

**Einstein and Religion.** Max Jammer. Princeton University Press, 41, William Street, Princeton, New Jersey 08540, USA. 1999. 279 pp. Price: US\$ 22.95.

'God does not play dice.' 'Science without religion is lame and religion without science is blind.' These are two statements of Einstein which have attracted the attention of scientists as well as others, because of the reference in them of god, science and religion. Everyone would like to know what precisely were the views of the great physicist and Nobel laureate on these and the inter-relationships between them. Max Jammer's book essentially deals with these very questions and puts Einstein's views in their proper perspective. Considerable authenticity is provided by the fact that Max Jammer is a physicist himself and a student and a collaborator of Einstein.

The book has three chapters. The first entitled 'Einstein's Religiousity and Role of Religion in His Private Life' starts out with a biographical sketch of Einstein's childhood and schooling in a Catholic public primary school with additional training in Judaism by a private tutor. Einstein's ardent attachment as a boy to nature and music, violin in particular, as well as the strong resentment he developed by the age of 12 against the stories of the *Bible* after reading popular books on science, and Ludwiig Buchener's *Kraft and Stoff* and Kant's *Kritik der Reinen Vernunft* and several books on mathematics, are portrayed in detail to provide a background for an understanding of his later reactions and convictions. Einstein refused to have the bar mitzvah ceremony – the Jewish Confirmation Ceremony. In his whole life he never attended a religious service, or prayed in a synagogue. Nevertheless, Einstein was religious. In reply to a query by Alfred Kerr in Berlin on 14 February 1927 whether Einstein was deeply religious, he had replied 'yes, you can call it that. Try and penetrate with our limited means the secrets of nature, you will find that behind all discernible concatenations there remains something subtle, intangible and inexplicable. Veneration for this force beyond anything that we can comprehend is my religion. To that extent, I am in point of fact religious.'

Max Jammer highlights the influence of the philosophy of Spinoza, the 17th

century Jewish philosopher on Einstein. Spinoza rejected the traditional concept of god, denied the existence of a cosmic purpose, believed in strict causality for all events and a mechanical or mathematical order that governed the universe, not according to purposeful or moral intentions. While Einstein fully agreed with Spinoza, what impressed him most was the idea of an all-pervasive determinism in Spinoza's philosophy, and also the strong belief in the existence of a super-intelligence that was revealed in the harmony and beauty of nature. This unrestricted determinism, according to Einstein did not admit 'a god who rewards and punishes the objects of his creation'. Like Spinoza, Einstein too emphatically denied the existence of a personal god. For Einstein music was an expression of religious feeling. Often while playing on the violin, he found the solution to a scientific problem that intrigued him for sometime. Jammer reproduces the fascinating report by Einstein's wife Elsa on Einstein's isolation, and intense concentration during the weeks of his work on the general theory of relativity with only occasional breaks to play on the violin. Even food had to be sent to his room in the upper storey of his building.

The second chapter entitled 'Einstein's Philosophy of Religion', provides more insight into the writings of Einstein on this topic and the controversies they created among the clergy and the bishops of America. In the essay with the title 'Religion and Science' published in the *New York Times* of 9 November 1930, Einstein spelt out his concept of 'Cosmic Religious Feeling' as: 'the emotional state that one experiences when one recognizes the futility of human desires and the sublimity and marvellous order which reveals itself both in nature and thought'. Jammer emphasizes, 'this one order in nature and thought underlies Einstein's epistemological realism, his belief that a rational explanation of the universe is possible, his belief in the mysterious comprehensibility of the world'.

Einstein's opposition to the concept of a personal god did not go well with many. The most strongly worded letter came from the founder of the Calvary Tabernacle Association in Oklahoma City, who wrote 'Professor Einstein, I believe that every Christian in America will answer you. We will not give up our own belief

in our God and His son Jesus... take your crazy fallacious theory of evolution and go back to Germany where you came from or stop trying to break down the faith of a people who gave you a welcome when you were forced to flee from your native land'. There are many such angry responses.

To clarify the statement 'Science without Religion is lame and Religion without Science is blind', the author reproduces the answer that Einstein gave to his long-time friend Solovine '... what we call Science has the sole purpose of determining *what is*. The determining of *what ought to be* is unrelated to it and cannot be accomplished methodically. Science can only arrange ethical propositions logically and furnish the means for the realization of ethical aims, but the determination of aims is beyond its scope. At least that is the way I see it'.

The differences and also partial agreements in the views of Einstein and Tagore on the question whether truth like beauty is independent of human beings, are also given the necessary coverage in the book.

The third and final chapter is concerned with the influence of Einstein's relativity theories on theology as a discipline. In this connection, the author goes quite a bit out of Einstein's own work and traces the historical connection between scientific theories and the ideas of god and religion starting from the time of Newton. The drastic changes in the ideas of space, time causality, simultaneity brought about by the relativity theories and the consequences on theological theories are discussed in great detail. Jammer also discusses the cosmological consequences of Einstein's famous energy-mass equivalence relation ( $E = mc^2$ ) and its bearing on the 'Creatio ex nihilo' hypothesis. The implications of the field concepts of the theory of relativity to theological theories, in particular the ideas of the physicist Sachs, are presented. Jammer then brings in the issue of the displeasure of Einstein with the statistical interpretation of quantum mechanics as evident from the statements of Einstein, 'The more success quantum theory has, the sillier it looks', made in 1912 and 'Quantum mechanics is very worthy of regard; but an inner voice tells me that it is not the true Jacob. The theory yields much, but it hardly brings us close to the secrets of the old one. In any case I am convinced 'He does not play dice'. The

latter was in a letter written to Max Born in 1926. While Bohr maintained that 'it is wrong to think that the task of physics is to find out how nature is. Physics concerns what we can say about nature'. In contrast, Einstein held the view that 'physics is an attempt to grasp reality as it is thought, independently of its being observed'. Jammer also discusses in sufficient detail the Einstein-Podolsky-Rosen Paradox – the locality principle according to which 'the properties of one system cannot be affected by what is done to another system in space-like separation from the former', the experimental support by Alain Aspect to the non-locality predictions of quantum mechanics, etc., David Bohm's ideas of implicate order, all of which have profound philosophical significance. In this context, Jammer quotes appropriately from G. S. Stent's article 'Does God Play Dice?' in *The Sciences* 19 March 1979. What is significant is that unlike Einstein, Bohr did not regard the world as an objective reality.

Jammer in the end proceeds to an extensive discussion of the influence of Einstein's work on cosmology, in raising the status of the field from a jumble of mythical speculations to a respectful scientific discipline. The question of the origin of the universe could at least be scientifically addressed. The big bang theory, the discovery of the microwave radiation, the crucial contributions of Penrose and Hawking are all discussed in sufficient detail.

The book is eminently readable by specialists as well as by non-specialists. It is replete with quotations from Einstein and from many of his colleagues and critics. Very extensive references to all topics covered are available. Definitely the book throws a lot of new light on Einstein's personality as well as on his views on many issues of general interest and dispels many of the wrong views on Einstein.

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**Medicine's 10 Greatest Discoveries.** M. Friedman and G. W. Friedland. Universities Press (India) Limited, 3-5-819, Hyderguda, Hyderabad 500 029, India. 1999. 263 pp. Price: Rs 200.

The history of medicine is, inexplicably not taught in medical colleges in India. There are also not many medical teachers to whom an eager student can turn to for guidance on the subject. It is no wonder that medical graduates who are familiar with great names in medical history are small in number.

This book by Friedman and Friedland will satisfy the need of those who need an introduction to the history of medicine. It is also an excellent commentary on how a discovery evolves from a previous one. What makes the book distinct among texts of medical history is the narrative style. Instead of a chronological record of events, the authors engage the readers with a weave of excitement of discoveries and candid portrayal of the personae of the pioneers.

The authors have chosen the ten discoveries carefully. Initially the authors selected hundred most significant ones from more than 5000 discoveries and then focused on twenty five. Three dealers of rare medical books and four physicians who are zealous gatherers of exceptional medical publications vetted the list of the finally picked up ten discoveries. Some of the living scientists who played major roles in the achievements were also interviewed for seeking historical facts. The milestones thus singled out are renowned ones. They include description of the human anatomy, explanation of the concept of circulation of blood, origin of the germ theory of diseases, initiation of vaccination, introduction of anesthesia, discovery of X-rays, finding methods to grow cells in culture, recognition of the antibiotic nature of penicillin, realization of the harmful nature of cholesterol and determination of the structure of deoxyribonucleic acid. What is not so well known are the names of the heroes responsible for some of the above mentioned discoveries. Authors found to their dismay that none of the physicians who taught at either Stanford University or at University of California Medical School was aware of Ross Harrison who pioneered the tissue culture technique. They also did not recollect Nikolai Anichkov who

demonstrated the link between atherosclerosis and cholesterol and Maurice Wilkins who shared the Nobel Prize with Watson and Crick. Many also did not recognize Antony Leeuwenhoek and his discovery of the microscopic world of living organisms or connect Crawford Long with the initial use of anesthesia for surgical purposes. Presidents of John Hopkins and Yale Universities where Ross Harrison worked, were unable to recall who Harrison was. So much is our concern for our illustrious predecessors!

Each of the ten chapters in the book contains descriptions of the background of the awesome discoveries. The chapters also have details of important experiments. There are vivid descriptions of the experiments by which Harvey demonstrated that valves in the veins permit blood to flow only in one direction to the heart, how Pasteur demolished the concept that living matter 'sprang' from non-living matter, and the experiments that led to the discovery of the relationship between cholesterol and atherosclerosis. Not only are the initial discoveries detailed, but subsequent related breakthroughs are also rendered. The biographical sketches of the scientists do provide insights into their tensions, disappointments and frailties. One also gets to know the bitter animosity and hostile exchanges among some of the great men. Robert Koch was critical of Pasteur's impatient hastiness in announcing the anthrax vaccine. He wrote: 'Such goings on are perhaps suitable for the advertising of a business house, but science should reject them vigorously'. Koch, however, a few years later in introducing tuberculin moved on in the same way as Pasteur did earlier. The dramatic events connected with the discovery of DNA are retold with candour. There is an extensive verbatim account of an interview with Raymond Gosling on the Franklin-Wilkins conflict.

There are fourteen black and white pictures. The third skeletal drawing in Vesalius's *Fabrica*, the only illustration in Harvey's book *De motu cordis*, a drawing of the cowpox pustules on the hand of a milkmaid, taken from Edward Jenner's book and a photograph of Nikolai Anichkov are some of them. These are rarely seen elsewhere.

Several hitherto unknown facts are available in the book. The role of chance in Roentgen's discovery of X-rays and Fleming's recognition of antibacterial