

emphasize it with some actual stories. Funnier, the better. However, humour is usually very limited in science circles, unlike elsewhere. Even teachers and students as a class fare better on the humour front than the scientists, though nowhere close the class of doctors and nurses. The egghead is usually at the butt end of jokes than be the perpetrator of *humour most foul* on his fellow beings. Search the NET and you will surely find out that science is rather low on humour. If my friend Gangal became hysterical when someone used the term temperature fluctuations, since for him it is an oxymoron, I would think it is very specialized humour. My students very politely smile, if not yawn, when I tell them that Szent Gyorgyi named the then unknown ascorbate originally as ignose, and when the editor objected violently to the lowly pun, renamed it as godnose.

Many anecdotes came to my mind that have not been mentioned in this book. I do not want to fall prey to the temptation saying that I know many more anecdotes, while the fact of the matter is that many anecdotes I read here were not known to me. The book is decidedly for the younger in language and temperament: I would place the recommended readership at the school level.

Strange as it is, I still have to review it for *Current Science* and therefore I need to say a few things about what the author stated as his purpose for the book, if only to reflect the kind of thoughts other readers also may have when they read this book.

The book came into my hands after just having completed Hal Hellman's *Great Feuds in Science* (John Wiley and Sons, 1998). It was about Urban VIII vs Galileo, Huxley vs Soapy Sam, Cope vs Marsh, Newton vs Leibnitz, Freeman vs Mead and so on . . . , some ten issues in all. The fact is that the issues could be bloody. There was some mild interest on the author's part in the preface to state that a greater familiarity with lives and foibles of scientists interspersed in lectures will make students see science as a more human activity and be attracted to it. Could be. The problem of course is that all foibles do not contribute to science. Nor are folk tales simply humorous. Some indeed are intensely sad. There is an aspect of life which is more real than that *Reader's Digest* paints for us. There is more to doing science than what Brownowski tells us. If Conant, the then

President of Harvard preferred to accept the letter of Subbarow (who did not figure in the list) that all the credit should go to Fiske and did not appreciate nor reward the handsomeness of the gesture, that is also science for you. If power politics of a courtier, rather than the undiluted love of truth turned Galileo against the Church who did not heed the advise of the Jesuit priest that refutation of a canon cannot be based on observations for which a theory does not exist (he was referring to the theory of optics), and was duly chastised for it, must not the modern students argue about the unexpurgated history?

I remember a meeting long ago on philosophy of science in a university. The speaker, a very balanced person, was speaking of how difficult it is to do good philosophy of science in India because philosophy of science cannot be done *in vacuo* . . . It requires the presence of top science, of a level that raises important questions. Popper referred to top dogs. The ensuing discussion was an antithesis. The local professor went on to say that top science is unnecessary for a philosopher. According to him, the statement that 'matter gravitates' is enough (*sic*) of science. He would then take that statement and could go on philosophizing (his emphasis was largely on linguistic analysis). It became very clear to all of us how a perfectly legitimate expression of anguish regarding the poverty of environment could be diluted and trivialized by someone who has never 'lived' in the thickness of things.

In a sense, Salwi may not have any objection to what I am saying. His selection of Indians, a very proper 10% of the lot, is dotted with people whose claim to fame is administration and teaching. He must have had considerable difficulty in getting acceptable anecdotes about good scientists from here. The tragedy of the lives of the wives of two greatest among Indian scientists (is that acceptable?), Ramanujam and Subbarow, would not be inspiring reading. Given the times, what would they have contributed had they been god-fearing loyal husbands . . . what price, science?

All this is very unfair to write about a book which is very unpretentious and written in a very proper and mild manner. At least, Salwi has gone ahead and taken the effort to write a book that many could read. I hope they do. All I do is ineffec-

tually teach a small number of students. Whether either activity inspires the students, I have my doubts. Indians usually test the bath water, they rarely jump in.

V. SITARAMAM

*Department of Biotechnology,  
University of Pune,  
Pune 411 007, India  
e-mail: sitaram@unipune.ernet.in*

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**Plant Cell Vacuoles: An Introduction.**

D. N. De. CSIRO Publishing, P.O. Box 1139 (150 Oxford Street), Collingwood VIC 3066, Australia. 2000. 288 pp. Price: US \$ 60.00.

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'Vacuoles are ubiquitous, multifaceted and indispensable organelles and yet they have been thinly treated in the literature to date. This is at odds with the amount of interest in vacuoles that has been expressed in the last two decades.' The statement on the cover of the book and other comments in the preface of the book by D. N. De highlight a small part of the larger syndrome experienced in the plant sciences which are often perceived as overwhelmed by work on animal systems. However, it should hardly surprise one, considering the facts that (a) a vast majority of cell and molecular biologists (and there are tens of thousands of them!) work with microbes and animal cells, and (b) botany and zoology were and still are taught as separate subjects in many schools and colleges. In fact, biochemistry, cell biology and molecular biology have evolved in a fashion that automatically excludes from the mainstream, anything that is related to plants. Thus, despite the customary chapters on biochemical and cellular unity of life, almost all good texts may not even provide passing reference to plants, except about chloroplasts and photosynthesis. The predicament of the out-of-the-mainstream biologists working with plants was clearly expressed two decades ago by Stumpf and Conn<sup>1</sup> and despite the upsurge of interest in plant cell and molecular biology in the subsequent years, the perception of continued marginalization of plant knowledge has pained many, including De. Now, there are separate books on Biochemistry (read *Animal Biochemistry*) and Plant

Biochemistry, and there are journals, e.g. *The Cell*, and *The Plant Cell*, or *Journal of Molecular Biology* distinct from *Plant Molecular Biology*. This bifurcation is not without undesirable fallout on teaching of biology, e.g. every biology teacher comes across master's or doctoral degree holders harbouring a notion that in the plant cells, chloroplasts are substitutes for mitochondria!! And some life scientists are shocked when given some common facts about plant life such as (a) all plant cells have electric potential across their membranes, and (b) animal neurotransmitters are also present in plants. The phenomenal ignorance of plant life goes to the extent that according to the most widely read school biology text in India, while animals have proteins in all cells, in plants, the proteins are found in exine of pollen grains (ONLY)!!! It is in this scenario that thin treatment given to plant cell vacuoles even in the standard textbooks written by Nobel laureates like Watson and Baltimore motivated De to write this treatise on an organelle without which a plant cell cannot long survive.

In De's *Plant Cell Vacuoles*, the 'obscure' and 'mysterious' 'water bags of plant cell' of yesteryears comes alive and is seen busy not only in housekeeping, but also in fortification against disease and stress. The largest chapter comprising about thirty per cent of the book is devoted to functional aspects, and here one learns that plant cell vacuoles are directly involved in resistance to diseases, herbicides, drought and soil salinity, in preventing unwanted oxidation, intracellular digestion, osmoregulation, overproduction and storage of starch, fructose and even pharmaceuticals. One wonders how vacuoles can be ignored in quest for plant improvement or biotechnology.

The book throws spotlight on landmark developments that have changed our notion of 'the large fluid-filled organelle' as we have known the vacuoles, e.g. discovery of proton pumps and vacuolar-ATPases, of aquaporin, the water selective proteinaceous channels in the tonoplast, the use of patch-clamp technique for discerning ion channels in the tonoplast, understanding the role of vacuoles in detoxification of xenobiotics, and use of genetic engineering for modifying tonoplast proteins (there are 68 polypeptides in the tonoplast). The book is both timely and welcome. Written by the

co-discoverer of a distinct tonoplast, it is an excellent book containing a wealth of information, which was hereto confined to research journals. The only other available comprehensive compilation on plant vacuoles which has been published recently<sup>2</sup>, has its own merits, but De's book can also be used as a ready reference. The usefulness of De's book is enhanced by a detailed chapter on methodology and some master tables, including one on distribution of enzymes in various types of vacuoles (table 5.5), to serve as important database for researchers. The author needs to be congratulated for bringing together, single-handed, remarkable information on vacuoles for the first time. The book is well researched and has all the information on vacuoles up to June 1999. In a field where there was no book earlier, publication of a compilation of reviews in 1997 (ref. 2), De's book in 2000, and now the announcement of another book due in early 2001 (ref. 3), marks the fact that vacuology has come of age.

The book has been written with great clarity and is highly readable even by a non-specialist. It has a distinct flavour, which only a teacher can provide. Special care seems to have been taken to explain botanical terms for the benefit of a non-botanist reader and all this has been very nicely woven into the text. Although there are very useful separate chapters on 'Early Studies' and 'Methodologies', historical notes and experiments dot the entire text and help in gaining insight. The chapter on 'Methodologies' provides detailed protocols for isolation of vacuoles and tonoplasts, staining and assaying of marker enzymes. Topic-wise summary has been provided at the end of each chapter.

The work presented in this book is of a very high academic standard. Adequate references have been provided at the end of each chapter. The author seems to have applied some filters for citations, e.g. barring a few exceptions (including historical papers and a few of the self-citations), almost all the references cited in the book are from core journals of very high impact factor. Similarly the books cited here are also publications of a few very highly reputed international publishing houses only. However, a notable omission has been a reference to Marin's book<sup>4</sup>. Although most of the work included in Marin's symposium volume has been cited as papers published in refereed journals or books by the respective authors, the book

itself being a compilation of papers on plant vacuoles only, should not have been missed. Secondly, it is becoming increasingly fashionable in the post-Gutenberg era books to provide URLs to the WWW literature. This is another area, which the author may consider for a possible next edition, which I am sure all readers would love to have. And a second edition may become inevitable, as De's *Plant Cell Vacuoles*, the first book of its kinds on vacuoles, is a definite landmark which is bound to inspire many to choose a research career in vacuology. One would also like to see a section on role of vacuoles in 'excretory system of plants' and a more detailed account with reference to rubber formation.

Since most of the targets for plant improvement for commercial products may involve vacuoles, this book will provide cell biologists and molecular biologists an easy opportunity to become better informed about interesting and somewhat unique problems, which the plant cell vacuoles provide. The book would be highly useful not only to researchers, but also to teachers and students of advanced courses in cell biology, cell physiology, plant physiology, biochemistry and biotechnology. It shall really be a welcome addition to libraries of all departments dealing with life sciences and not botany alone.

Finally, CSIRO Publishing needs to be complimented for their excellent publication.

1. Stumpf, P. K. and Conn, E. E. (eds), *The Biochemistry of Plants: A Comprehensive Treatise*, Academic Press, New York, 1980 (General Preface).
2. Leigh, R. A. and Sanders, D. (eds), *The Plant Vacuole (Advances in Botanical Research)*, Academic Press, San Diego, 1997, vol. 25, pp. 463.
3. Robinson, D. G. and Rogers, J. G. (eds), *Vacuolar Compartments*, Annual Plant Reviews, CRC Press, Boca Raton (to be published in January 2001).
4. Marin, B. (ed.), *Plant Vacuoles: Their Importance in Solute Compartmentation in Cells and their Application in Plant Biotechnology*, NATO ASI Series A, Life Sciences, Plenum Press, New York, 1987, vol. 134, pp. 562.

RAJENDRA GUPTA

Department of Botany,  
University of Delhi,  
Delhi 110 007, India  
e-mail: rajendra@nda.vsnl.net.in