

BOOK REVIEWS

Pharmaceutical Education. Dr Harkishan Singh. Vallabh Prakashan, SU-221, Pitampura, Delhi 110 034. Price: Rs 350, \$ 40. 204 pp.

Pharmacists are recognized world over as pivotal players in the healthcare system, primarily responsible for the final quality and therapeutic efficacy of administered medicaments, and, consequently, the education they receive must equip them to contribute at one or several stages of the 'laboratory-to-clinic' journey of a pharmaceutical product. These stages include: (a) the new drug discovery process; (b) the design, development and manufacture of pharmaceutical dosage forms; (c) optimization of therapy in the hospital/clinic; (d) dissemination of product information to the practising physician and community at large, and (e) the drug regulatory process which ensures the final quality, safety and efficacy of the pharmaceutical product.

Education in the pharmaceutical sciences and technology is therefore multidisciplinary and necessitates inputs from both basic and applied sciences relevant to the drug discovery process and the subsequent development, evaluation and clinical performance of a new drug molecule and/or its pharmaceutical products. The education system must therefore provide not only multiple avenues for specialization but also a comprehensive foundation. This necessitates the development of a system which is liberal enough to incorporate and assimilate all the relevant streams of science and technology. With the increasingly proliferating knowledge base and the concomitant fading of barriers between scientific disciplines, education must know no barriers and the education system must be flexible and open to a continuous interdisciplinary exchange of knowledge, expertise and people. This is of particular importance for interdisciplinary sciences such as the pharmaceutical sciences.

Harkishan Singh informs us that pharmaceutical education in India is imparted through a vast network of 290 diploma institutions, 62 degree institutions and approximately 30 postgraduate programmes, with the objective of either qualifying registered pharmacists (diploma) or providing trained manpower to the pharmaceutical industry (degree). The role of hospital pharmacy and clinical pharmacy, both in the

curriculum as well as in practice, however, still remains to be defined.

While the diploma and degree institutions, both government and private, have flourished in India, the evolution and progress of postgraduate education has been painfully slow, hampered by lack of direction and national will. Singh narrates the events that finally led to the establishment of India's first National Institute for Pharmaceutical Education and Research, NIPER, at Mohali in Punjab, as late as 1993-94, even though the idea was mooted in the 1950s, when the All India Institute of Medical Sciences and the five Indian Institutes of Technology were set up.

Till date, despite the increasing demand for pharmacy graduates and pharmaceutical scientists, there appear to be no plans by the central government to set up other such institutes in the country. The state governments are strangely reticent on the subject as their portfolios and budgets permit a rather short-sighted view of postgraduate education, de-linked from research. It is ironic that only in case of the pharmaceutical sciences have the policy makers and educationists of this nation failed to recognize the relevance of a sound scientific research base as a pre-requisite for quality education, and this is despite a flourishing pharmaceutical industry in India and the increasing importance of pharmaceutical R&D both in India and abroad, in the era of globalization, with India a signatory to GATT and WTO.

The setting up of the B.V. Patel PERD Centre in 1991, in Ahmedabad, represents the first initiative of its kind by the pharmaceutical industry and a state government to establish a postgraduate research institute of excellence. However, without the continued financial support of the industry and recognition and support by the Centre, this maiden venture maybe starved and its growth and development hampered. Postgraduate research and education in the pharmaceutical sciences is clearly at a crossroad and awaits its rightful place on the national agenda.

Much of this and more is the subject of Singh's treatise on pharmaceutical education, as he traces the development of diploma, degree and postgraduate education and research since the introduction of pharmacy education in 1860 at the Medical College, Madras, culminating with the establishment of NIPER and

B.V. Patel PERD Centre in the early 1990s. The format of the book provides details of important landmarks and a chronological listing of events that led to the establishment of the major pharmacy degree and postgraduate institutes, with due recognition of the individuals who have contributed to the development of these educational institutes as well as played a role in delineating the policies that have influenced the course of pharmaceutical education. Singh has also highlighted the role of professional and statutory policy-making bodies, the Pharmacy Council of India (PCI), the All India Council of Technical Education (AICTE) and the various advisory committees which were set up by the Central Government, post-independence, to frame the health policies of the nation as well as the agenda for imparting technical education, to train manpower for industrial growth and development.

The most significant outcome of Singh's book is the issues that have emerged unresolved, which demand a solution from the educationists, the profession and national policy makers. These include: (a) the need to delineate two distinct paths of pharmaceutical education and training -- for registered pharmacists and hospital and clinical pharmacists, and for the pharmaceutical industry and pharmaceutical research; (b) the debate on whether diploma education is adequate or be replaced by a 4-year-degree course as a minimum qualification for registered pharmacists; (c) the ambiguous and inadequately defined roles of PCI and AICTE, the two bodies which control the quality of education imparted; (d) the necessity of carving a niche for the pharmaceutical sciences by establishing separate pharmacy faculties, instead of subjecting pharmaceutical education to a tug-of-war between the Education Commission in Health Sciences and AICTE, neither of which can adequately cater to the needs of pharmaceutical education with its multidisciplinary approach; (e) the importance of developing at least one model institution in each State, for providing courses of study in pharmacy, along the lines of IITs and IIMs; (f) strengthening of doctoral and postdoctoral research programmes; and (g) positioning pharmacy on the national health, science and technology agenda, in recognition of its importance in the national and international scenario.

Singh's book provides a timely opportunity for introspection as to how it all began, how far we have travelled and what needs to be done to chart the future course. It is hoped that this voice of experience will be paid heed to!

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The Refrigerator and the Universe: Understanding the Laws of Energy. Martin Goldstein and Inge F. Goldstein. Universities Press (India) Ltd. 1997. Reprinted by arrangement with Harvard University Press. 1993. 433 pp. Rs 225.

Two kinds of people reach for a book with this kind of title: the curious youngsters who are on the lookout for reading what is 'in' and the aged who need to find ways and means to enhance communication while teaching. It was written by those who had a need to teach. It caters much less to those with a need to practise, i.e., practise the application of thermodynamics to areas like biology wherein disappointment exceeds promises.

On the positive side, the book is written by those who perceived the need for learning thermodynamics for didactic reasons. The book attempts to convey a strong sense of history. Is the Napoleonic injunction (those who do not know history are condemned to repeat it!) relevant? The book deals with the laws of thermodynamics taking the historically relevant examples. Throughout the text, there has been a pointed effort to be simple, clear and helpful. Whether this helpful attitude is a result of having to teach or learn from courses in thermodynamics (which the authors apparently took) *while being in the army* is not clear. The worth of the book is primarily in three areas: its simple exposition of basic textbook stuff, its capacity to give a historical account, including bibliography, of a similar kind and thirdly its user-friendliness. It is basically an undergraduate book in

its content. It indicates that the authors are not particularly aware of or deliberately ignored (unlikely from the references they have otherwise given) the shortcomings of thermodynamics as seen in the recent decades. Perhaps, the glorious debacles on the application of thermodynamics, the unwritten text in this book, would have made better reading. On the other hand, if you want to know who was Carnot (we learn that he was named after a Persian poet who was popular in France at that time) or Mayer's heartburn over Joule, there are interesting things here. If you want to know the basic descriptions of the laws, information, entropy, etc., they are all there. The book is a compendium of standard reading material and touches thermodynamics in relation to chemistry, geology, cosmology among other things. If we are to go by what has been done in physics and biology, the description is general and to that extent superficial. I believe I have stated enough regarding the limitations of the book. The book is moderately priced and is worth acquiring as an excellent addition to undergraduate reading in physical sciences and even postgraduate students in other areas including biology.

However, I suggest some serious caution to the readers: while the ideas may be alright, it is worth double-checking the sources of the statements made in a book such as this since it attempts to paint a broad canvas. I was taken aback by the statement that myoglobin is the oxygen-binding protein from the blood (*sic*) of whales while haemoglobin is that from humans!!! This is when the clock strikes thirteen making us wonder about all that has transpired.

If I am to follow the editor's views on reviewing a book for *Current Science*, I must summarize, however briefly, what I would have liked to see here and why this approach turns me off, without in any way decrying the didactic value of the book. The major thing about thermodynamics (equilibrium thermodynamics is the major concern here barring a small reference to nonlinear dynamic systems and chaos) is that it is opaque to mechanism. This equilibrium thermodynamics has no variables with the dimension of time in it. It has a metatheoretic ambience in that it makes rules for others to follow. In itself, it offers consistency rather than proof. Obviously, since physics arrogates itself to be theory knowledge (Feyerabend

once mentioned to me that the reason is that the physical laws came from the brow of Zeus), thermodynamics has attempted, once upon a time (e.g. Lord Kelvin), to arrogate itself to a central position in physics. Those who fell for its charisma mistook the grammarian for the poet. That is about the only reason we can account for the preoccupation with the General Systems Theory of Van Bertalanffy followed by Laszlo and many others (Arthur Koestler at a more popular level). Open systems *per se* did not lead us far. This indeed was followed by Brussels school of dissipative structures. Predictivity remained elusive. Much reading has become indeed a weariness to flesh. Open systems in biology were attempted to be explained and even solved by formulations on irreversible thermodynamics, starting with Katchalsky followed by Kedem, Kaplan and others. Curiously the initial formulations themselves were wrong, leading to absurdities like vectorial cross-coefficients, which was pointed out by us in a paper in *Current Science* (Vaidhyanathan, V. S. and Sitaramam, V., *Curr. Sci.*, 1991, 62, 604-608). Response of the practitioners (of some 2-3 decades standing) in the West was interesting. A primary journal in which much of the initial work on irreversible thermodynamics was published did not wish to publish this fundamental error on the grounds that 'while the arguments (ours) are right, there is no urgency to publish this clarification'!

Logical positivism notwithstanding, much of the Western science is dominated by 'the King is dead, long live the king' syndrome... except that they themselves would prefer to remain the king-makers. The lesser mortals may not commit the effront of pointing out the errors. Much of the progress is also illusory based on over-elaborate 'straw man' hypotheses. Take the case of the so-called metabolic control theory. The situation is reminiscent of Catastrophe theory in the seventies which was applied to everything from reflections in a swimming pool to Vietnam wars and biology. It took Gina Bari Kolata to declare in *Science* in 1970s that it is much akin to Emperor's new clothes. Smell also did that among the more professional mathematicians. Why does this happen? Obviously it stems from academic greed. A grammarian may not usurp the position of the more utili-