Meandering in Medical Physics – A Personal Account of Hospital Physics. J. E. Roberts. Institute of Physics Publishing, Dirac House, Temple Back, Bristol BS1, 6BE, UK. 1999. 181 pp. Price: £ 40.00/US $ 65.00.

Discoveries in the physical sciences, with their associated technological growth, have brought about a very substantial transformation in medical and clinical practice the world over. In the last six decades, the rapidly burgeoning use of sophisticated hospital equipment, often based and developed on a fundamental principle of physics such as radioactivity or the interaction of X-rays with matter, has led to the inevitable creation and eventual spread of a specialist category called the 'Medical Physicist'. Between the mid-30s and the mid-50s, in particular, the profession of medical physics had an interesting phase of initial teething and subsequent healthy growth. Described as a 'Hospital Physicist' in those days, this professional had to work hard and carry out a bewildering variety of technical jobs ranging from radiation dosimetry – the *sine qua non* of all radiotherapeutic work of that time – to retrieving truant radium needles from hospital drains.

John Eric Roberts' *Meandering in Medical Physics*, published posthumously under the 'History of Science' series by the Institute of Physics, chronicles the varied personal reminiscences of an eminent nonagenarian physicist who is considered to be the father of medical physics as we know the discipline today. Plunged thrillingly back into the hospital activities of the pre-war and early post-war eras, the reader of this book experiences the distinct feeling of standing right close to the horse's mouth, and the experience is further enriched by several anecdotal passages which have been narrated in an informal style with a typically understated British sense of humour.

The first one-third of the book documents the author's own pioneering contributions to X-ray dosimetric techniques at the Cancer Hospital (Free) in London during the war years of 1939 to 1945. The succeeding chapters not only document various milestones in his illustrious career at London's Middlesex Hospital Medical School where he became Joel Professor of Physics in 1946, but also the rapid compulsions on the medical physicist of the day to adapt newer inventions and technologies to hospital services. Of particular interest are some of Roberts' own contributions to home-made laboratory equipment (e.g. gassing of mercury breakers in X-ray induction coils) in the years preceding the use of commercialized high-voltage hospital X-ray machines. Following the end of World War II and the Manhattan Project in the US, when experimental nuclear reactors came into being, radioactive isotopes such as ^{131}I were produced for use in medicine. This, and the advent of the electron synchrotron in several physical laboratories of the time, spelt out newer exercises in adaptation and self-improvization amongst medical physicists, eventually resulting in the birth of 'Nuclear Medicine' department in hospitals.

The latter half of the book reads more like a travelogue detailing the author's globe-trottings and lecture tours, and is made up entirely of little anecdotal meanderings such as his maiden trans-Atlantic sailing in the 'steerage' class of the *Queen Mary*, and the disarmingly sweet reminiscence about the invited lecture at the Royal Institution where, according to tradition prevailing since Michael Faraday's time, the author was locked up in the anteroom for fifteen minutes to settle his nerves prior to being led to the theatre for his lecture. Although one hears commonly enough about captive audiences, this is perhaps the first chronicled instance of a captive lecturer!

Overall, the author nostalgically recalls an era in British medical history where the disciplines of physics, medicine and clinical radiology came together to forge a strong and serviceable link in hospitals. There is, too, an occasional note of implied sadness in Roberts' meanderings. He bemoans, for instance, the lack of a proper medical physics curriculum in the early days which necessitated the growth of the DIY (do-it-yourself) medical physicist. This would perhaps still hold true in today's fast-changing medical care environment, where the diagnostic and therapeutic activities of the older era are rapidly becoming *passé* and newer imaging modalities such as CT and MRI have taken over and themes such as 'virtual reality' and 'telesurgery' are already making inroads. Indeed, were he alive today, Roberts would exhort the medical physicist of the new millennium to get adapted to the workings of the computer scientist, the information technologist and the teleradiologist.

Produced as a handy hard-cover volume, and containing some really rare photo reproductions such as a vintage 400 kV X-ray machine (p. 19) and the 'Clucking Hen' Radiation Detector Unit (p. 31), this highly readable book will be of immense archival value in medical physics and medical school libraries.

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Imagined Worlds. Freeman Dyson. Universities Press (India) Ltd., 3-5-819, Hyderguda, Hyderabad 500 029, India. 1999. 216 pp. Price: Rs. 160.

This book has emerged from a set of lectures given in May 1995 at the Hebrew University of Jerusalem. As is the case when delivered lectures become written texts, the Baconian prescription of readiness of conference and the exactness of writing is given to this 'voice of science' that records the journey into the future.

Freeman Dyson is singularly equipped to write on the modern Promethean concerns of science, technology, evolution and ethics. One of the pioneers contributing to the fundamental understanding of quantum electrodynamics, he has in a distinguished life, also worked over an astonishing spectrum of scientific studies: operations research, nuclear design, rocket propulsion and space colonization. He is a scientist who writes and a writer who did science, and as writer, he made an indelible mark in science fiction, which he calls the 'landscape of my dreams.'

Dyson agonises over a modern world that has grown increasingly short-sighted and unpredictable, and sees only two voices, science and religion, that could speak for the future. He sees two forces ranged against each other, in a battle for the modern mind, the backward-looking conservationist agenda, and the short

horizons of the champions of the free-market economies. Neither side looks to the future or is willing 'to sacrifice the present for the sake of the future'. The introductory essay is therefore a brief for the voice of science but points out that only ethical considerations can temper the short-sighted, self-interested course of science and technology, and it is here that the voice of religion representing social justice and ethical considerations must be added to the voice of science.

Dyson prefers to use case studies and science fiction (or, dramatized novelistic accounts) to imagine the future. As an aeronautical engineer, I found his use of aeronautical history particularly appealing. What began as an hobby in a small-is-beautiful Tolstoyan way, soon evolved into a technology and became a vast industry and economy. The important lesson is that repeated failure is the only guarantee for success; 'out of a 100,000 types of airplanes, about a 100 survive to form the basis of modern aviation.' The evolution of all technology is supervised by a relentless Darwinian process of elimination and selection. Here is a warning for the Grand Designer, who is ideologically driven to believe in a big-is-best Napoleonic conceit, that to short-circuit the evolutionary learning process is to invite colossal disaster. The R101 airship project and the Comet jetliner serve as signal examples of the tragedy that can ensue. This is a lesson I see for many of our own Grand Designers, blinded by national pride, who promote ideologically driven technologies, believing that we can succeed where we have not failed enough. Technologies should be driven by pragmatism and not ideology. The best technology is the one that 'brightens the lives of individual people.' Dyson quotes three examples of 'joyful technology' over a span of three generations – the motorcycle for his father, the nuclear fission reactor for himself and the CAD–CAM technology, that his son took very gladly to.

Dyson recalls that it has been a hundred years since H. G. Wells' *The Time Machine* projected a dismal future if the gross inequalities and injustices of society had been allowed to continue. 'The main cause of economic tensions today is the unequal distribution of wealth and skill between the rich and poor countries and between the rich and poor segments of society,' observes Dyson. For the fifty years of Wells' working life, these social injustices were ameliorated, but in the fifty years since his death, these inequalities have again sharpened, often a result of accelerating technological changes.

How science goes about performing its tasks is the subject of an entire chapter. Dyson emphasizes that science can be concept-driven (explaining old things in new ways) or tool-driven (discovering new things that need to be explained). Styles also vary – rigid, organized and disciplined in the Napoleonic fashion, or creative, chaotic and free after a Tolstoyan manner. Future science will require one or a judicious mix of both styles to be employed. Dyson predicts that the dominant science of the next century will be biology, and here, two branches, genetics and neurophysiology, will pose the greatest challenges.

To understand technology, Dyson takes us from Wells to another visionary, J. B. S. Haldane. Haldane uses the myth of Daedalus, in an eponymously named book, to paint again, a skeptical scenario. Science, without ethical concern, will bring confusion and misery. It is as if the scientist is predestined to turn good into evil. The same keys will open the gates of Heaven or Hell. When not leading to war, technology in peace, relentlessly widens the gulf between the rich and the poor. This is inevitable, as science, driven only by market forces, will produce goods (toys) and services (games and leisure) that only the rich can afford. Already in the last decade of this century we see this everywhere. Dyson sees genetic engineering and computer technology as having the potential to turn the world upside down. Genetic engineering could lead to neurotechnology, where the human brain can be explored or manipulated, and to radiotelepathy, where information can be transferred from the brain to another using radio signals.

'The best way to predict the future of human society is to study the past,' concludes Dyson. The chapter entitled 'Evolution' undertakes distant views into the past and the future of human society on time scales up to millions of years. Dyson's prediction is that intelligence and life will mutate in ways unpredictable, but will live forever and inhabit distant worlds. New technologies such as space colonization, computer-assisted selection and reproduction, may be dangerous as well as liberating. Ethics would play a crucial role here in sifting good technology from bad. As a humane and liberal philosopher, Dyson shows how a moral order is very important. He endorses Samuel Gompers, a pioneer of the Labour Movement in the US whose platform was for 'more school houses, books, learning, leisure and justice' and fewer 'jails, guns,' and less 'vice, greed and revenge.' Is anyone listening out there?

As an activist for nuclear disarmament, Dyson echoes George Kennan's warning that 'Nuclear weapons remain the most serious danger to mankind and the most serious insult to God'. Dyson, prematurely concludes, 'The evil face of science was personified by the nuclear bomb designer. Now, quietly and unexpectedly, the bombs have faded from our view.' And that the nuclear arms race is over. Our own sub-continental Grand Designers have thought otherwise.

Unhesitatingly, I regard this slim volume as one of the most illuminating accounts I have read; perhaps very fittingly the book to close the century with and imagine hopefully to the next.

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Vedic Sarasvati: Evolutionary History of a Lost River of North-western India. B. P. Radhakrishna and S. S. Merh (eds). Memoir 42, The Geological Society of India, P.B. 1922, Gavipuram P.O., Bangalore 560 019. 1999. 329 pp. Price Rs 500/US $ 50.

This book is one of the latest publications of the Geological Society of India. True to its title, the book centres around the great mythical river Sarasvati, which is now lost in the sands of the Thar desert. Bulk of the papers included in this multi-authored volume were presented at a seminar held at M.S. University of Baroda in December 1977, organized by the Geological Society of India on 'Drainage evolution of north-western India with particular reference to the lost Sarasvati'. The title of the book, therefore, suggests a clear shift in focus from a basically geomorphologic theme to a more fasci-