

X-Ray Spectroscopy and Allied Areas. S. K. Joshi, B. D. Shrivastava and A. D. Deshpande (eds). Narosa Publishing House, 6 Community Centre, Panchsteel Park, New Delhi 110 017. 1998. pp. 280. Price not stated.

X-ray emission and absorption spectroscopy paved the way for detecting elements, modifying the periodic law and determination of the 1s, 2s, 2p, etc. energy levels of elements. Measurement of energies and their intensities of K_{α} , L_{α} , M_{α} characteristic X-rays emitted by the impact of 10–30 keV electron beam in a scanning electron microscope is now a routine technique (EDAX) for elemental analysis in a solid. Analysis of X-ray absorption edges provides information on the chemical state (oxidation state) of elements. Analysis of oscillations observed beyond K_{α} and L_{α} absorption edges of an element in a complex solid provides information on the near neighbour, next nearest neighbour distances along with the number of neighbours. X-ray spectroscopy was initiated in India by B. B. Ray of Calcutta University and G. B. Deodhar of Allahabad University. Subsequently, Chintamani Mande of Nagpur University has been responsible for the spread of modern developments on this subject in India. The book under review is the proceedings of the 6th National Seminar on the topic. Beginning with an overview by B. D. Padalia of IIT, Mumbai, the book contains over 75 short research articles in the broad areas of X-ray emission and absorption spectroscopy, instrumentation and applications of the technique in characterizing complex oxides, chalcogenides, metals and alloys.

X-ray emission spectrum (intensity vs energy) of a material contains several lines each of which needs to be assigned. They can be normally assigned to K_{α} , K_{β} , M_{α} , etc. emission lines corresponding to elements present in the solid. Additional lines other than these are often observed and they are called satellites. Plasmon excitation is one of the reasons for observation of satellites. Plasmon excitation in several metals and metal oxides has been analysed by several authors.

Further, $L_{3}M_{45}M_{45}$ Auger electron spectrum of In, Sn, Sb, Ag, Pd and Rh also showed Plasmon excitation. Of particular interest is the article on the

origin of satellites in the L-emission spectra (p. 34).

There are some new developments during the last 10 years, viz. Giant Magnetoresistance (GMR). The idea of metallic multilayers showing GMR has been utilized to fabricate multilayers as soft X-ray mirrors. Results shown by Chaudhari seem encouraging towards the development of soft X-ray mirrors.

A large variety of materials including the cation substituted $YBa_2Cu_3O_7$ and ferrites have been examined by X-ray absorption, XANES and EXAFS. These articles present state-of-the-art X-ray spectroscopic studies.

Articles on the development of rotating anode X-ray generator and energy dispersive X-ray fluorescence spectrometer by scientists from CAT, Indore show the level of advancement in the instrumentation. Several X-ray absorption spectrometers have been developed earlier by Mande and his students and the new rotating X-ray anodes with high X-ray flux should be useful to take up studies of materials in which concentration of an element is low.

Overall, the articles presented in the book give an impression that sufficient know-how in the area of X-ray spectroscopy exist in the country. The book essentially presents the status of this subject in Indian Universities.

M. S. HEGDE

*Solid State and Structural Chemistry Unit,
Indian Institute of Science,
Bangalore 560 012, India*

The Solvay Councils and the Birth of Modern Physics. P. Marage and G. Wallenborn (eds). Birkhauser Verlag, AG, P.O. Box 133, CH-4010, Basel, Switzerland. pp. 240. Price: sFr 98/DM 118.

This is a book about the famous Solvay Councils, popularly misnamed as Solvay Conferences as we learn in the book, that were of such great importance in the birth of modern Quantum Mechanics (QM). The book consists of several essays/articles written by eight different science

historians/essayists. It may have a reasonably large target audience including historians of science as well as scientists from other disciplines. The format causes a bit of a problem to a practising scientist due to its many authors. The difficulty lies in the repetitions, and occasionally a Eurocentric vision that was probably justifiable only at the time of the Solvay Councils. Modern readers will be less interested in the relative merits of e.g. French science and English science, and even the personality of Ernest Solvay, than in the contents of conversations or interactions between the likes of Bohr and Dirac. These may be of greater interest to lay readers, wanting to know the background of the Solvay Councils and of the times.

The book is in two parts, the first deals with the background, the interplay between different players such as the Nobel Institution, the French and the British scientific societies, the war years, the exclusion of the Germans and their later reinclusion, etc.

The second part is more concerned with the specific issues discussed in the different Councils. There are many interesting points made and facts that fascinate in this part. I list here a few tasty snippets:

We learn [p.101] that it was the hardcore mathematician Henri Poincare, who formulated the doctrine that most physicists proclaim *vis-à-vis* the utility/originality of a theory, namely *they should not introduce as many arbitrary constants as there are phenomena to be explained*. This adage is often presented more humorously in the theoretical circles as *fitting an elephant to the data, and then making the elephant shake its trunk, given enough adjustable parameters*.

In the Bohr–Einstein debate on the interpretation of QM, the somewhat extreme positivist views of Dirac are well presented [p.166]: Dirac rejects classical theory as it deals with isolated systems that are not observable, since observation implies coupling to a disturbance, and measuring the response. This seals the matter for him, he has no further use of debate with the deterministic view. The debate, carried out by a much more ‘woolly’ Bohr, who was prepared to be vague and to be sneered at by Einstein, is well documented and is the high point of this book. This confrontation aided the precise formulation of QM as we know it now.

Still talking of Dirac, the birth of Quantum Electrodynamics is well related, with Anderson's discovery of the positron and Dirac's immediate understanding/explanation of it, invoking the Pauli principle to fill up the infinite 'Dirac sea'.

The historic meeting between Fermi and Pauli in 1933 resulting in the prediction of the neutrino and the β -decay is well documented [p. 194]. One learns of the extreme audacity of the pioneers, e.g. the advocacy of Bohr to give up the principle of conservation of energy to explain these experiments, prior to Pauli's bright idea.

There are several interesting stories on the three Nobel Curies, on Langevin, and the two de Broglies. The role played by Nernst in 'instigating' the Solvay meetings, his rivalry with Arrhenius and the resulting competition between the Solvay meetings and the Nobel foundation are recorded in an interesting way, in the particularly readable essay by Elisabeth Crawford. Nernst's Nobel quest propelled by the third law of thermodynamics, and the specific heat of solids is very interestingly presented.

All in all the book deals with an interesting subject in a way that manages to come through as interesting, despite the fragmentation of the format.

B. SRIRAM SHASTRY

Department of Physics,
Indian Institute of Science,
Bangalore 560 012, India

Annual Review of Pharmacology and Toxicology 1999. Vol. 39. A. K. Cho, T. F. Blaschke, I. K. Ho and H. H. Loh (eds). Annual Review Inc., 4139, El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. pp. 470. Price: Individuals, US \$ 65; Institutions, US \$ 130.

The discovery of new therapeutic molecules demands an understanding of the nature of drug targets, features of detoxification mechanisms, drug toxicology and the regulatory features of the cellular machinery that is involved in all

these responses. *The Annual Review of Toxicology and Pharmacology 1999* has several articles that reflect these elements.

There are two articles which directly discuss molecular targets for drugs. The article on nitric oxide synthase (NOS) examines this enzyme as a potential therapeutic target. Inhibitors of NOS are potentially useful in diseases including septic shock, neurodegenerative disorders and inflammation. The article on phospholipase A2 (PLA2) emphasizes the role of phospholipids as second messenger molecules with key roles in cellular signalling. PLA2 is a key to the synthesis of key inflammatory mediators that include prostaglandins, leukotrienes and platelet activating factors. Inhibitors of PLA2 could potentially block these pathways.

Five articles could be classified under the subject of detoxification mechanisms. The article on 'human cytochrome P-450 3A4' highlights the broad catalytic selectivity, catalytic mechanism, cooperativity, mechanism of induction and possible genetic polymorphism of this protein of major interest. It accounts for the metabolism of 50% of the currently available drugs in use. The article on 'methylation pharmacogenetics' deals with methyltransferases, especially those that catalyse O, S or N-methylation of organic molecules. Phenotyping for the thiopurine methyltransferase genetic polymorphism represents one of the first examples in which testing for pharmacogenetic variant has entered standard clinical practice to decide on therapy of individuals with thiopurine drugs. The article on 'metallothionein (MT)' indicates that contradicting the expectation arising out of the postulated role of MT as a storehouse of zinc and free radical scavenger, null mutants of mice are found to be normal, but highly susceptible to cadmium toxicity. It appears that during evolution, the role of MT against cadmium toxicity has acquired an overriding importance, with compensatory mechanisms perhaps being available to fulfill the other postulated functions. The article on the 'multidrug transporter', P-glycoprotein, that is known to play a role in multiple drug resistance in cancer, highlights the complexity of this pump involved in the efflux of drugs. The full range of exogenous and endogenous substrates for P-glycoprotein is yet to be explored. The article on 'excitatory amino acid transporters' concentrates on the glutamate transport system in neurons

and glial cells. Glutamate has the potential to influence the function of most neuronal circuits in the CNS and to limit receptor activation, extracellular concentrations of excitatory amino acids need to be tightly controlled by appropriate transport systems.

A couple of articles are devoted to discussing aspects of toxicology. One focuses on the cytotoxicity of short chain alcohols and the other on the teratology of retinoids. The damage resulting from acute or chronic exposure to short chain alcohols, including ethanol, is associated with aberrations in phospholipid metabolism, changes in cellular redox state, disruptions of the energy state and increased production of reactive oxygen. Teratology of retinoids including vitamin A governs all the six principles of teratology ranging from the genotype of the conceptus to the sequelae of abnormal development. The retinoid receptors have come into focus in recent years as the mediators of several converging signal transduction pathways and it is of interest to learn that the RAR ligands as opposed to RXR ligands or retinoids that do not bind to receptors, are most potent teratogens.

Majority of the articles deal with the regulatory features of the cellular machinery that respond to and are affected in toxicological responses. Three articles relate to the brain environment. Neurological cells consist of astrocytes, oligodendrocytes and microglia and Schwann cells in the peripheral nervous system. When neurons become severely damaged, microglia become brain macrophages and aid in the disposal of the dying nerve cell. The article on 'genetic regulation of glutamate receptor ion channels' discusses the role of specific glutamate receptor subunits in long term potentiation and depression, learning, seizures, neuronal pattern formation and survival with the use of transgenic and knockout mice. fifteen genes are now known to encode ionotropic glutamate receptor subunits and these together determine the molecular make up of the three pharmacologically defined families of glutamate receptors. The article on 'dopaminergic receptors', that are targets in Parkinson's schizophrenia and hyperlactinemia, elaborates the role of the five different receptors known. D₁ and D₂ receptor subtypes are positive modulators, with antisense treatment or knock out leading to loss of behavioural activity.