



Nuclear Forces: The Making of the Physicist Hans Bethe. Silvan S. Schweber. Harvard University Press, Cambridge, Massachusetts and London, England. 2012. viii + 579 pp. Price: US\$ 35.

This magnificent book traces the origins and development of the great physicist Hans Albrecht Bethe (1906–2005), who was among the great stalwarts in the field of theoretical physics. He is best known for having been the person who first figured out how the sun shines, thereby becoming the founder of the subject of nuclear astrophysics in his early years of work in USA at Cornell University. Bethe also worked with some of the originators of the field of quantum mechanics with his earliest contributions lying in the field of solid-state physics during his doctoral and postdoctoral years in Germany, Italy and England, with remarkable contributions coming later in the field of elementary particle physics and field theory, including his famous computation of the Lamb shift on a train ride after the effect was described at a Shelter Island conference. Bethe was also the head of the theoretical physics effort of the Manhattan project and was closely linked with the development of the fission bomb. He later devoted his energies to disarmament and eventually called on his fellow scientists to renounce working on atomic weapons research.

The book under review covers the first third of his remarkable life and attempts to combine both the scientific parts of Bethe's work with a personal biography. It attempts to describe the leading influences in his life in terms of his parents, close acquaintance and friends and women in his life. The daunting book of 579 pages consists of 398 pages of main

text, with the remainder being devoted to detailed appendices covering among others, family genealogy and Bethe's doctoral thesis and over 90 pages of notes and 35 pages of references and 3 pages of acknowledgements. This is to say that the author has deployed such tremendous scholarship and detailed research in the form of reading of archival material, letters, in-depth study of transcripts of interviews with Bethe and also interviews that he has himself conducted which makes the book a major benchmark for future historians of Bethe to measure up against. A physicist by training and Professor of Physics at Brandeis University, Schweber turned to the history of science in the 1970s and is now Associate, Department of the History of Science at Harvard University and Richard Koret Professor in the History of Idea, Emeritus at Brandeis University.

It would be a truism to say that Hans Bethe was born in a particularly turbulent period in history in Germany. Hans was the only son of Anna, a Jewish mother and Albrecht, a Protestant father, a highly successful Professor of Physiology. His prodigious talent in mathematics and physics was noticed early and honed by his father who was proud of his proclivities. After his early university studies at Frankfurt, Hans moved to Munich and was accepted to the prestigious seminar conducted by the great doyen Arnold Sommerfeld, who was later to be his thesis supervisor. Although Hans never thought of himself as Jewish and described himself as an atheist, Schweber spends a considerable amount of time orienting the reader towards an appreciation of the prevailing environment in Europe in that period. The reader is taken through a quick tour of the changing laws of exclusion and inclusion towards European Jewry in, for example, France and Germany, and a lot is attributed to the social and cultural environment prevalent among Jewish families, assimilated and Christianized, and indeed those who cultivated the *Bildung*. Not many were prepared for the horror that was to unfold in the 1930s with the capturing of power by the Nazis which led to several physicists losing their jobs at universities, including Bethe who held a position at that time in Tuebingen. In any event, before leaving Germany permanently for USA with a two-year interim stay in the UK at Manchester and at Bristol, Bethe benefited immensely from his inter-

actions with Sommerfeld and wrote seminal papers on condensed matter physics and had spent postdoctoral stints at Cambridge and in Rome. Not the least among his great contributions to solid-state physics is his paper on what is now known as the Bethe ansatz for solving quantum mechanical problems in one dimension. The Bethe ansatz continues to this day to be a magic wand for solving seemingly intractable problems. Schweber notes, 'Before tackling any problem he would always ask himself whether he had the tools and the intellectual capabilities to successfully find a solution. Only if the answer was "I can do that" would he undertake any project.' His work on solid-state physics culminated in two articles he wrote for *Handbuch der Physik*. Hans made some indelible friendships, including that with Rudolf Peierls, who along with his wife Genia played an important role in his personal life.

Schweber skillfully divides the scientific part of the biography into chapters entitled 'Maturing', 'Becoming Bethe' and 'Beyond the doctorate: 1928–1933' as far as Bethe's work in Germany and postdoctoral work are concerned, and the period after into 'England 1933–1935', 'Cornell University' (which is primarily about arrival and settling in) and 'The happy thirties'. Besides describing the scientific work accomplished in this period, the reader also meets a whole panoply of interesting and famous persons.

Schweber does not shy away from the personal aspects of Bethe's life, since, after all, the book is about the making of Hans Bethe. He describes in some detail the lives of Anna, Albrecht and Hans and describes sensitively the failed marriage of Hans' parents and Albrecht's subsequent second marriage. It turned out



Hans, age eight or nine, with his parents in Frankfurt (Courtesy: Rose Bethe).

that Anna would have a lasting role in Hans' life and moved to USA and an insight is offered on how Hans was pre-occupied with taking care of his mother, and the difficulties of elderly immigrants. Chapters in the book are devoted to two women. One of them is on Hilde Levi who Bethe was once engaged to for a short period, but did not marry, which was to also impact his relationship and friendship with Niels Bohr. Levi went on to become a leading biologist in Denmark. The other chapter is devoted to Rose Ewald Bethe, the daughter of Paul Ewald who had been one of Bethe's teachers. Rose was the woman that Hans spent over 60 years with and was the mother of his two children, and according to Schweber the one who provided the moral compass to Hans Bethe's life in terms of his engagement with atomic weapons research and disarmament.

The book, however, essentially stops with the first one-third of Bethe's life, except for the last chapter entitled 'Conclusion', which condenses the second and final thirds of his life into a few succinct pages.

This book indeed provides the reader with much food for thought and contemplation on the difficult times in which Hans was born into and the remarkable achievements that were accomplished by him and many of his peers in that period. In contrast to the chapters entitled 'Maturing', 'Becoming Bethe' and 'Beyond the doctorate: 1928–1933' which are primarily set in Germany, the chapters entitled 'England, 1933–1935', 'Cornell University' and 'The happy thirties' are about exile and then settling into the new permanent home. Cornell University was to be where Bethe would spend the rest of his career and Ithaca, New York, would be where he would spend the rest of his life. After the war, Sommerfeld tried to lure him back with a Professorship in Germany, to which Bethe would politely write a note declining and offering reasons, including that America has been a wonderful home to him and would note that his birth in Germany was perhaps only an accident. Indeed, in his early years in USA, Bethe would write the famous 'Bethe Bible' a series of articles in the *Review of Modern Physics* on the nuclear processes that power the sun. It would be no exaggeration to say that perhaps Bethe was the first human being to have known how the sun shines!

In his grand tour through the life and times of Bethe, the physicist Schweber explains a lot of the physics that went into each of the *tours de force* that Bethe would create. While it is the lore that Bethe was a self-effacing person, a somewhat different picture emerges in this book which points out that he was a supremely self-confident person, fully aware of his prowess and general technical superiority: apparently at a later stage in his life Bethe said that he was still very conceited, but knew how to hide it better! Schweber explains that in Germany in the 1920s academia was rife with intense competition, both for success and for plum academic positions and hence it is no surprise that a person needed many attributes of the type listed earlier in order to succeed. Although Schweber himself says in his introduction quoting Claude Levi-Strauss that biography has always been considered 'weak' history, he has rendered a yeoman service by providing this sensitive yet complex portrait of an 'off-scale' scientist. While the present reviewer feels that true justice cannot be done to this book at the end of a simple reading and what it deserves is repeated and in-depth study, he feels thankful for having had this opportunity.

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Annual Review of Pathology: Mechanisms of Disease, 2012. Abul K. Abbas, Stephen J. Galli and Peter M. Howley (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 7. vi + 507 pp. Price not mentioned.

Yet another splendid volume on pathology from the *Annual Reviews* stable! As with all other volumes, this one begins with an autobiographical essay, this time by David Korn, of Stanford Medical School. I do have an interest in history and biography/autobiography, and so may be biased to some extent – but of all the essays in the book, I thought the autobiographical essay was the best. Which is no mean thing, given that there

are 17 other excellent articles on diverse topics. Cancer forms the subject of six of these articles, while neurological disease is the subject of three. General topics such as phagocytosis and the human microbiome are also addressed. The essays range from the diseases known from ancient times, such as tuberculosis to concepts described only in the past decade.

Korn is the pathologist who blew life into the then decrepit department of pathology at Stanford University. Today, Stanford is one of the leading centres in the field and it amazes one to learn that as recently as 1967, it had the 'worst pathology program in the United States' and was 'a pit'. Korn, who was trained at the Massachusetts General Hospital and Harvard Medical School, decided to take up the challenge of transforming the department – and succeeded. It was not roses all the way, however, he explains, as he had to battle tradition, established colleagues and officialdom. It is because of this that I rate the article so highly and strongly recommend it to all – current heads of departments of pathology and indeed, other departments and to potential heads of departments, i.e. all youngsters, to understand the meaning of vision, something many of our present-day academic leaders lack.

NUT midline tract carcinoma (NMC) is an example of a 'new' cancer that is recognized only because of the contributions of molecular biology to medical science. NMC is a highly aggressive, poorly differentiated squamous carcinoma which is characterized by acquired chromosomal rearrangements involving NUT (nuclear protein in testis), usually BRD4-NUT fusion genes. As the name suggests, most of these cancers arise in the midline, particularly the upper aerodigestive tract and the mediastinum. The characteristic cytogenetic abnormality is t(15;19) (q14;p13.1) and a significant number of these tumours is seen in the young, unlike conventional tobacco-related squamous carcinoma, which are seen in adults and have complex karyotypes. Because NMC is almost always diagnosed initially at histopathologic evaluation of the biopsy material, after the tissue has been fixed in formalin and embedded in paraffin wax, the author's (Christopher French, Brigham and Women's Hospital, Boston) group has developed a FISH assay that can detect the NUT locus in archival material; they have even characterized a monoclonal