

Genetics reviews

Annual Review of Genetics 1990. Vol. 24. A. Campbell, B. S. Baker and E. W. Jones, eds. Annual Reviews, Palo Alto, USA. 1990. 718 pp. \$42.

The biographical essay in this volume is on the renowned geneticist G. N. Beadle who died in 1989 after nearly half a century of pioneering work on the genetics of *Neurospora*. The next article 'Molecular genetics of *Aspergillus* development' by W. E. Timberlake deals with a fungus closely related to *Neurospora*. The genetic controls of development in *Aspergillus* have been studied in detail recently but numerous questions still remain unanswered. The molecular-genetic system of *A. nidulans* makes it possible to adopt experimental approaches that are available in only a few experimental systems.

A topic of general interest to molecular biologists is the article 'Regulated mRNA stability' by J. A. Atwater, R. Wisdom and I. M. Verma. The critical role of control of mRNA metabolism as a regulatory point in gene expression has recently come into focus. The successful application of methods recently developed for careful dissection of regulatory elements to define the structural features important for the control of degradation of some mRNAs has been presented and discussed in the review.

Two reviews, 'Genetics of extracellular protein secretion by gram-negative bacteria' by A. P. Pugsley, C. d'Enfert, I. Reyss and M. G. Kornacker and 'Genetic analysis of protein export in *Escherichia coli*' by P. J. Schatz and J. Beckwith, deal with two aspects of protein secretion in prokaryotes. In the second review a brief description of yeast secretion machinery is also dealt with. Protein export and secretion in bacteria have been found to be very complex but are being slowly understood. Many of the components of the secretion apparatus have been identified in *E. coli*. The secretion of proteins in bacteria and yeast are of great importance in recombinant-DNA technology, where foreign proteins made in these organisms must be secreted outside to be useful.

An important subject is dealt with in the review 'The LDL receptor locus in familial hypercholesterolemia: Mutational analysis of a membrane protein'

by H. H. Hobbs, D. W. Russell, M. S. Brown and J. L. Goldstein. The classical studies of the inborn errors of metabolism have taught us much about the properties of enzymes, the mechanisms of their mutations, and the metabolic consequences that follow. Another class of proteins, the cell-surface receptor, has begun to yield its secrets to the same type of genetic analysis. This review deals with mutations in the low-density-lipoprotein receptor in patients with familial hypercholesterolaemia.

Closely related to the above is the review 'Genetics of atherosclerosis' by C. F. Sing and P. P. Moll. Quantitative risk factor traits for genetic studies of coronary artery disease have been focused on in this review. The challenge we face in relating allelic variations in genes that influence these traits to estimates of risk of the disease in the population at large is also discussed.

'The comparative radiation genetics of humans and mice' by J. V. Neel and S. E. Lewis describes attempts to develop a rounded appraisal of the genetic effects of radiation on the mouse and human genomes. This represents one of the most complex undertakings of modern genetics. Closely related to this is the article '*In vivo* somatic mutations in humans; measurement and analysis' by R. J. Albertini, J. A. Nicklas, J. O. Neill and S. H. Robinson. Four systems for detecting *in vivo* gene mutations in four genes in human somatic cells, two in RBC, and two in T lymphocytes have been described, including details of the assays. The subjects of these two articles are of great importance for biology and medicine.

'Human tumor suppressor genes' by E. J. Stanbridge presents the evidence for tumour suppressor genes and discusses their role in the control of neoplasia. A knowledge of the functional roles that tumour suppressor genes and oncogenes play is critical for our understanding of cancer progression.

Plant geneticists will be interested in the review 'Cell-specific gene expression in plants' by J. W. Edwards and G. M. Coruzzi. It encompasses many cell-specific gene expression studies that have provided insight into the function of plant cells. Since cell-specific gene expression studies in plants have had a large impact on agricultural biotechnology, relevant examples have also been included.

'Gene-for-gene complementarity in plant-pathogen interactions' by N. T. Keen describes recent progress in understanding plant recognition of pathogens leading to disease resistance, particularly where resistance is controlled by single, complementary genes in plant and pathogen. A mechanistic understanding of this gene-for-gene complementarity promises considerable insight into the basis of disease defence in plants, as well as the probability of improved disease control in practical agriculture.

'Genetics of response to slow virus (prion) infection' by D. T. Kingsbury discusses the fundamental nature of the aetiological agent of the neurodegenerative diseases scrapie, kuru, etc. The agent of these disorders is a novel proteinaceous pathogen encoded in the host genome and has been named prion. The prion model represents a radical departure from conventional wisdom and predicts an agent with little or no nucleic acid of its own.

A review of great interest is 'Genetics of circadian rhythms' by J. C. Hall. Contemporary genetic studies of biological rhythms involve isolation and application of mutants for loci defined by the 'clock mutations'. The review discusses recent findings in this area and how these may lead to 'cracking the clock'.

Other subjects dealt with in this volume relate to polyketide, frameshift mutation, bacterial cell division, phage T4 introns, retroviruses and neurogenesis in *Drosophila melanogaster*.

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Biochemistry reviews

Annual Review of Biochemistry 1990. Vol. 59. Charles C. Richardson and others, eds. Annual Reviews, Palo Alto, USA. 1990. 1134 pp. \$44.

The autobiographical article in this volume, by O. H. Lowry ('How to succeed in research without being a genius'), recapitulates the emergence of

biochemistry from the forties to the seventies. There are three reviews on coenzymes. The article on pyridoxal 5'-phosphate enzyme reviews progress made with a few aminotransferases, decarboxylases and racemases. In recent years many enzymes containing the pyruvoyl group cofactor instead of pyridoxal phosphate have been identified. Their mechanism of action, regulation, etc. are covered in the second review. The third article on coenzymes deals with the unusual ones found in methanogenic bacteria. These archaeobacteria differ from eubacteria in a variety of properties, and possess new metabolic pathways and unconventional coenzymes.

Among the four immunology reviews, the article on antigen-antibody complexes deals with the interaction of antibody Fab's with specific haptens and proteins. Binding studies, structural aspects, model-building studies, and their practical application in the development of 'abzymes', diagnostics and therapy are discussed. The review of cytokines gives an overview on the interleukins and other cytokines, and regulation of expression of their genes. The structure and function of cytokine receptors and their role in signal transduction are described. The other two reviews—one on T-cell receptors and the other on class I MHC molecules—deal with more recent developments. The cloning of T-cell receptor genes has led to analysis of receptor polypeptides, gene organization and rearrangements, and T-cell target specificity. This in turn has yielded information on T-cell differentiation and repertoire selection. MHC molecules present antigen in a processed form to the T-cell receptor. There are two classes of MHC glycoproteins; the members of the first family present antigens to the T cells that express CD8 cell-surface glycoprotein while the class II molecules present antigens to CD4-expressing T cells. The article on MHC deals with the three-dimensional structure of one such class I MHC molecule (HLA-A2), the diversity of such molecules, and their interaction with CD8 glycoprotein and T-cell receptor.

There are several chapters in molecular biology. DNA unwinding is an integral event during replication, transcription, recombination and conjugation. The unwinding and the concomitant hydrolysis of nucleotide 5'-triphosphates is

brought about by helicases. Helicases of various types from different systems have been reviewed. Ten helicases have been discovered in *E. coli* itself. These enzymes differ in size, location in the genome and in their specialized roles in cellular function. Another review deals with sequence-dependent curvature of naked DNA. Such bent structures, observed in several instances, may have functional relevance. Chemical nucleases are organic compounds used as probes to study protein-nucleic acid interactions. Now a variety of compounds are extensively used to analyse unusual nucleic-acid structures (such as DNA curvature) and protein-nucleic acid complexes. Some of these chemicals are being 'tailored' to act as site-specific targeting agents. The helix-turn-helix motif is found in many DNA-binding proteins with regulatory functions. One review focuses on X-ray crystallographic studies on phage 434 repressor, Cro, and other well-characterized proteins and their complexes with DNA. Six different kinds of HTH motif are found in various DNA-binding proteins, which act as either activators or repressors. In all the cases, some helices form bundles—with different numbers of helices in different proteins—for DNA recognition, while the rest of the helices take part in dimerization or other functions. The amino-terminal ends of the helices in the bundle are positively charged, enabling them to contact phosphates in DNA. T. Cech's review updates information on group I introns. RNA forms the catalytic centre in this class of introns, and the 'enzymology' of the process is described. B. Moss' article on regulation of vaccinia virus transcription covers the entire molecular biology of the system. Vaccinia are large, self-sufficient viruses with unique features like cytoplasmic replication and virus-coded multisubunit RNA polymerase. The information in this review is invaluable towards developing improved expression systems. In spite of the discovery of a variety of transcription factors and a large body of knowledge on RNA polymerases, the molecular interactions involved in transcription initiation are not completely elucidated. A review in this volume gives a detailed account of structure and function of different subunits of RNA polymerase B and their interaction with various transcription factors. An account of the structure of

the collagen gene family is presented in another article. The different collagens, the gene organization, regulatory elements, and structural alterations by mutations are described.

Endotoxins are lipopolysaccharides (LPS) located on the outer surface of gram-negative bacteria. Lipid A is the major component of endotoxins and has unique structure. Since it is essential for the growth of the organism, the biosynthetic pathway of this molecule is an attractive target for developing new drugs. The biochemistry of lipid A, the O-antigens, their biosynthesis, transport of LPS to the outer membrane, and interactions of LPS in the animal system have been reviewed.

Cadherins are a class of molecules involved in Ca^{++} -dependent cell-cell adhesion. Animal cells recognize each other and selectively adhere to particular cell types. Recent developments in the area have been summarized. Other articles review clathrins, phytochelatin, selenium-binding proteins, peptides of frog skin, and protein folding patterns.

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Practical pest control

Pest Management in Tea. N. Muraleedharan, The United Planters' Association of South India, Tea Research Institute, Valparai 642 127. 1991. 130 pp.

The publication of a monograph on pest management of tea is a timely one, because, for India, a major tea producing and exporting country, information regarding pest management is very relevant for increased production. The author, an experienced tea entomologist, introduces the reader to the basic concepts of pest management, necessarily involving the ecology of pest control, economic threshold levels, crop resistance, biocontrol, and pheromonal, genetic and chemical controls. He rightly indicates that indiscriminate application of chemical pesticides leads to pest outbreaks, which is typical of the tea crop. He gives some familiar instances of outbreaks of several species of