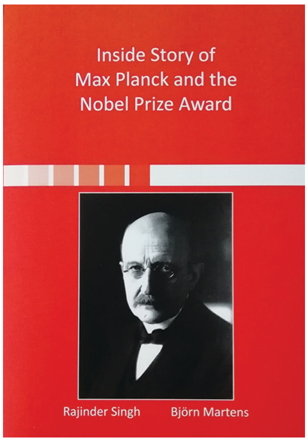

Inside Story of Max Planck and the Nobel Prize Award. Rajinder Singh and Björn Martens. Shaker Publisher, Germany. 2023. xiv + 94 pages. Price: 21.90 Euro.

Rajinder Singh, one of the authors of this book, is a well-known historian of science with 41 books to his credit, while his co-author Björn Martens is a new entrant in this field. They write in the Preface to this book: 'The Nobel Prize is a most coveted and one of the best-known honours in the world. However, the fact is, only Europeans and later Americans played/play major role in the "game" of the Prize.'

S. C. Roy (Ex-Editor-in-Chief Science & Culture, Kolkata) writes in his Foreword: 'It was through his research in thermodynamics, the science of heat, that the German physicist Max Planck discovered the quantum principle – that energy is emitted not as a continuum but in discrete units or quanta. Planck announced his theory on 14 December 1900, at a meeting of the German Physical Society in Berlin'. He writes further about Rajinder Singh: 'Rajinder, as I understand, has two areas of special interest: a) writing biographies, especially of Indian physicists who had done exceptional research but are not much known to the scientific community, b) on Nobel Prize nominations and their nominators with intricate analysis of the report of the experts and the Nobel Committee.'

In the Introduction, the authors write: 'In some circles he (Max Planck) is considered as the founder of the quantum theory (better known as "old quantum theory"), as he gave the concept of the energy quantum. In 1919, he was awarded the Physics Nobel Prize for the year 1918, "in recognition of the services he rendered to the advancement of Physics by his discovery of energy quanta".'

Chapter 1 describes Planck's landmark achievements in science education and research: 'After passing high school examination, Planck, who was considered hard-working and talented, was enrolled at the University of Munich to study mathematics and natural sciences. He was tutored by the well-known mathematicians, Gustav Bauer and Ludwig Seidel, for three years. He learnt physics from eminent Professors of his time, such as Hermann von Helmholtz and Gustav Kirchoff in Berlin University. He got his Doctorate from Munich University in 1879 for his work on thermodynamics. At the age of 22, in 1880, he received "habilitation" (this degree qualifies a person to become a professor in German Universities).'

Planck played a dubious role in supporting the agenda of the Nazis as early as 14 July 1933. He assured the Nazi Internal Minister Wilhelm Frick 'that the Kaiser Wilhelm Society for the Advancement of Science, of which Planck was President, is willing to systematically serve the Reich with regard to racial hygiene research'. Despite his support, he suffered humiliation after the arrest and execution of his son Erwin Planck, who was involved in the Adolf Hitler's assassination attempt on 20 July 1944.

Chapter 2 describes the nominations of Max Planck for the Nobel Prize during 1907 and 1908 for his research leading to Planck's radiation law. The authors write about Planck's recommendation for the Nobel Prize by the Nobel Committee: 'After discussing the cases of W. Wien and M. Planck, the Nobel Committee decided for an unshared Nobel Prize for the latter. A part of the Nobel Committee report contains S. Arrhenius's report, in which he had argued in favour of Planck. S. Arrhenius considered Planck's achievement of more importance than that of W. Wien.' Despite positive recommendation of the Nobel Committee, Planck lost in the race to win the Nobel Prize to G. Lipmann in 1908, who was the ultimate choice of the Royal Swedish Academy of Sciences, the final authority to award the Nobel Prize.

Chapter 3 revolves around Planck's idea of quantum theory. The first Solvay Conference was held in 1911 in Brussels, Belgium, where all the topmost scientists were invited. The subject for discussion was: 'The theory of radiation and quanta' and it provided a platform to make Planck's energy quanta known outside German-speaking areas. Many comments for and against the quantum hypothesis of Planck were received. Einstein wrote to a friend that in Brussels, the failure of quantum theory was lamented, without a remedy being found. Still, the Conference was a success – by positively changing attitudes towards the quantum concept and emphasizing the central importance of this concept for future physical research. Max Born wrote: 'According to Planck hypothesis absorption was a continuous while emission discontinuous phenomenon involving discrete quanta. But this strange hypothesis seemed to him the only way out of the dilemma between quantum effects and electro-magnetic theory.'

Planck received dozens of nominations for the Nobel Prize during 1909–14 from several European countries, namely Austria, Italy, Norway, Sweden, Holland, Germany and Russia. He got 11 nominations in 1914. Despite so much support, he failed to win the Nobel Prize. The authors mention the reason for his failure: 'The nominators believed, the theory in the present form is not perfect. Max Planck is aware and continues to improve the theory. The "quanta" hypothesis has already passed successfully through many discussions and applied successfully by Einstein to his theory of specific heats.' The report of the Nobel Committee was against Planck: 'Based on Expert's report, the committee also concluded in its report, despite numerous confirmations, Planck's work is not yet as complete to be rewarded with a Nobel Prize.'

Chapter 4 describes the success story of Planck winning the Nobel Prize: 'In 1916, H. Rubens of Berlin, wrote to the Nobel Committee, that from electrodynamic, thermodynamic and probability theory, Planck gave a radiation law, which is named after him. For the derivation of the law, he found it necessary to introduce a universal constant. This is to be seen as the starting point of the modern quantum theory. It is one of the greatest achievements of the modern physics, even of science.'

Albert Einstein wrote a letter which reached the Nobel Committee on 18 October 1918. In it, he had nominated Planck for his achievements in the field of heat radiation, and specially for his work 'on the law of energy distribution in normal spectrum' and 'on the elementary quanta of matter and the electricity'. According to Einstein, with them Planck made possible not only to determine the exact and absolute size of the atom, but also laid the foundation for quantum theory.

Erich A. Marx of Leipzig wrote that Planck's discovery of the constant (named after him) and energy quantum is fundamental for the advancement of physics. Not only radiation theory, but also to explain the problems of mechanics, solid-state physics, specific heat, photo-electricity, the production of X-rays, atomic model of gases, and the application of energy quanta.

Even though the Nobel Committee acknowledged Planck's work in 1918, it did not find the quantum theory worthy of a Nobel Prize, due to contradictions within the theory. The Nobel Committee in its report of 15 September 1919, first noted that since 1907 Planck had received the most nominations over the years from the most competent nominees. In 1919, Einstein, Born, von Laue and Wien were among the notable nominees. The report referred to the discussion about Planck's candidacy in 1908 and the unanimous opinion of the Nobel Committee members, and decline of the proposal by the Royal Swedish Academy of Sciences.

The Nobel Committee considered Planck's discoveries on par with the classical theories. It even implicitly described him as a pioneer of science and discoverer of the elementary quanta and subsequently proposed his name for the 1918 Nobel Prize. The recommendation of the Nobel Committee was accepted by the Royal Swedish Academy of Sciences and Max Planck was awarded the Nobel Prize in 2019.

Chapter 5 gives the country-wise classification of nominees of Planck in a tabulated form from 1907 to 1919. Subject-wise classification of nominations is given by the authors as follows: (i) his work on thermodynamics and his radiation law are mentioned 44 times, (ii) the discovery of the Planck constant and/or energy quantum 13 times, and (iii) for his quantum hypothesis theory 28 times. These three categories are given as the main reasons in the 74 nominations. Planck was one of the highly nominated scientists in the history of the Nobel Prize. For the entire period of 1907–19, there was an average of ~5.6 nominations per year. Planck received nominations from nine different countries during 1907–19, of which Germany accounted for about 61.2% of the nominations.

Chapter 6 gives an account of the nominations made by Planck. Even before he won the Nobel Prize, his nominees won it. This list includes W. C. Roentgen, the first Nobel laureate in history, H. A. Lorentz, J. Stark, Einstein, Neils Bohr, A. H. Compton, Werner Heisenberg and Erwin Schrödinger. Planck's last nomination went to Enrico Fermi in 1937, who was nominated for his investigations on artificial radioactivity. It proves that Planck's reputation as a scientist was established beyond any doubt for his fundamental contributions to science.

Chapter 7 gives conclusions of the authors based on data of nominations received by Planck: 'In the first decade of the 20th century, Planck's energy quantum did not play any role. Its application to explain the specific heat by others, such as A. Einstein, Peter Debye, and Walther Nernst attracted the attention of scientific community. In the second decade of the 20th century, on the one hand Planck's energy-quantum won popularity; and at the same time its drawbacks became clear.' The authors are of the opinion that the Nobel Committee was not to be blamed for the delay in awarding the Nobel Prize to Planck. It was due to lackadaisical attitude of his nominators, who expressed reservations about the veracity of his quantum ideas. After much wrangling for 11 years (1908–19), Planck was awarded the Nobel Prize for his 'speculative' idea of energy quanta proposed to explain the black body radiation spectrum over all wavelengths, now known as the Planck's law.

In 1924, S. N. Bose derived Planck's law of black-body radiation using Einstein's light quantum. This derivation is the most popular in the literature. It is unfortunate that Bose missed the Nobel Prize in physics despite his fundamental contributions to science. Planck's legacy is so strong that more than hundred institutions are named after him in Germany and elsewhere. The authors of this book deserve praise for telling the reader the interesting story of Max Planck winning the Nobel Prize in physics.

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Annual Review of Plant Biology 2021. Sabeeha S. Merchant, Wilhelm Gruissem and Donald R. Ort (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 72. xii + 891 pages. Price: US$ 118.

This volume contains 131 well-compiled reviews contributed by experts mainly from USA, Europe, Canada and a few from Japan, Vietnam, etc. The prefatory chapter is by Maarten Koornneef (Max Planck Institute (MPI), Germany and Wageningen University (WU), The Netherlands).

Broadly, the volume has two chapters on light perception – one on phytochrome and the other on UV receptors. Following different environmental clues, plants produce various signals. There is a chapter on histidine kinases and two-component signalling. The role of ions as regulated by ion channels and salicylic acid as a signal in defence and other responses is covered in two elaborate reviews. A major portion of the book is devoted to new work that has been reported to explain various developmental responses. Accordingly, there is a chapter each on cell cycle, tuberous and tuber root development, regulation of leaf shape and epidermis, and development of male gametophyte. In addition, there is a review on pollen–pistil interactions and embryogenesis.

Under metabolism, there is a chapter on evolutionary history of plant metabolism and others specifically dealing with the role of trehalose. There is a review on next-generation mass spectrometry for a detailed analysis of the metabolome. Interestingly, some detailed reviews on recent work regarding genomics and transcriptomics are on single-cell transcriptomics, shuttle RNA, long non-coding RNAs and on systems biology approach to search for gene regulatory networks. There is chapter on pan-genome technology and another on the utilization of natural variation in crop plants towards their applications in agriculture and crop improvement. Three plant-specific reviews deal with cotton, *Marchantia* and carnivorous plants. The importance of diploidization in land plants is also reviewed separately. A novel and interesting study on biological phase separation and its functions is discussed. New findings on plant foliar and microbiome interactions, and on biological phase separation are mentioned. Molecular mechanism of energy dissipation and engineering crassulacean acid metabolism have also been elaborated in two separate reviews. With respect to biotic stress, the function of NLRs (nucleotide-binding domain leucine rice repeat receptors) in innate immunity as defence components is covered in detail.

The chapter on phytochrome signalling networks by Cheng *et al.* has brought in focus the role of both positive and negative components under dark and light conditions in downstream signalling, following photo-perception, in controlling various developmental and biological functions.