

BOOK REVIEWS

C. V. Raman: A memoir by A. Jayaraman. Affiliated East-West Press Pvt Ltd, 25, Dr. Muniappa Road, Kilpauk, Madras 600 010, 1989, pp 214, Rs. 80.

Professor C. V. Raman still remains the most outstanding scientist and the best known amongst the Indian scientists in the whole world today. This is mainly due to his discovery of the effect known after his name for which he was awarded the Nobel Prize for Physics in 1930, the first and the only Indian citizen to win a Nobel Prize in Science. This discovery reigns supreme even today since the experimental technique called Raman Spectroscopy has turned out to be an indispensable tool for solving problems in a wide range of disciplines such as physics, chemistry, medicine, geology, communication, engineering and technology. Professor Raman was also a colourful personality and a brilliant spokesman for science in India. A memoir on Professor C. V. Raman's life and work depicting his courage, his faith in young men and women, his love of nature and his ceaseless quest for truth will be a source of inspiration to the youth of our country. This is the principal aim of Dr Jayaraman in bringing out the present memoir. Professor Raman's motto throughout his life has been the following: A professor who succeeds in attracting and inspiring a group of highly gifted young students was also benefiting himself and rendering to the cause of science far greater service than he could even hope to offer in splendid isolation.

During Raman's life time only a short bibliographical sketch was published for private circulation in 1938 coinciding with the tenth year of the discovery of the Raman Effect and the Golden Jubilee Year of its discoverer. The next biographical sketch of Raman's life and a review of his scientific contributions were contained in a detailed article written in 1971 by his most brilliant student and collaborator, Dr S. Bhagavantam, in the *Biographical Memoirs of the Fellows of the Royal Society of London* who passed away in 1970. This is a chronological account of Raman's life, achievements and scientific publications.

In 1972, the Andhra Akademi of Sciences published a short adulatory memoir entitled *Professor Chandrasekhara Venkataraman: His life and work* authored by Prof. S. Bhagavantam. The later volume *Raman and his effect* written by G. H. Keswani (National Book Trust, New Delhi, 1980) consists of short essays on the life and scientific contributions of Raman. It lays emphasis on the major controversies connected with Raman's work.

The most recent, important and detailed publication on Prof. Raman was the one entitled *Journey into light: Life and science of C. V. Raman* by G. Venkataraman of Anurag, DRDO, Hyderabad. This was published by the Indian Academy of Sciences, Bangalore, of which Prof. Raman was the President from its very inception in 1934 till his death in 1970, and was released on his Birth Centenary Day in November 1988.

The present publication under review is the latest memoir on Professor Raman written by Dr A. Jayaraman, a former student and close associate of Raman at the Raman Research Institute (RRI). He was not only close to Raman but also intimately involved with the development of the Raman Research Institute from its very inception in 1949 to 1960. The departure of Dr Jayaraman from the

RRI in 1960 to take up a Post-Doctoral Research Fellowship at the University of California at Los Angeles had upset Prof. Raman considerably and he disbanded the research team under him and refrained from taking any more new students. He later carried on his research work with the help of a technical assistant only.

The book under review is divided into five chapters. The first deals with Raman's early education, his debut in the Indian Financial Service, his accidental discovery of the existence of the Indian Association for the Cultivation of Science at Calcutta and his contributions to scientific advancement as Palit Professor of Physics at the Calcutta University from 1917 to 1933. It also contains a review of the momentous work carried out by Raman and his students at the Association leading to the discovery of the new effect since known as Raman Effect. The next chapter deals with Raman's career at the Indian Institute of Science till 1948 and later at the Raman Research Institute till his death in 1970. Chapter III deals with the visits of important personalities, both Indian and foreign, to his laboratories and also about a few of his distinguished students and associates of the Calcutta days. The next chapter deals with a long list of honours and awards showered on Prof. Raman, his wide interests, spirits, traits and the exceptional qualities of a good teacher. There are some reflections on Raman's personality and also a review of Raman's contributions to Indian science. The last chapter deals with Lady Raman, Raman's interest in music and musical instruments and the Raman Effect. Raman's first lecture on 'A new radiation' delivered at the South Indian Science Association on Friday, March 16, 1928, at Bangalore which appeared in the *Indian Journal of Physics* (1928, Vol. 2, pp 387-398) is reproduced. This chapter is followed by an epilogue containing an abstract of Raman's life and career with some references to his shortcomings. Important dates in the life of C. V. Raman, which originally appeared in this Journal, are listed at the end. The book is well illustrated with some good photographs.

Being a close companion and confident of Prof. Raman, Dr Jayaraman has given a first hand and accurate account of Raman's achievements focusing on Raman's personality with a wealth of humorous anecdotes and incidents. The events which took place during the decade 1950-1960 and with which the author was familiar have been referred to in great detail and with accuracy. However, some of the events mentioned in the book which took place long before the author joined Prof. Raman's laboratory have not been correctly reported. A few important ones are mentioned here. On page 50, it has been stated that the 'Maharajah of Mysore had gifted, for starting a research institute, a lovely piece of land, 11 acres in extent in one of the prime localities in Bangalore'. Actually, in 1934 Raman along with some of the prominent professors in the South started the Indian Academy of Sciences at Bangalore and had requested the Maharajah of Mysore for a gift of a piece of land near the Indian Institute of Science for the Academy headquarters to which the Maharajah had agreed to. As the Academy did not have enough funds to put up even a decent building for its office, not to talk of a research institute, it could not make use of the big plot of land assigned to it. Raman along with some of his old associates, Ramanathan, Krishnan, Bhagavantham, Ganesan and others, conceived the idea of putting up a research institute for him and his old research associates to work after retirement from active service and started collecting funds for the same. In the Forties, Prof. Raman as Director of the proposed research institute entered into an agreement with Prof. Raman, as the President of the Indian Academy of Sciences, for putting up a first-rate research institute in the land belonging to the Academy with funds collected for the purpose. This was later ratified by the Council and the Fellows of the Academy. On the same page of the book, it is stated that the main building of the Raman Institute was essentially designed by Raman with the help of some architects. Actually, contrary to such a belief, it was not designed by any architect but was conceived and planned by Prof. Raman in active collaboration with Dr. C. S. Venkateswaran, the seniormost member of his research staff at the Physics Department of the Indian Institute of Science, who was also a good mechanic and an excellent draughtsman. It has been stated on page 112 that Raman was also attracted

by the investment opportunity presented by the notorious Gopala Rao Trust and invested into it Rs. 2,00,000 of his Nobel Prize Award. In fact, immediately after the Second World War broke out, real estate prices were shooting up and Raman immediately invested the Nobel Prize money on a few houses in a good residential locality of Madras. These houses fetched him high profits when he sold them later. He donated the proceeds to the Raman Research Institute. With the help of his student, Dr Vikram Sarabhai, former Chairman of Atomic Energy and Space Commissions, Raman had collected considerable sum of money from the millowners of Ahmedabad for constructing the Raman Research Institute. As he could not start its construction immediately, he placed in the Gopal Rao Trust a major part of the money collected and not the Nobel Prize money. When the Trust went bankrupt, the late K. Hanumanthayya, the then Chief Minister of Mysore, helped Raman to retrieve a large part of the money which he used for the construction of the main building of the Institute.

The book is well written and makes pleasant reading and is well illustrated. The front wrapper has a colourful photo of Prof. Raman with a lace turban holding a large artificially grown crystal of quartz in his hand.

Although the price is a little on the higher side it should find a place not only in educational institutions but also in all public libraries in India.

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Cognitive science in medicine: Biomedical modeling edited by David A. Evans and Vimla L. Patel. The MIT Press, 55, Hayward Street, Cambridge, Massachusetts, 02142, USA, 1989, pp 421, \$ 35. Indian orders to: Affiliated East-West Press Pvt Ltd, 25, Dr. Muniappa Road, Kilpauk, Madras 600 010.

The volume is an outcome of the efforts of a group of scientists drawn from the disciplines appropriate to the subject and supported by Josiah Macy Jr Foundation. The initiative, motto and conviction of the Foundation are reflected in James G. Hersh's statement: to obtain a complete reassessment of both content and method of medical education and to recast the medical school in a form more appropriate for students, faculty and society besides providing support to cognitive research in its own right. Since many years, it is realized by medical educators that the practice of medicine is a cognitive discipline and clinical models are cognitive models and to understand medicine, one must understand first how experts who practice medicine actually think about the problems they solve. Research on medical reasoning can extend our understanding of how experts and novices process information, reason and solve problems in a relatively ill-structured, complex, rich, real-world domain and thus make a modest contribution to our understanding of human information processing. Thus, biomedicine has become one of the best analysed problem-solving domains from the perspectives of artificial intelligence as well as psychology and social sciences. However, few studies have combined these two points of view, linking explicit models of physician knowledge with models of physician behaviour and the present volume projects a more formal connection between these two points of view. The book seems to be the first of its kind devoted exclusively to issues and results in applying techniques from cognitive science to biomedical problem solving both implicit (in discourse) and explicit (in clinical decisions). The book contains the results presented at a workshop on 'Cognitive science in medicine' and is edited by David A. Evans, a computer scientist and Vimla L. Patel engaged

in medical education. Besides the editors, other contributors are drawn from the fields of physiology, philosophy, psychiatry, medicine, medical education, computer science, judgement and decision making. The book has ten chapters with three sub themes. The first one dealing with the scientific/conceptual basis of medical problem formulation is treated in Chapters 2 to 4 by Elstein *et al*, Patel *et al* and Feltovich *et al*. The second one deals, in particular, with the problem of discourse-mediated problem solving in Chapters 5–8 by Hammond *et al*, Evans *et al*, and Rodolitz & Clansey, while the first and last two chapters by Evans, Glymour, and Lesgold focus on issues in methodology and theory of the third sub theme.

In Chapter 1, the issues of cognitive science in medicine are grouped under three categories: (1) the *a priori*, (2) the nonscientific or pragmatic, and (3) the scientific, and are followed by a discussion of the role of knowledge and effective learning. It is argued that more need not be better in developing expertise, *i.e.*, effective processing of information depends on learning to ignore details selectively.

Chapter 2 describes the performance of third-year residents from three specialities with recommendations derived from two subjective expected utility (SEU) models and then with those obtained previously from experienced physicians in deciding about the appropriateness of estrogen-replacement therapy for menopausal women. Decision trees for multi attribute utility (MAU) and single attribute models, subjective probabilities for no treatment and treatment conditions, comparison of the models, and models with observed decisions, the role of background speciality on the decisions arrived at are dealt with. It was concluded that neither SEU models adequately described intuitive decision process, and both residents and experienced physicians preferred no treatment more often than treatment and thus the prescription of estrogen-replacement therapy seems little affected by experience.

The main theme of Chapter 3 is on biomedical knowledge and clinical reasoning and to examine whether the theory involves (1) models of abnormality, (2) makes use of exemplars, and (3) includes models of human behaviour. The chapter provides results of a number of experiments conducted and clearly brings out a comparison of the backward- and forward-chaining strategies and models used by medical students at different levels – first, second and fourth years, an expert physician and a researcher in biomedical science. It is found that expert clinicians generate accurate diagnoses with maximum efficiency using the extensive examples, *i.e.*, stereotyped situation models and adopt more frequently backward reasoning and textual cues when asked to solve a problem outside their own speciality. Practitioners do not appeal to basic biomedical science in constructing new situation models whereas a researcher who too appears to develop a situation model wherein the basic biomedical knowledge plays an important natural role. The chapter is illustrated with models developed in each group for a number of diseases – endocarditis, stomach cancer, endocrinology and concludes with patterns of inference and general strategies in medical problem solving.

Chapter 4 deals with the nature of conceptual understanding and development of misconceptions in biomedicine. Instead of superficial coverage of a large number of biomedical concepts the chapter initially deals with in-depth coverage of small sets of important and complex concepts in advanced knowledge acquisition, concept selection based on concept nominations by medical teachers and practitioners, domain ill-structuredness, several kinds of generality – cross-contextual applicability of concepts, importation of explanatory models, cognitive biases in management of difficult concepts, patterns of development of higher order misconceptions, learning scenarios that cause conceptual error, etc., are considered. Then the anatomy of a misconception regarding congestive heart failure and cardiac muscle-cell function, the nature, acquisition and maintenance of the misconception are explained. The four-component misconceptions that are involved in the overall misunderstanding, educational influences towards its development on the part of the learner, the medical student and the teaching process are discussed. This aspect is dealt with at length using charts of converging influences, network of reciprocating beliefs for each of the four-component misconceptions.

Cognitive theory and student-teacher dialogue are considered in Chapter 5, after explaining the historical shift in epistemology and its significance for medicine. Although Aristotelian theory and methods have largely been replaced by Galileian methods by the modern scientists, it is argued that both forms of cognitive activity are used to acquire knowledge as is evident in contemporary medical decision making. With the help of a number of case studies, it is shown that teachers had a greater role in the dialogue and did much more teaching with the third-year medical students than with fourth-year students suggesting that the teacher found more teaching to be necessary with the former than the latter. It is found that Galileian or modern functional analyses occupied a slightly greater place than Aristotelian pattern recognition during the cognitive activity of the student, during his independent diagnosis and during student-teacher dialogue.

Chapter 6 reflects three paradigm situations of medical discourse: between expert-expert, expert-intermediate, and expert-novice and attempts to establish a conceptual and computational basis for identifying contexts and measures of coherence in medical problem-solving discourse. Several classification levels at which medical knowledge stratifies in the service of diagnostic problem solving are distinguished. These are labelled and explained as empirium, observation, finding, facet, diagnosis and global complex. The interdependence of knowledge in the classification hierarchy is illustrated in the diagnosis of Laennec's cirrhosis. Then, the effects of domain-specific strategic planning, discourse-specific tactical planning and general conversation planning are dealt with for the resolution of uncertainty for inference and diagnosis.

Analysis of clinical interview as a special case of problem instantiation, driven by the heuristics of general medical problem solving and subject to the limitations and biases of medical knowledge representation and a methodology for coding the natural language discourse that illuminates the process as well as the results of doctor-patient interaction are dealt with in Chapter 7. This is attempted in the first approach by integrating the hierarchical organization of medical knowledge and management of context in interactive medical discourse while the second is based on the notion of situation models, whereas the conventional studies are labelled as decision analysis, engineering and patient simulation. Observations and findings are the principal elements of medical problem solving and these are classified as positive and negative observations, and this is followed by utility of exemplars and reference models in the process of diagnosis. These ideas are illustrated by mappings of observations to findings in reference model for specific diseases, protocol analysis and schematic representation of an expert's problem-solving methodology consisting findings, facets and diagnoses. These ideas are then extended to residents and medical students.

Chapter 8 deals with teaching two types of knowledge: (i) of domain of facets and relationships, and (ii) how to apply these facets to solve a particular problem as used by expert problem solvers through computer tutoring system called Guidon-manage which teaches the strategic knowledge used in medical diagnostic consultations. A student learns a skill through observation of the mentor, coaching by the mentor and then by independent practice. Representation of strategic knowledge as a hierarchy of tasks and metarules in Neomycin is used as an example. Guidon-manage consisting of design and implementation issues, interaction and interface issues and student trials are dealt with.

Chapter 9 'When less is more' considers cognitive science as empirical, and the role of artificial intelligence in understanding the expert performance and assessment of some of the available automated systems. The computational cost of representations, the databases and the TETRAD programs developed at Carnegie-Mellon University and based on the notion that less is more are explained.

The last and final chapter throws light on modelling of expert and student knowledge for the purpose of intelligence machine assistance to the medical education process whose goals impose

differing requirements based on the forms of modeling. Approaches to student assessment, the abstract problem space approach, experience and connectionist processing to explain levels of cognitive activity and the problems with such models of expertise or of student knowledge and schematic processing are then explained.

Each chapter is provided with sufficient number of references and illustrations. The book is a cohesive presentation of concepts, experimental methodology involved in the application of the principles of cognitive science in medicine and the authors succeeded fully in their attempt in reflecting the fundamental problems involved and thus serves its purpose well.

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Matter and consciousness by Paul M. Churchland. The MIT Press, 55, Hayward Street, Cambridge, Mass. 02142, USA, Revised edition, 1988, pp xii + 184, \$9.95. Indian orders to: Affiliated East-West Press Pvt Ltd, 25, Dr. Muniappa Road, Kilpauk, Madras 600 010.

Despite the impressive progress made in the scientific understanding of many natural phenomena, one fundamental question, *i.e.*, the nature of 'conscious intelligence' remains largely unanswered. Encouraging progress was however made in many disciplines that impinge on this question and these include philosophy, cognitive psychology, neuroscience, artificial intelligence, ethology and evolution. This book gives an admirable account of the progress made in the above areas relevant to this subject and brings into sharp focus the current philosophical/scientific debate on the major issues and plausible theories in the philosophy of mind. The subject was discussed essentially in four chapters which cover the ontological (mind-body problem), semantical, epistemological and the methodological problems. The central issues of the materialist and dualist theories of mind, philosophical behaviorism, reductive materialism (the identity theory), functionalism and eliminative materialism are clearly presented. Similarly the various manifestations of the semantical problem, the problem of other minds, the nature of self-consciousness and introspection and the methodological issues which concern the most appropriate approach involved in constructing a 'science of the mind' are dealt with with clarity and precision. In addition, there are chapters on artificial intelligence and neuroscience, areas in which great progress that distinctly influences any theory of the mind was made. In the last chapter, very appropriately, the author presented strong arguments for the existence of conscious intelligence in other planets in the universe.

This is a fascinating book and as the author states, written primarily for the newcomer but it will also serve as a comprehensive summary and source book on the philosophy of mind.

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Free: The end of the human condition by Jeremy Griffith. Centre for Humanity's Adulthood, Sydney, 1988, pp 228, \$ 12.

There are at least two ways of dealing with a book of this sort. One is to treat it as *Nature*, the scientific periodical, appears to have done. In a personal encounter with the author, when he presented

his ideas contained in the book, *Nature* all but slammed its door on Griffith's face. Science's celebrated Journal could not countenance the heresy of 'introspection, not research'.

The other way is to take a look at his ideas and examine them with a sympathy and understanding which Griffith's efforts of several years almost certainly merit. That the book has not had the benefit, nor enjoyed the privilege, of a prestigious publishing house has had no influence on the reviewer who hopefully wishes to present an unbiased appraisal of the book.

The title was arresting and called for examination of at least two themes central to the book. One referred to 'the human condition'; the other was its 'end', and the announcement of freedom. While either could claim interest on its own, together they demanded singular attention and appeal.

It soon became clear that Griffith was a compulsive complainer. Everything was wrong with man; his origins two million years ago; his evolution and development over this period, and his current condition. There was, to begin with, this conflict between 'gene-based' and 'mind-based' learning systems, illustrated by difference in behaviour between the lone eight-year old boy at the birthday party, and his friends all of whom happen to be seven-year olds. Griffith's analysis of the scenario where the eight-year old grabs the cake while the rest, all seven-year olds, look on with restraint, is faulty, to say the least. That the 'obedience' of the seven-year olds is instinctive and gene-based, and 'grabbing' the cake by the eight-year old is mind-engineered; that the spectacular change from one to the other takes place in a single year period is hardly valid. There is no biological evidence for this.

Griffith's further inferences and his transpositions into the evolutionary history of the human species are just as ingenious and fanciful. His analogy of the 'self-managing' behaviour of the eight-year old boy (at the birthday party) and a similar effort at 'self-managing' by *Homo* starting 2 million years ago is entirely unproven. Thinking man didn't appear till much later.

'The human condition' is therefore one of 'upset': continual conflict between instinct and reason, between gene-based learning of the distant past and mind-based learning of the more recent history of man. Griffith sees it as quite serious and left to itself, would work to human destruction.

Do we want to do something about it? Yes, we do; both as individuals and as a society. Only two concerns govern man; his personal happiness and the happiness and welfare of mankind.

The current problem of man and his society is a denial of integrativeness. At one time it was believed religion would solve it, but failed. Later, science was expected to do it. It failed too. Science became an evasion, and religion a retreat; and neither was an effective response to the dilemmas of man.

Against this background of the 'human condition' Griffith would try and redeem us. His prescription is simple, he terms it '*Love-indoctrination*', synonymous with selflessness, integrative behaviour. Love-indoctrination is not genetic as sociobiologists would have us believe. It is very much a learning process. It is the basis of all integration. It is the prime theme of the future of man and the essential message of this book.

Griffith, however, has no rules for this 'love-indoctrination', at any rate, on new methods, since the Buddha or Jesus Christ. He recommends a Prophet, even as he is aware that the prophets of yore have not been notably successful in transforming man or his society.

Man is confronted today with the problem of the difference between what is *correct* and what is *right*. Science employed experimentation to establish what is *correct*, and was phenomenally successful. Religion and philosophy adopted introspection to know what is *right* and met with some positive results. It is an integration between the two, between what is *correct* and what is *right*, it is this that is bothering him. Griffith has no answer to this problem. Mere optimism does not carry us across the dark waters of humanity's predicaments. Crying out loud that deliverance is coming or that redemption

is near will not relieve the situation. Contrary to its highly emotional, melodramatic title, the book fails to delineate guidelines to freedom. The dilemma of the human situation is that we do not know what to do with it.

It might appear something of an anticlimax to speak of Griffith's writing. It is a pity that Griffith has denied himself the advantage of a competent scrutiny of his manuscript. The result has been a great deal of confused writing. Punctuation, grammar and construction have all been thrown away. The author's admission that he cannot spell or use grammar correctly (p. 185), it appears, is borne out by evidence on almost every page of this book which otherwise is printed and produced beautifully.

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