'Footprints of ICMR's century-long journey' and provides an exhaustive chronicle of ICMR's efforts to combat communicable and non-communicable diseases, maternal & child health disorders and malnutrition and how they align to the Gandhian philosophy. For instance, the growth of ICMR-National Institute of Nutrition (NIN) and nutrition research in India is almost inseparable just as Mahatma's life and India's freedom movement are. The chapter on Gandhi's views on nutrition and balanced diets highlight that Mahatma was a keen researcher and he kept his constant search on for the perfect food for humankind to keep body, mind and soul in a sound condition, just as NIN through its 100 year-long odyssey has been endeavouring to find simple and practicable solutions to empower the nation nutritionally. Gandhiji used to have long conversation with NIN's founding Director Robert McCarrison. The interactions of these two giants lead a formidable exchange of lay views into research and vice-versa.

Preventive prescriptions of healthy environment and nutrition that Gandhi suggested hold good even today. Gandhiji urged for need-based rather than greed-based consumption. The idea of sustainable consumption to ensure sustainable development has become extremely vital today in the era of climate change and global warming. Gandhiji experimented on himself by trying out different foods, of plant origin. He believed in diversity and local self-sufficiency in food production. These indeed are what scientists are advocating today.

The last section 'Gandhi and Health: through medical student's perspective' gives the award winning essay of C. H. Shafneed on Gandhi and Health. The essay lists some of the present day efforts in India towards the Gandhian philosophy of health is wealth and its relevance for national development.

When Gandhi was assassinated in 1948, Jawaharlal Nehru bemoaned that light had gone off. 'He showed us the path of truth, non-violence, commitment and serving the humanity with eco-friendly and community acceptable approaches'. The Gandhian way of leading a simple life by eating minimal and healthy food, exercising regularly, practicing meditation and cleanliness are indeed the saviours of the nation heading toward the modern-age health debacle. In conclusion, this edition of *IJMR* is an honest compilation of Gandhi's views, practices, beliefs and experiments in health.

We have all lost and found Gandhi in many ways. We may have our own views on Gandhian philosophy – some concurring and the others differing with his. Whatever be our view, to support or contradict his philosophy one needs to know what he thought, felt and did. This book provides that necessary information and insights into Gandhi's views on health and therefore makes it a must read for all those who want to harness their scientific temper. And no better occasion to do so than his 150th birth anniversary.

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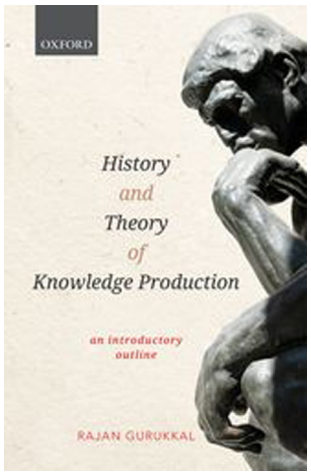

History and Theory of Knowledge Production. An Introductory Outline. Rajan Gurukkal. Oxford University Press, 2/11, Ground Floor, Ansari Road, Daryaganj, New Delhi 110 002. 2019. x + 308 pages. Price: Rs 995.

Books reviewed in *Current Science* are usually authored or edited by scientists. The book presently under review is written by Rajan Gurukkal, an eminent historian, thinker and educationist. The book is, however, rich in scientific content. Gurukkal is no stranger to the Indian scientific community. He has been involved with the *Indian Journal of History of Science* published by the Indian National Science Academy. Furthermore, he has been a Visiting Professor at the Centre for Contemporary Studies at the Indian Institute of Science, in between his assignments as Vice-Chancellor of Mahatma Gandhi University, Kottayam and the Chairman of the Kerala Higher Education Council. Much of the book was written when Gurukkal was working in the Indian Institute of Science. Central to the narrative in the book is the history of production of scientific knowledge. Of course, the book contains much else. The book has been written with intimidating thoroughness and contains material well beyond my immediate area of competence. Therefore, it was with some trepidation that I undertook the review of the book. However, I strongly felt that this splendid book should be brought to the attention of the Indian scientific community. That is the main motivation for the present attempt.

The book contains seven chapters. The first is entitled 'Introduction' and the last 'Summing up'. The gist of the discussion in the entire book can be gleaned from these two chapters. However, that should not discourage a serious reader from carefully reading the chapters in between which provide an intellectual fare of high quality.

The approach adopted by the author in studying the history and theory of knowledge production, is enunciated in the second chapter. Knowledge production is as old as humankind itself and has involved complex and multifarious processes. The method followed by the author is historical, with special emphasis on historical materialism. Knowledge production is intimately related to social formation. Social theory of knowledge evolved over centuries. However, the author asserts that 'Marx's theory of social formation is the most comprehensive framework for analysing as well as interpreting the nature, position and function of knowledge in relation to the socio-economic aggregate in time and space.' Many, including myself, believe that the status of Marxism in social sciences is akin to that of Darwinism in biology. In

addition to being a theory, Marxism is also a call for action. Over more than a century, Darwinism has been enriched and developed by a very large number of scientists. The development of Marxism was impaired to a substantial extent on account of its becoming the official ideology of the establishment in a number of countries for a period spanning several decades. Marxism is also often perceived as the exclusive preserve of some leftist political parties, which is not true. The relevance of Marxism transcends governments and political parties. Although not as extensively as in the case of Darwinism, there have been attempts to further develop Marxism. The author takes into account these attempts as well. Due importance is given to contributions outside the ambit of Marxism also. Thus, social theory on knowledge production is treated in a comprehensive manner. The author explains how science and technology got a boost under capitalism as a means for fulfilling enhancing human requirements. Knowledge then gets commodified as evidenced, for instance, by the patent regime.

The development of knowledge systems in the East and in Europe is dealt with in the book. Understandably, the Indian scenario receives special attention. The narrative, starting from the Stone Age, goes on to the Age of metallurgy and beyond. The technology of other crafts during that period has also been dealt with. The importance of Vedic knowledge is emphasized. In the Indian knowledge tradition, 'Vedic knowledge is self-evident, unquestionable and foundational, defying epistemological scrutiny'. The author goes on to refer to Vedangas and Upanishads which involve abstract knowledge. The beginning of the materialistic strand of Indian thought is also referred to. The amazing perfection of Sanskrit and Panini's grammar is clearly brought out. Mention is made of the Jain and Buddhist knowledge traditions. Vedic mathematics and early astronomy are also referred to.

Starting with Vedic times, the author takes us through the entire course of knowledge production in India and the development of different strands of Indian thought. The six systems of thought or Darsanas are dealt with in some detail. The development of science and technology form an important component of the narrative. Ayurveda, Vastu-vidya or architecture, metallurgy, irrigation technology, mathematics and astronomy are all dealt with in adequate detail. The author gives a clear picture as to how knowledge systems developed in India. The sociology of production and dissemination of knowledge is also described. The magnificence of Indian discoveries, particularly in mathematics and astronomy, is clearly brought out. The narrative of knowledge production in India takes us up to the efforts of scholars of Kerala during the fourteenth to the seventeenth centuries. The transmission of knowledge produced in India to different parts of the world also receives the attention of the author.

As part of the knowledge production of non-European origin, the history of the evolution of knowledge systems in China is also briefly touched upon. The works of Confucius and Lao-Tzu are discussed in the historical context. The technological contributions that emanated from ancient China have been noteworthy. Chinese metaphysics and cosmology have been critically examined. It is pointed out that perhaps the only major external influence on Chinese thought was that from India in the form of Buddhism. Most of the pre-modern Chinese knowledge was more technological and practical than theoretical.

Relics of archaic knowledge production going back to tens of thousands of years exist in the European region. However, the quest for European roots of knowledge production naturally leads to Greece. The splendor of Greek civilization is outlined by the author. The great advances made by the Greeks in science and philosophy are also chronicled. According to the author, 'In the history of knowledge, it is the ancient and early Greek phase that marks the first unprecedented intellectual explosion, thanks to the strange phenomenal rise of a series of philosophers with rare erudition and ingenuity.' The glorious age of ancient Greek and Roman civilizations eventually came to an end during a period starting from the third century CE, partly consequent to various invasions including those of Arabs and Persians. Europe then entered into what is described as the Dark ages. The role of Arabs in preserving and enriching Greek knowledge and handing it back to Europe is well known.

In parallel, great civilizations flourished in Egypt and West Asia. The fascinating story of production and acquisition of knowledge in these regions is summarized in the book. West Asia served as a conduit for transmission of knowledge between the East and the West. In addition, the intellectual contribution of the Arabs has been remarkable.

As a working scientist, I read the chapter on 'The Rise of Science' with utmost interest. One cannot but be impressed by the thoroughness with which the author has chronicled the development of modern science in the West. The information density of the chapter is so high that it is impossible to summarize the contents. All the great scientists and important developments of modern science have been touched upon. In ancient times, scientists were called philosophers. Subsequently, they came to be called as natural philosophers. By the nineteenth century, the term scientist gained currency. By then, the methodology of science also got well established. Inevitably, Newton receives the pride of place in the narrative. The revolutionary impact of Darwinism is highlighted. Equal, if not higher, importance is given to Marxism. The rise of great universities and professorial societies has been chronicled. The glorious period of deterministic classical science spanning the seventeenth, eighteenth and the nineteenth centuries, also witnessed great technological advances and inventions. At every stage of the narrative, care has been taken to emphasize the societal underpinnings of the production of knowledge.

The penultimate chapter, which precedes 'Summing up' which has already been referred to, is entitled 'Science of Uncertainty'. This title encompasses only part of the material presented in the chapter which is rich in information content. The term uncertainty is often used in the context of quantum phenomena. Uncertainty is built into the theoretical framework of quantum mechanics. However, the theory predicts results which can be verified with certainty. Einstein's theory of relativity also receives adequate attention. The predictions of the theory are being continuously verified with great precision. Biology offers instances of certainties and uncertainties. The greatest unsolved question is whether life came into existence by chance or necessity. The author explains how the history of science, philosophy of science, science communication, societal relevance of science, etc., developed into semi-autonomous disciplines. The conduct and

utilization of science underwent a sea-change in the twentieth century, particularly during and after the Second World War. Science now involves large organizations, huge funds and mega projects. Much of science is in the firm grip of governments and corporates. Commodification of science has also progressed apace. The author dwells on the negative consequences of the globalized techno-capitalism. However, the intellectual excitement of pursuing science shines through the entire narrative.

The final chapter briefly recapitulates the material presented in the previous chapters. The concluding thoughts of the author are summarized in a section called 'Afterword'. They do not easily lend themselves to critical scrutiny. They are, of course, naturally in consonance with the narrative in the body of the book.

The book provides a panoramic view of the theory and history of knowledge production from antiquity to the present day, with Science at the centre stage. The study of the book has enriched me. I recommend the book to working scientists and others who are engaged in intellectual pursuits.

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Annual Review of Biophysics, 2018. Ken A. Dill (ed.). Annual Reviews, 4139 El Camino Way, PO Box 10139, Palo Alto, California 94303-0139, USA. Vol. 47, vii + 677 pages. Price: US$ 112.

The *Annual Review of Biophysics 2018*, edited by Ken Dill of Stony Brook University, is part of a series published every year since 1972. Each volume in the series combines reviews of those developments in biophysics that have attracted attention in the recent past. The only requirement placed on the contributions, apart from the fact that they should be reasonably current, is that they must represent areas where physics and biology speak to each other. At 677 pages this year, the hard-back version of this book is weighty in every sense of the word.

This year's reviews, 30 of them, cover much ground. Some themes are common to more than one article. These include the structural basis for GPCR signalling, the structure and biophysical aspects of membrane proteins, regulation across multiple scales and mechanobiology. There is something here to satisfy biophysicists of every stripe.

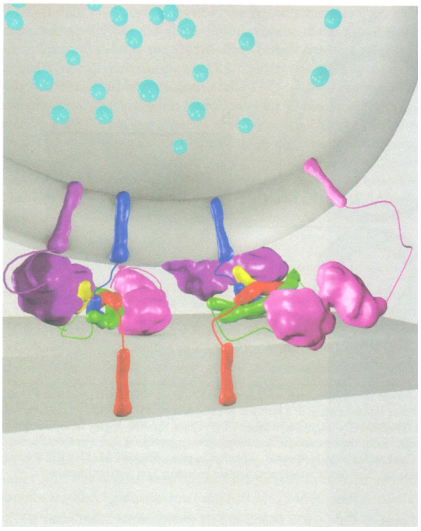
Some of these topics represent scientific directions that have remained largely the same over the past decade or more. What usually changes from year to year are advances marked by the introduction of novel tools, analysis methodologies and, occasionally, the flash of exceptional insight that upends a field. In this review, I will try to isolate those broader trends that appear to motivate a reasonable fraction of the biophysical community at this point in time, as manifest in the contributions to this volume.

Erlandson *et al.* describe recent advances in the understanding of how GPCR conformation switching underlies the activation of effector proteins. Such allostery appears to be pervasive. Stauch and Cherezov study the ultra-fast dynamics of GPCRs using X-ray free-electron lasers. Wand and Sharp study questions of the thermodynamic landscape governing protein–ligand interactions. Theory and simulations suggest that solution NMR relaxation measurements should yield a dynamical proxy for changes in conformational entropy upon ligand binding.

Newer microscopies, as usual, provide fresh insights into structure. Hashem and Frank review the structural biology of the eukaryotic translation initiation process, focusing on X-ray and cryo-EM methods. Wilkinson *et al.* summarize achievements in using cryo-EM to study the structures of spliceosomes captured in different assembly and catalytic states. Mandala *et al.* describe solid-state NMR measurements of membrane proteins, elucidating the role of the protonation state of polar residues in determining structure and function as well as the importance of structural plasticity in cases where membrane remodelling happens. Kiselar and Chance provide a review of assessment of proteins structure through the technology of hydroxyl radical footprinting (HRF) of proteins with mass spectrometry (MS). Smith and collaborators review the use of dynamical neutron scattering techniques to examine vibrations in proteins, the temperature dependence of protein motions, as well as new concepts that emerge from these studies.

The organization of cell membranes, of membrane-bound proteins and of membrane–membrane interactions are dealt with in multiple articles. Betune and Wielend describe the current state of knowledge of the organization of coat proteins, including the COPI and COPII coats, using cryo-EM. McLean *et al.* note that many complex multi-protein assemblies involved in cellular communication require an integral membrane protein and a membrane surface for assembly as well as for information transfer to soluble partners in a signalling cascade. Incorporating these protein components into nanodiscs provides a native bilayer environment with a precisely controlled composition of lipids, cholesterol and other components. Boonstra and collaborators describe biophysical studies of influenza haemagglutinin (HA) mediated membrane fusion. HA mediates binding of the virus particle to the host–cell membrane, also catalysing the fusion of the viral membrane with that of the host. These authors provide a thorough biophysical description of the membrane fusion process, describing our current understanding of how HA conformation changes and their membrane interactions might together lower barriers between fusion intermediates.

Axel Brunger and colleagues summarize the current knowledge of synaptic proteins central to synaptic vesicle fusion in presynaptic active zones, including



Model of primed prefusion SNARE/Cpx1/Syt1 complexes. Article by Brunger *et al.* on p. 469.