

ing from femtoseconds to a few seconds and spatial boundaries ranging from nanometre to metre. This requires mosaic partial modelling. The major problem is filling the gaps when validity ranges do not overlap any partial model and modelling inter-regulatory mechanism. Comprehensive Modelling Space (CMS) overcomes to some extent the problem of different timescales. These aspects are discussed with respect to e-model of photosystem II.

The Part II also contains two chapters – one is on modelling the light harvesting by the antenna and charge separation, and the other is on mathematical evaluation of the nature of antenna excitations. The kinetics of O₂ evolution and chlorophyll *a* fluorescence provide information on photoelectron transport in the photosynthetic organisms. Part III of the book contains four chapters, two on modelling of the chlorophyll fluorescence transient or induction, as induction of fluorescence transient is lavishly studied by many researchers, and the modelling of fluorescence phenomenology and kinetics are going to be of extreme use in modelling global photosynthesis. The two remaining chapters in the section deal with multi-particle modelling of the photosynthesis processes in the thylakoid membranes and the other on clustering of the electron transport components. Integrated solid versus diffusive electron transfer chain models are discussed in this chapter as well as the characteristics of the *in vivo* quinone domains. This draws the attention of readers from macroscopic averaging to the microscopic scale information to single molecule spectroscopy

The Part IV of the book deals with the dark reactions in photosynthesis and these meaty topics have very much influenced the photosynthesis and productivity research. This part contains seven chapters out of which five are on C₃ plants carrying out the Calvin–Benson type of metabolism, one on plants exhibiting the Hatch-Slack type strategic metabolism and the last one on the ‘control fluxes’ generated by genetically modified key enzymes controlling the metabolic fluxes. The models on Rubisco limited CO₂ assimilation rates and electron transport limited rates of carbon assimilation influenced our physiological and agronomic research for years.

In Part IV the readers get to visualize the predictions of overall photosynthesis

from leaf gas exchange, chloroplast biochemistry, the activation and the reactions of Rubisco from gas exchanges, the temperature dependence on C₃-type photosynthesis and carbon/nitrogen partitioning the computerized model for CO₂ concentrating mechanisms in different C₄ sub-type like NADP malic enzyme. Plants have been discussed to provide a new understanding of the concentrating mechanisms of bundle sheath (BS) cells in C₄ plants that maintain strict ATP and NADPH stoichiometry.

Simulations and fitting of the experimental data to the models under CO₂ saturated and CO₂ limiting conditions have been copiously illustrated. The metabolic fluxes are regulated by enzymes. The fluxes are sensitive to small change in enzyme concentration. This provides a control coefficient, varying from 0 to 1. Chapter 15 evaluated the flux control analysis for CO₂ assimilatory power of plants and transgenics.

The last part of the book discusses the modelling of photosynthesis machineries from leaves to canopies and to the global environment. This section has five chapters dealing with packaging of global scale models of daily and annual C gain in canopies, biogeochemical cycles, interactions of different cycles, and global scale models of terrestrial and marine as well as coastal ecosystems. The fifth chapter in this part has opened a global space for the e-photosynthesis discussing issues like increasing productivity by increasing specificity of Rubisco for carbon dioxide over oxygen in Chapter 17. This part integrates various aspects of e-photosynthesis, namely, the biotechnology for increasing production and its limitations, biogeochemical cycles, canopy and global perspective. This gives a philosophical flavour to rigorous mathematical expressions.

The book imparts a separate status to e-modelling in photosynthesis. It can serve as a resource for research students and scientists working in the area of photosynthesis, especially in the area of modelling. The book also caters to the need of a text book for advanced higher level course in ‘Systems Biology in Photosynthesis’. Overall, it is a book which all plant scientists must go through. It is expected there would be initiation of dialogues between experimenters and theoretical analysts through these models. The computers could mimic the structure and functional correlation in the plant

cells, leaves, trees, canopies, ecosystem and our beautiful earth by appropriate programming.

Lastly, the review of the book will remain incomplete if a comment on the cover page is not included. Leaf canopy bearing the imprints of silicon circuits expresses the theme of the book that is e-modelling from leaf to canopy to globe. This book is recommended not only for photosynthesis researchers but other scientists interested in biology, agronomy, ecology, biogeography and biomathematics. The new programmes involving integrated courses should find a robust reference text in this book. Libraries will find this book useful for their readers.

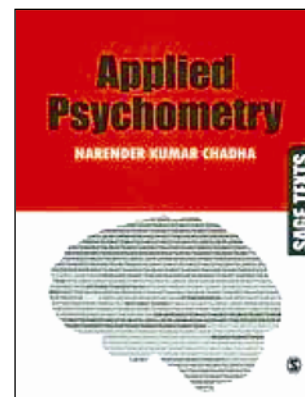
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Applied Psychometry. Narender Kumar Chadha. SAGE Publications India Pvt Ltd, B1/I-1, Mohan Cooperative Industrial Area, Mathura Road, New Delhi 110 044, India. 2009. xiii + 362 pp. Price: Rs 395.

This book addresses an important branch of the science of measurement. Measurement science becomes complicated when researchers want to attribute numeric values to variables that have no apparent measurement metric (such as, latent variables). Paper–pencil tools serve as instruments designed to measure

such variables. Psychometricians are skilled at designing instruments in a scientific manner. These instruments are referred to as questionnaires and psychological tests when they satisfy psychometric properties. Psychometric properties refer to a description of validity, reliability and standardization conducted on the instrument.

Instruments that are designed to measure latent variables have wide applications. They are used for behavioural diagnosis, intelligence, and aptitude screening and personality assessments in both clinical and non-clinical settings. Such instruments are also widely used during survey research when large samples are to be measured on same variables. This book elaborates the fundamentals of psychometry. What is different about this book when compared to few such titles in the domestic market is that it describes calculations with worked illustrations applied to different data. The importance of understanding this discipline rigorously is best stated in the words of Dyer, 1964, 'Tests are a menace to education only in the sense that automobiles are a menace to physical well-being. If you use them wrong, you get into trouble. If you use them right, you open up all parts of new possibilities for the betterment of mankind' (p. 286).

This book is handy and concise, designed to aid student learning. Each chapter includes an outline followed by learning objectives. Mathematical and theoretical explanations on many important concepts in psychometry are included. The book is divided into five parts.

Part 1 titled 'Measurement in modern psychological research' includes four chapters. Chapter 1 introduces the concept of measurement, theories of measurement, types of measurement scales and goes on to describe the problems encountered in psychological measurement. Chapter 2 deals with different errors that occur in the process of measurement. It describes in detail the sources and types of errors. It describes seven types of errors including the statistical errors and test errors. Chapter 3 explains speed and power tests and the difference between both. It also describes the effect of unattempted items on the errors of measurement in speed and power tests. Chapter 4 explains the nuances of parallel tests in detail and ends by explaining the use of parallel tests in calculating reliability of a test. There is a bias towards exam-

ples from clinical and psychological setting applications in this chapter. Whilst the types of scales are well described in pages 10–16, not much is mentioned subsequently about tests using these different types of scales.

Part 2 is titled 'Theory and practice of psychological testing'. Seven chapters are included in this part. Chapter 5 gives an introduction to psychological testing. It explains the meaning, nature and characteristics of psychological tests. It also includes a history of psychological testing and ends with describing the types of psychological tests. Chapter 6 deals with test construction. It describes briefly the steps involved in test construction. Chapter 7 explains item analysis. It deals with item discrimination, item difficulty, item validity and the role of item characteristics curve in predicting the test scores. Chapter 8 elucidates the scoring of tests and the problems encountered while scoring the tests and the importance of scoring in psychological testing. Chapter 9 focuses on reliability. It deals with the meaning, types of reliability, methods of calculating reliability, factors affecting reliability and the importance of reliability in psychological testing. Chapter 10 describes validity, the methods of calculating validity, factors affecting validity, using validity to make prediction and the relationship between validity and reliability. Chapter 11 explains the concept of norms. It describes the types and methods of calculating norms, the difference between norms and standards, and gives examples of the type of norms used in some psychological tests.

This part can be enhanced if the book clearly delineates those techniques that are to be adopted in creating tests to determine the abilities of an individual versus those that measure personality, attitude or values (where there are no right or wrong answers). The questions, such as, does the concept of item difficulty become redundant in the case of personality test, or how to apply item discrimination in the case of attitude test, or how to measure variables such as innovativeness, creativity, happiness (where rating scales are used) if explained will be of much use to the learner.

Part 3 deals with the applications of psychological testing, in chapters 12–15. Examples are given of educational, counselling, guidance, clinical and organizational settings. We do hold the view that these examples of psychological tests

could have been better represented in pages 235–256. It would have been better if the population on whom the standardization was carried out was mentioned for each test. Mention of the open source databases of psychological tests, like International Personality Item Pool (<http://ipip.ori.org/ipip/>) may help readers.

Part 4 (chapter 16) is nicely written. It deals with ethical issues in psychological testing. The author has brought in many important areas including responsibility, public statements, confidentiality and impersonality regarding code of conduct of the psychometry expert designing and conducting the questionnaire or tests.

Part 5 addresses the most important statistical method for Psychometricians, namely Factor Analysis (FA). Chapter 17 explains the basics of FA. Chapter 18 describes the centroid method in detail along with the methods of factor extraction and interpretation. Chapter 19 deals with the application of FA in various fields. The theory of FA could have been described at the beginning of the chapter. The definitions of terms like communalities, percentage of variance, factor loadings, sample adequacy, eigen values, factor scores, importance and use of FA could have been discussed up front. This could have been followed by the various types of FA commonly encountered by measurement experts. For example, the principal component analysis or factor analysis with varimax rotation is commonly used when questionnaire-based instruments are made. Currently, these terms are distributed across pages 302–353.

Considering that the book is being taught to students and will be used by consultant's accuracy of formula and equations is important. Hence, the book needs the precision of any mathematical or statistical book with reference to language and errata. Illustratively, the following are a few errors that must be corrected urgently. On page 29, the last paragraph reads as 'Suppose the t value calculated for these groups is *more than* 2.58, then the H_0 is *accepted* but actually there is a difference between the two groups'. When the calculated t -value is greater than the value given in the t table then the null hypothesis is rejected and not accepted. On page 28, while stating the formula for standard error of standard deviation of a sample (number 5), the numerator is given as $071Q$ when actually it should be $0.17Q$. Further, the legend

below the next formula (number 6 on the same page) states both P and Q to be the same. On page 140, the formula for standard deviation used in the calculation of Cronbach Alpha has an error. It helps if the role of the negative sign in calculation of Cronbach Alpha is described. Page 303 has an error in matrix representation, the first matrix on the page must have a gap to be read as 3×2 matrix. It could be easily mistaken for 3×1 matrix.

This book explains the 'beautiful, fascinating, and attractive' subject of

psychometry to quote the author's words. This book can help a wider variety of students, researchers and consultants. The area of psychometry is taught traditionally to students of psychology and education. Widening the scope of such a book makes research in social sciences scientific and generalizable. It would be of immense use to students specializing in marketing, organizational behaviour, human resources management and other multi-disciplinary research areas. Readers from such disciplines will gain if the

scope of the book is widened by including examples from other areas. The book needs a quick new edition as a follow up to the current one.

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PERSONAL NEWS

T. C. Anand Kumar (1936–2010)

T. C. Anand Kumar, the pioneer of India's first scientifically documented test tube baby, passed away on 26 January 2010 at the age of 74. A reproductive biologist of international repute, he will always be remembered for his diverse contributions to the field, ranging from the role of the neuro-endocrine system in reproduction; developing the means of administering hormones via the nasal route and spearheading the team that produced India's first test tube baby at the ICMR's Institute for Research in Reproduction and the KEM Hospital, Mumbai in 1986. After his retirement as the Director of the Institute for Research in Reproduction, he founded Hope Infertility Clinic in Bangalore in 1991 where many of the first generation of Assisted Reproductive Technology (ART) specialists in the country were trained and started their careers in this field.

A graduate from Bangalore, he obtained his doctorate from the University of Jaipur and then went to Birmingham, UK to pursue his studies. Despite several job opportunities provided to him in UK, so strong was his spirit of nationalism that he returned to India to participate in the growth of science in the young nation. It was then that he started the electron microscopy laboratory at the All India Institute of Medical Sciences (AIIMS) in 1970 which is still functional today. He served at AIIMS from 1969 to 1982, where he was committed to teaching medical students, and also started the neuro-endocrine research laboratory.

He founded the Indian Society for the Study of Reproduction and Fertility in 1988 comprising members representing

distinguished scientists, public health executives, programme managers and clinicians from the field of reproductive sciences which is an active and flourishing society today.



He continued sharing his wisdom and experience with the younger generation of scientists by serving as an adviser on many committees, including the World Health Organization, Department of Science and Technology, Council of Scientific and Industrial Research, Department of Biotechnology, and the Indian Council of Medical Research till September 2009.

His work was recognized by his peers and he received the Shanti Swarup Bhatnagar Award, and the Sanjay Gandhi National Award. He was a Fellow of the Indian Academy of Sciences, the National Academy of Medical Sciences (India), and a Fellow of the Gonville and Caius College, Cambridge.

The visionary in Anand Kumar was equally concerned about the welfare of his patients seeking treatment with newer reproductive technologies. When the first scientifically documented test tube baby

was born, he was always questioned whether an overpopulated country needed test-tube babies. With this modality of treatment gaining acceptance and hundreds of clinics operating in India, he took the lead in formulating National Guidelines for Accreditation, Supervision and Regulation of ART Clinics in India.

A man who stood for truth and integrity he had the magnanimity to give away his fame and glory of being the pioneer of India's first test tube baby when he discovered all the handwritten notes of Subhas Mukerjee. Mukerjee from Kolkata had claimed to have created a test tube baby in 1979 (the second in the world) but his claims were neither substantiated nor recognized by scientists or the authorities leading to his premature death. Anand Kumar had the courage to research his predecessor's findings and scientifically present it to the world giving Mukerjee his due place in medical history¹. Such generosity and honesty is a very rare attribute.

Anand Kumar's love for science and the search for truth will always be remembered. His students, who are now highly placed all over the world would always cherish their mentor. He is survived by his wife, a son and a daughter.

1. Anand Kumar, T. C., *Curr. Sci.*, 1997, **72**, 526–531.

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