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BOOK REVIEWS

Quantum mechanics and statistical methods edited by M. M. Suschinskiy (transl. by K. S. Hendzel), [Proceedings of the Lebedev Physics Institute of the Academy of Sciences of the USSR; Series Editor: N. G. Basov; Vol. No. 173], Nova Science Publishers, Commack, USA, 1988, pp. x 340, $111.

After sixty years of intense study, quantum mechanics has the status of a mature fully developed subject with applications extending right from the subnuclear microscopic world to cosmological macro systems. It is even making inroads into the explanations of the living processes. However, subtle questions on the foundations or axioms of the subject or on the validity of the computational processes used, remain to be settled. The present book is concerned with the mathematical physical aspects of the latter problem concentrating on the applications to systems with a large number of degrees of freedom, making it necessary to use statistical methods in the computations.

The first article, by L. A. Shelepin, sets the stage by enumerating some select issues in the quantum theory. The measurement problems involving the interaction between the observing processes and the systems under observation, the role of unitary symmetry in enabling the existence of solutions to be proved and the description of dissipative as well as nonlinear systems in quantum mechanics are listed among the issues to be tackled. The relationship with Markov Chains, showing probabilistic links with the past and the future is highlighted, a relationship which repeats many times in the book. The second article, by V. D. Vainshtein and Yu. A. Gol'fand, is concerned with the quantum mechanics of measurement of macro and micro processes. The information theoretic statistical interpretation of the measurement process is analysed as an evolution of the density matrix of the system, especially if the system consists of weakly interacting particles. The incompleteness of the past description and its consequence on the uncertainty of the future trajectories are brought out as the main physical content of the detailed mathematical investigations. The third article by S. A. Reshetnyak, S. M. Kharchev and L. A. Shelepin discusses the asymptotic time evolution of systems undergoing transformations. The Landau theory of second-order phase transitions is used as the mathematical framework to consider this question of the kinetic temporal behaviour of the order present in the system.

The questions connected with the use of the unitary group theoretic methods are discussed in two articles. The first by V. P. Karasev and N. P. Shchelok starts with the angular momentum theory in the framework of the SU(2) group and considers the general SU(n) group from the point of view of polynominal realisations of the bases of the irreducible representations and their applications to many particle quantum systems. The second article by A. L. Shelepin and L. A. Shelepin continues the probabilistic treatment of the Clebsch-Gordon coefficients of SU(2) and higher dimensional SU(n) groups.

The next article by V. K. Potekhin and L. A. Shelepin applies the group theoretic methods to statistical optics. The polarisation properties of light and the statistical aspects of emission propagation in a medium are considered in the group representation theory. This is pursued further in the article by V. A. Andreev on the use of the inverse scattering techniques in the quantum optics equations. In particular the soliton-type solutions, studied in nonlinear field theories, are found to be

present in unstable or nonlinear situations. The last article by Ye. V. Doktorov and V. L. Man'ko discusses the synchrotron radiation sources and their use in studying the structure, time and space evolution of large molecules or aggregate systems. The computations of the overlap integrals needed in these cases are discussed at some length.

The book thus covers a range of studies in which the authors from FIAN have contributed over the years. The series of books has the object of drawing attention to these contributions and in this task it has succeeded well. The publications have been in Russian and hance have not received the widespread attention of the western scientists. The book provides a digested version of the studies in an easily accessible form. The only problem is the high cost of the book. Because of the specialised nature and the small circulation for such books it appears difficult to reduce the cost. Thus the book is beyond the reach of most individuals and must depend upon exclusive libraries for the availability.

Department of Physics
Indian Institute of Science
Bangalore 560 012.

E. S. R. GOPAL

Molecules and radiation—an introduction to modern molecular spectroscopy (2nd edition) by Jeffrey I. Steinfeld. The MIT Press, 55, Hayward Street, Cambridge, Massachusetts 02142, USA, 1985, pp. xv + 485, $43.13. Indian orders to Affiliated East-West Press Pvt. Ltd., 25, Dr. Muniappa Road, Kilpauk, Madras 600 010.

The main interest of the book lies in molecular dynamics and the interaction of radiation and matter. The concepts and the methods of modern spectroscopy are covered in Chapters 1 to 9 and this forms the basis of the later chapters in which attention is focussed on newer areas of spectroscopy developed during the last 25 years. Chapters 10 to 14 reflect the developments in laser spectroscopy to probe molecular dynamics. The book contains a comprehensive index and is fairly well referenced. There are six appendices, which include a literature survey on spectroscopy.

The book commences with a review of the essential quantum mechanical background and atomic spectroscopy (Chapters 1 and 2). A good account of electronic energy levels and electronic transitions and simple molecular orbital theory of diatomic molecules is given in Chapter 3. The following chapter covers the rotation and vibration spectra of diatomic molecules. The influence of nuclear spin on rotation and rotation-vibration spectra is discussed. The analysis of the vibrational and rotational energy changes occurring during an electronic transition of a diatomic molecule is described in Chapter 5. Zeeman, Stark and Faraday effects in molecules are also considered.

The elements of molecular symmetry and group theory necessary for the consideration of spectra of polyatomic molecules are given in Chapter 6. This is followed by a chapter on rotational spectra of polyatomic molecules, wherein l-doubling, inversion doubling, quadrupole and Zeeman effects are briefly discussed. The chapter on vibrational spectra of polyatomic molecules deals with normal vibrations in classical mechanics and FG matrix methods. The selection rules for vibrational transitions and rotational fine structure on vibrational bonds are covered. The chapter on electronic spectra of polyatomic molecules describes Walsh rules and the spectra of simple molecules such as formaldehyde and benzene. Also covered herein are introductory aspects of molecular photoelectron spectroscopy and energy dissipation by non-radiative processes.

The first of the chapters dealing with developments in laser spectroscopy discusses the use of optical pumping to study high-resolution atomic spectra and relaxation processes. This leads to consideration of molecular beam spectroscopy and then to important types of lasers. The area of

optical masers is enormous and continually developing one. The studies on coherent optical effects are discussed in detail in Chapter 11. Close analogy between magnetic resonance spectroscopy and coherent optical spectroscopy is brought about. The next chapter discusses several coherent transient experiments and related processes. Interesting effects such as optical nutation and photon echoes and their application in FT spectroscopy are discussed. Also considered here are double-resonance and multiphonon spectroscopy. Nonlinear multiple photon processes between atomic and molecular energy levels form the subject of Chapter 13. A simple theory of stimulated Raman effect is presented. Methods for the production of ultrashort light pulses to study molecular processes at pico-second time scale are discussed. The book concludes with a chapter projecting the future developments in laser spectroscopy.

This book is a revised edition of the one published in 1974. This is one of the very few books that presents, from a consistent theoretical perspective, an introduction both to classical atomic and molecular spectroscopy and to the spectroscopic advances made by laser-based methods and thus provides the necessary foundation for modern spectroscopic research. The main area where this book shows its strength is the unified treatment and breadth of coverage making it very useful to serve as a textbook. This book is sure to interest post-graduate students and research scholars of chemistry and physics orientation and specialising in molecular spectroscopy and related fields.

Department of Inorganic and Physical Chemistry D. N. SATHYANARAYANA
Indian Institute of Science
Bangalore 560 012.

Molecular spectroscopy by P. S. Sindhu. Tata McGraw-Hill Publishing Company Ltd., 12/4, Asaf Ali Road, New Delhi 110 002, 1985, pp. 348, Rs. 39.

Several books are available on molecular spectroscopy, and this is yet another on the subject. It contains ten chapters, commences with a brief introduction to electromagnetic radiation and electromagnetic spectrum followed by elements of atomic spectroscopy. In the next chapter concepts of molecular symmetry which include some information on character tables of point groups are given.

Topics in molecular spectroscopy commence with a chapter on rotational spectra of diatomic and polyatomic molecules. This chapter is followed by chapters which cover vibrational spectroscopy. In chapter 5, vibrational infrared spectra of diatomic and polyatomic molecules, and vibration-rotation spectra of simple molecules are covered. The chapter on Raman spectroscopy describes classical theory of the Raman effect, vibrational and rotational Raman effect, group theoretical classification of the normal modes according to the molecular point group and classification of vibrations of single crystals. This is followed by chapters on electronic spectra of diatomic and polyatomic molecules.

The chapter on spin-resonance spectroscopy covers electron-spin resonance, nuclear-magnetic resonance and nuclear quadrupole resonance spectroscopic methods. The concluding chapter discusses briefly Mossbauer spectroscopy of chiefly iron compounds.

The book contains a few problems towards the end of each chapter, followed by a few references. There are five appendices (15 pages), so also a subject index.

There is nothing new in this book which 'distinguishes' it from other books currently in use. It appears to lean heavily on C. N. Banwell (*Fundamentals of molecular spectroscopy*) and I. W. Levin (*Molecular spectroscopy*). However, it has some serious lapses. Some clearly improper sentences misrepresent the meaning and add to possible source of confusion. Added to this, there are numerous mistakes, typographical as well as scientific. The chapters are not well written and the treatment is

'uneven' For example, without any mention of the site group or factor group approach the procedure for the analysis of vibrations of single crystals is given. There is no mention of the more important resonance Raman among the nonlinear Raman effects but hyper-Raman effect is mentioned. Likewise, the molecular orbital treatments given under chapters on electronic spectroscopy lack adequate explanation so also the background of simpler treatments. For these reasons, the book may have very limited interest for the individual reader.

Department of Inorganic and Physical Chemistry
Indian Institute of Science
Bangalore 560012.

D. N. SATHYANARAYANA

Human immunogenetics by Stephen Litwin. Marcel Dekker, Inc., 270 Madison Avenue, New York, NY. 10016, 1989, pp. 828, $150.

Immunogenetics is an interdisciplinary field that draws its strength from both immunology and genetics. This book on human immunogenetics brings together diverse new findings in human and mouse immunogenetics. The book is generally well presented but judging from the topics covered, it is a very ambitious one and appears to be written for specialists in the field. This book will not engage the attention of students for long since it is not meant for them. In fact, the editor's comment, "No attempt will be made to cover basic immunologic or genetic concepts" seems to be significant in this regard. Although relatively up-to-date, experts might feel that the book has lagged behind in some chapters *e.g.*, much more is known today about α, β and γ genes of the T-cell receptor (TCR) than that described. These points apart, the book is a source of very good information and in its entirety, the topics encompass the major thrust of contemporary immunogenetics. The description of future research trends and developments in many chapters will be very valuable to many readers.

The book contains five sections spearheaded by an excellent first section on immunogenetic tools. This chapter deals with a variety of approaches and techniques being used today in the study of cell surface immunogenetics, cloning and immortalisation of lymphoid cells, acquiring genetic data and analysis of tumor-associated antigens. Chapter 1 has been well presented and seems to deal briefly with many aspects of immunology and gives the reader a hint of what follows in other chapters. Table 2 however is unclear whether the comparison was between proteins from different organisms or between proteins from the same animal. The importance of restriction fragment length polymorphism (RFLP) and application of recombinant DNA technology in modern immunology has been highlighted in Chapter 2. This chapter on 'Human gene mapping and linkage analysis' does not go into any specific details and can, at best, serve as a preliminary introduction into this complex and fast developing field. Chapter 3 by Henry Winn describes the laws of transplantation and production of congenic mouse strains. Exceptions to these laws that served as a forerunner to natural killer cell (NK cell) discovery have also been described. The use of diagrams would have greatly aided the reader in a better understanding of this chapter. Chapter 4 on maternal-foetal immunogenetics is probably the most interesting one in this section and highlights many important observations in a highly controversial but remarkable field. This chapter describes the evidence available to support the variety of mechanisms that help in the survival of the allogeneic conceptus till term. Due to its attempts to cover a very vast area the chapter by Brian Pollok may appear too simple and shallow in depth to an expert in molecular biology. Chapter 6 brings out the salient features of the usefulness of certain specific monoclonal antibodies such as C017-1A in analysing tumor antigens. Authors remind the readers about the pitfalls in trying to generate monoclonal antibodies to detect tumor-specific transplantation antigens (TSTA) since these antibodies are most likely to be non-specific in nature.

Section II summarises the nature of cellular interactions and molecular events that occur during immunological activation. The basis for the defects and failure of this complex system that finally leads to autoimmunity and immunodeficiency diseases is described in subsequent chapters. Chapter 7 represents a bird's eye-view of the entire immune system and describes the salient features of the important lymphokines needed for initiation of an immune response. It must, however, be mentioned that many advancements have been made after the book was written, especially the identification of the lymphocyte homing receptor on endothelial cells and the isolation of the pluripotent stem cell precursor from the bone marrow. Chapter 8 seems to overlap with information given in earlier chapters but the data are presented to benefit a clinical scientist who may be interested in basic immunology. The NK cell, its lineage and cell surface markers are described. The next chapter on 'Antigen-specific immune regulation' by Judith Kapp and Carl Pierce has been written very well and benefits immunologists as well as non-immunologists. The chapter covers a lot of ground and perhaps lays more emphasis on suppressor cells, suppressor factors and their influence on the total immune response. Although taken from different books, the use of appropriate diagrams is a plus point for the chapter. Fill and Tucker have presented most current information on immunoglobulin genes, their regulation and expression on the 'B'-cell surface. Interesting information normally not found in many books such as Kde region participation in K chain deletion has been described. Immunoglobulin gene translocations and the manner in which they cause neoplasms have also been described. Litwin has given an elaborate and exhaustive account on immunoglobulin allotypes in the next chapter. A section on the association of allotypes with specific immune responses and disease states have been included. Chapter 12 on 'Autoimmune states' presents evidences that link immune dysregulation with immunoglobulin genes, MHC and the T-cell receptor. It reviews the association of MHC with selected autoimmune disorders and the use of molecular biological techniques for analysing the association of specific antigenic epitopes with diseases. Although many evidences have been described for the presence of cross-reactive idiotypes in anti-DNA and anti-Sm antibodies the possibility that somatic mutations could convert autoantibodies to normal antibodies has also been covered. The chapter has also a brief description on the regulation and induction of IL-2 synthesis. Richard Hong in his chapter on immunodeficiency diseases does not treat any specific disease in detail but describes the processes involved in the development of a healthy immune response and the production of diseases as a result of genetic and non-genetic disturbances in these processes.

Section III deals with the major histocompatibility antigens, their structure, functional aspects, molecular genetics and association with disease and transplantation. This section forms an excellent treatise for immunologists who wish to survey the entire MHC and related antigens. The chapter on t-complex is more developmental biology-oriented than immunogenetics except for its proximal location to MHC genes. The influence that the 't' complex may have on MHC function is as yet unclear.

Information on the structure and function of the MHC antigens of various species from xenopus to man has been comparatively presented by Blankenhorn. The tables and figures do go a long way in helping the reader in obtaining a clear picture of MHC antigenic structure and terminology. In addition, a description of molecular organisation of individual class I and class II genes together with a small section on the evolution of mouse genes does make this chapter very interesting.

The chapters on minor histocompatability locus and Qa/Tl Class I genes will indeed be of great interest for cellular immunologists. The association of xenotropic and ecotropic retroviral sequences with minor H loci serves as an excellent prelude to the next section on viral immunology.

Section IV on the immunogenetics of tumor and viral antigens seems to be the most interesting chapter in the book and represents an area that engages the attention of molecular biologists, oncologists, serologists as well as immunologists and geneticists. The section describes the use of

serology, cell biology, and genetic probes in the analysis of infection and tumor-related antigens. The chapters on EB virus (Chapter 21), hepatitis virus (Chapter 23) and influenza virus (Chapter 25) describe how both cell- and antibody-mediated immune mechanisms recognise and defend against viral infection. Milich appears to have deviated from the general trend in this book in that he describes his own work on Hepatitis B antigen most exhaustively. This section has been written very well except for some errors *e.g.*, on p. 500, the statement that IL-2 was discovered by Gallo is obviously a mistake. The complex problems posed by retroviruses are delineated by Wong-Staal and Wolfe and Hardy in Chapters 22 and 24, respectively. The genetic regulation of tumor-associated antigens is described in Chapter 25 on protooncogenes and Chapter 27 on melanoma-associated antigens.

The last section has been devoted to deal with topics of genetic and biomedical importance such as erythrocyte blood groups and serum complement. The blood group antigens which include erythrocyte alloantigens (*i.e.*, the ABO system) were the first to be described and is of great significance to clinicians and immunogeneticists. The chapter, in addition to describing the ABO, Lewis and Hh antigens deals with new areas of biological interest—abnormalities and their enzymatic and genetic bases. The polymorphism of MNSs antigens and their antigenic structure *i.e.*, importance of glycophorins is described in the next chapter. Chapter 31 (Tippett) describes the Rh blood group system and its role in causing hemolytic disease of the newborn. The chapter has been approached from the geneticists' point of view and could be of great interest to a haemotologist.

The chapters on complement reviewed by Schur form an excellent summary of this rapidly developing field and identifies areas of current and future biomedical importance.

Department of Biochemistry
Indian Institute of Science
Bangalore 560012.

R. MANJUNATH

Nucleic acid and monoclonal antibody probes—applications in diagnostic microbiology (Infectious Disease and Therapy Series/2) edited by Bala Swaminathan and Gyan Prakash. Marcel Dekker, Inc., 270, Madison Avenue, New York, NY 10016, 1989, pp. 752, $180.

This book covers a wide range of topics under the field of diagnostic probe technology. The individual contributors have made a serious attempt to project the advantages and disadvantages of DNA probes as a rapid diagnostic reagent. The book starts with five articles on the principles and techniques of nucleic-acid detection and characterisation, which include nucleic-acid hybridisation and plasmid and chromosomal DNA analyses. It then deals with probes for rapid identification of individual pathogens of human and veterinary importance. The rest of the book deals with monoclonal antibody-based immunoassays and follows the same pattern as before, *viz.*, a section on how to make hybridomas and purify antibodies, followed by the use of monoclonal antibodies for detection of individual human pathogens. In the concluding chapter, the authors have dealt with recent developments in nucleic acid and monoclonal antibody probe technologies, which have been reported after the main body of the book.

Most chapters in this book are well written, adequately referred and covers much of the progress made in the area. This allows readers to rapidly gauge the developments made in this area. However, two points stand out. One is the area of diagnostic virology using DNA/antibody probes has been completely ignored. This aspect perhaps has the greatest application in terms of treatment and care of the patient. Furthermore, logical discussions into the utility of various probes in clinical treatment is also not apparent. The second point is the authors' own experience in the experimental protocols for hybridisation should have been highlighted as a major contribution to trouble shooting.

In summary, while the book should definitely be able to enthuse interest in this field and should be read as a manual before jumping into this area, it falls short as a comprehensive on the bench manual which is useful for trouble shooting. Lastly, it is highly recommended for graduate students to bridge the gap of the application of molecular biology to clinical practice.

Astra Research Centre India
Bangalore 560003.

T. S. BALGANESH

Regulation of gene expression—25 years on edited by I. R. Booth and C. F. Higgins. Cambridge University Press, Cambridge, CB2 2RU, UK, 1986, pp. 309, $59.50. Indian orders to: Affiliated East-West Press Pvt. Ltd, 25, Dr. Muniappa Road, Kilpauk, Madras 600010.

The reviews on the regulation of gene expression—25 years on cover the recent developments on catabolite repression, RNA polymerase heterogenity, regulation of transcription at the level of initiation, termination, messenger RNA processing and decay, and regulation at the level of translation. Also the involvement of supercoiling of DNA and transposons in the regulation of gene expression are discussed. Topics on the regulation of nitrogen, Tn10 and IS10 transposition, plasmid maintenance and gene expression of *Streptomyces* and *Dictyostelium discoideum* stand out from the rest of the topics. The reviews presented are mostly on prokaryotes on topics which are unrelated. Though they serve very useful purpose, their scope and contents are very limited. With the advent of recombinant DNA technology, much progress has been made in the understanding of the gene expression and control. However, many areas covering the molecular mechanism of the catabolite repression, basic process in the recognition and binding of the RNA polymerase and factors on the promoter, various switches manifested during the life cycle of viruses and microorganisms and the role of many factors involved in gene expression are not clearly understood.

The discussion on the protein-nucleic acid intractions using lambda-phage regulatory protein CII helps to understand how the various activator/repressor proteins recognise and bind to specific DNA sequences selectively. DNA supercoiling is a potential modulator of gene expression. Much more data are required to establish how the topology of the DNA regulates the gene expression in prokaryotes and eukaryotes. Considerable effort has been put on the regulation by RNA polymerase at the level of initiation and termination of transcription. The RNA polymerase subunits, newer sigma and other factors which modulate gene expression are discussed. The pausing of the RNA polymerases at the stemloop structure, attenuation, antitermination and rho-independent termination are described in detail. The secondary structures at the 5'-and 3'-flanking regions of the messenger RNAs and factors which affect the half-life messengers and the specific-binding proteins involved in the modulation of the gene expression are covered in these reviews. The translational regulation and feedback loops are well dealt. There is coordination between the ribosomal protein synthesis and assembly of ribosomes. The free ribosomal proteins act as translational repressors on the respective messenger RNAs in *E. coli*.

The review on the regulation of nitrogen by enteric bacteria contains evidences to show that the product of the gene *ntrC* (*gpntrC*) is a DNA-binding protein which can activate and supress transcription. The mechanism and regulation of Tn10 and IS10 transposition are described. The molecular mechanisms in the maintenance of plasmid in a cell are not clearly understood. It is of vital importance as many recombinant plasmid DNA molecules, which are engineered to produce very useful products, reject the inserted foreign DNA during the course of multiplication. This aspect is not covered in this review. *Streptomyces* is an important organism which produces large number of

antibiotics. The life cycle and the linkage map of this organism are described. In many respects the RNA polymerase and regulation of gene expression of the *Streptomyces* and *E. coli* are similar with some differences in codon usage and initiation of transcription and translation. The life cycle, morphogenesis and the control of gene expression during cellular differentiation of *Dictyostelium discoideum* are covered. It is clear that there is a complete lack of understanding of the molecular mechanisms involved in the transition from one stage to the other, both in the *Streptomyces* and *Dictyoslelum.*

Centre for Genetic Engng
and Department of Biochemistry
Indian Institute of Science
Bangalore 560012.

J. D. PADAYATTY

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