigenetic regulation, heterosis and transgressive phenomenon which make polyploidy a common phenomenon in plants have been reviewed elegantly. Rokas provides a brief summary of the genetic basis of origin of multicellularity (pp. 235–251), mechanisms for development of complexity and discusses the relevance of multicellular evolution with several examples. In vertebrates, many aspects of how sex and sex chromosomes evolved have not been well understood. Graves (pp. 565–586) discusses how genome sequencing of rare animals is helping to deduce these problems. Development of sex chromosomes and dosage compensation cannot be segregated in higher organisms. Payer and Lee (pp. 733–772) discuss the main players and mechanisms involved in inactivation of X-chromosome for maintaining the gene expression dosage.

Palm and Lange (pp. 301–334) discuss how telomere protein Shelterin, which is a six protein complex, protects chromosome ends by repressing signaling pathways and by blocking non-homologous end joining and homology-directed repair. Abnormal chromosome segregation leads to multiple diseases in human. Bouck *et al.* (pp. 335–359) discuss the importance of studying mitotic apparatus segregation in yeast for understanding how mammalian kinetochore separate during cell division. The importance of centromere stiffness, DNA, chromatin and microtubules for spindle stability and maintenance has been well reviewed.

Few review articles explicitly discuss the relationship between genetic regulation of development and diseases. Simons and Mlodzik (pp. 517–540) provide a meaningful insight into signaling mechanisms that decides the proper epithelial tissue polarization with an emphasis on developmental defects like CNS axon guidance, neural tube closure, A-P body plan, etc. They also discuss how diseases like polycystic kidneys and cardiac abnormalities are associated with defective planar cell polarity. Galli and van den Heuvel (pp. 389–411) analyse recent development in understanding cleavage formation in *Caenorhabditis elegans*, which is dependent on spindle assembly and ultimately decides the fate of a cell through symmetric vs asymmetric division. Mathew Freeman (pp. 191–210) gives an account of Rhomboid proteases and their biological roles. Rhomboids belong to the transmembrane serine protease group and are involved in diverse

cellular processes, like growth factor signaling, protein translocation, host cell invasion and mitochondrial function. As a result, rhomboids show a widespread presence from bacteria to human and are involved in diseases like cancer and diabetes.

At the organismal level, Serbus *et al.* (pp. 683–707) provide an in-depth account of Wolbachia–host interactions. How Wolbachia modulates multiple genetic and physiological pathways to facilitate its spread has been discussed. Gibson *et al.* (pp. 413–414) discuss the symbiotic interplay between host legume plants and rhizobial bacteria. Genetic basis for how bacteria impinge upon the host by suppressing the pathogen-defence response, and how legumes exude over-infection is explicitly presented. Wolf and Goff (pp. 143–163) review how hosts have evolved restriction factors that interfere with replication and the life cycle of retroviruses.

An interesting review of bio-nano-engineering is presented by Kroger and Poulsen (pp. 83–107). They summarize how diatoms form biosilica through biomineralization. The biochemistry, cell biology and genetics of silica formation in the membrane-bound compartments of diatoms have been discussed in detail. Diatoms can serve as a model to study and dissect the mechanisms for chemical cross-linking and chemical displacement reaction in a biological system and even for understanding how nanomaterials self-assemble. The article also gives a new perspective on how diatom genetics can be exploited to make silica based sieve for biomolecules separation; micro-electromechanical systems and masks for micro-fabrication.

Surprisingly, a single article is attributed to the genetic basis for complex behaviour. Andretic *et al.* (pp. 361–388) discuss the multiple loci that could be involved in complex behaviour like sleep. It has been elucidated how in-depth genetic analyses in model organisms like worms, *drosophila* and mice are helping in overall understanding of sleep requirements, timing and the adverse effects of its deficit in learning and memory, etc.

As expected from a book of 'The Annual Review' stature, this book delivers many exciting topics and reviews which could serve as an invaluable resource for both students and principal investigators working in the field of genetics and also for those who are planning a career in genetics.

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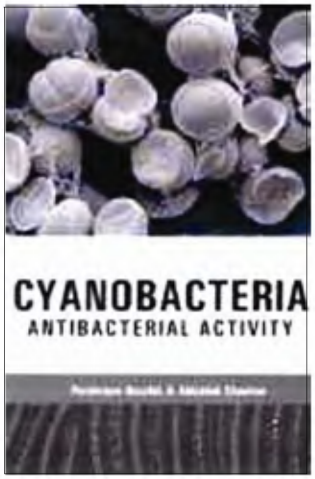

Cyanobacteria: Antibacterial Activity. Purshotam Kaushik and Abhishek Chauhan. New India Publishing Agency, 101 Vikas Surya Plaza, CV Block, L.S.C. Mkt, Pitam Pura, New Delhi 110 088. 2009. xii + 198 pp. Price: Rs 990.

The discovery of many classes of antibiotics represents a medical miracle, but at the same time, the problem of treating infectious diseases is always there. Resistance to antibiotics in bacterial populations has increased dramatically with time and usage of antimicrobial drugs. Consequently, there arises a need to explore and develop new and more effective antimicrobials. In this context, cyanobacteria offer a great opportunity as these are considered to be one of the potential organisms useful to mankind in many ways. Worldwide attention is drawn towards cyanobacteria for their possible use in mariculture, food, feed, fuel, fertilizer, natural colours, production of diverse secondary metabolites including vitamins, toxins, enzymes, pharmaceuticals, etc.

Cyanobacteria are photosynthetic prokaryotes that are known to produce a diverse array of toxic or otherwise bioactive metabolites. Though the functional role of the vast majority of compounds from these organisms, particularly in terms of the physiology and ecology of cyanobacteria that produce them, remain largely unknown, their role as anti-viral, anti-tumour, anti-bacterial, anti-HIV, etc. has been well established. Studies have also suggested that some of the compounds may have ecological roles as allelochemicals, specifically including compounds that may inhibit competing sympatric macrophytes, algae and microbes. This potential is being realized as more and more research information in the areas of physiology and biochemistry of these organisms is gathered and the knowledge of cyanobacterial genetics and genetic recombination increased.

The impact of bioactive compounds from cyanobacteria is promising. These provide novel and useful pharmaceuticals that are difficult to produce synthetically because of their structural complexity. The medicinal qualities of cyanobacteria were first appreciated as early as 1500 BC, when *Nostoc* species were used to treat gout, fistula and several forms of cancer. Yet, not much attention was paid till the turn of the century when during 1990, workers at the University of Hawaii, Oregon State had begun to screen extracts of cyanobacteria mostly strains of *Microcystis* and *Anabaena* spp., for various biological activities. It was reported that nearly 4000 strains of freshwater and marine cyanobacteria were screened inferring that cyanobacteria are a rich source of potentially useful natural products (6% having anti-cancer, anti-proliferative activity).

Later, several screening processes were initiated over important targets such as anti-bacterial, anti-fungal, anti-AIDS, anti-cancer and others. Lipophilic and hydrophilic extracts of over 900 strains of cultured cyanobacteria *in vitro* were examined for their ability to inhibit the enzyme reverse transcriptase of Avian Myeloblastosis Virus (AMV) and Human Immunodeficiency Virus type 1 (HIV-1). This was further taken up on large scale and more than 1500 strains representing nearly 400 species of blue green algae were cultured, and lipophilic and hydrophilic extracts prepared from these cultures were evaluated. Screening for a wide variety of potentially useful bioactives including cytotoxic, multidrug resistance reversal, anti-fungal and anti-viral effects has led to the discovery of numerous novel bioactive metabolites