



Memorial Volume for Y. Nambu. Lars Brink, Lay Nam Chang, Moo-Young Han and Kok Khoo Phua (eds). World Scientific Publishing Co. Pte. Ltd, 5 Toh Tuck Link, Singapore 596224. 2016. viii + 159 pages. Price: US\$ 48.

Asia's first two Nobel Prize winners, in 1913 and 1930, were from India. Thereafter, among Asian countries, recognition of excellence at the Nobel level accorded to Japan has been truly inspiring. In the 67 years from 1949 up to now, this prize has been given to a Japanese 25 times. The largest number has been in physics – 11 in all, 5 in theory and 6 in experiments – followed by 7 in chemistry, 4 in medicine or physiology, 2 in literature, and 1 in peace. Among theoretical physicists, we have Hideki Yukawa (1949); Sin-Itiro Tomonaga (with R. P. Feynman and J. Schwinger; 1965); and Yoichiro Nambu (with Toshihide Maskawa and Makoto Kobayashi; 2008). One can justifiably say that Nambu was truly in the Yukawa–Tomonaga class and tradition. He was given the Prize ‘for the discovery of the mechanism of spontaneous broken symmetry in subatomic physics’.

Nambu, who passed away in July 2015 at the age of 94, was a world leader in the field of elementary particle physics for several decades beginning in the late 1950s. He was a source of deep insights and key ideas that became an essential part of the foundations of the subject, in particular of the Standard Model of elementary particle interactions.

This book is a collection of 15 articles by some of Nambu's students, collaborators and admirers in a tribute to and appreciation of his magnificent gifts; followed by an Appendix titled ‘Reminis-

cences of the Youthful Years of Particle Physics’ by Nambu himself written in 2003.

The opening article by S. Weinberg on ‘Effective field theory, past and future’ mentions Nambu at the start; thereafter, it is a chronicle of Weinberg's own work and ideas starting from 1979, as recounted in a conference talk in 2009. All the later pieces are devoted more fully to Nambu's work, way of thinking, personality and human qualities in great detail. The more substantial pieces are by Giovanni Jona-Lasinio, Lars Brink, Pierre Ramond and Kazuo Fujikawa. From these, and from the shorter pieces too, one gets a fine and complete picture of Nambu's work, philosophical attitude and personality.

Born in 1921, Nambu graduated from the University of Tokyo in 1943, and was then involved in the war effort for a while. In 1950, he joined the Osaka City University; years later he would remember the time (three years) there with nostalgia and say ‘I had never felt and enjoyed so much the sense of freedom’. Under Tomonaga's guidance, Nambu completed his Ph D in 1952. After the discoveries of the pi meson and the Lamb shift in 1947, there arose in Japan a strong desire to compete with the US in elementary particle physics and quantum field theory. The philosophical ideas of Sakata and Taketani – greater emphasis on understanding experimental results rather than theory by itself – deeply influenced Nambu. In 1952, based on Tomonaga's recommendation to Oppenheimer, Nambu (and T. Kinoshita) went to the Institute for Advanced Study in Princeton, USA for a two-year period. Here he met Albert Einstein, but felt overawed by the smarter and more aggressive persons around him. Nambu describes the two years there as ‘heaven and hell’; the living conditions were much better than in Japan, but the feeling of fierce competition was intimidating. Fortunately in 1954 Marvin (‘Murph’) Goldberger invited him to join the University of Chicago, which he did. Nambu stayed there for the rest of his professional career. He retired in 1991, and in early 2010 moved to Osaka. In his last years, Nambu's and his wife's health gave way. He was unable to attend the Nobel Prize ceremony in Stockholm in 2008 and asked Jona-Lasinio to represent him instead. The Prize itself was given to him by the Swedish ambassador to the

US at a ceremony in Chicago. At the very end he suffered two strokes and kidney failure, and passed away in 2015.

From the articles in this book we learn of several instances where work done by Nambu was redone later by others, depriving him of due credit. These include the derivation of the Bethe–Salpeter equation within quantum field theory in 1950; the idea of associated production of strange particles (with Nishijima and Yamaguchi) in the early 1950s; and his independent calculation of the radiative corrections to the electron magnetic moment around the same time as Schwinger in the US. We also get a good picture of the exceptionally strong Japanese school of physicists in elementary particle physics and quantum field theory, including such well-known names as Hiroomi Umezawa, Hironari Miyazawa, Toichiro Kinoshita, Ziro Koba and Kazuhiko Nishijima among others. Without a doubt, all of this was possible thanks to the inspiration of figures like Yoshio Nishina, Yukawa and Tomonaga. What helped was the fact that, as Nambu wrote elsewhere, ‘Fortunately, a tradition exists in Japan which emphasizes constructive modes of thinking, as exemplified in the Yukawa theory’.

Nambu's most influential ideas and contributions have been the concept of spontaneous symmetry breaking, first elucidated around 1960 in his analysis of gauge invariance in the BCS theory of superconductivity and then transferred by him to the case of chiral symmetry in the pion–nucleon system (recounted by Kibble and Jona-Lasinio); colour symmetry of quarks and the first steps in 1965 towards the formulation of quantum chromodynamics, now accepted as the theory of the strong interaction (article



Nambu offered Einstein a ride in his car and took this picture of him.

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by Moo-Young Han and the Appendix by Nambu); and the idea in 1970 of one-dimensional strings as the ultimate building blocks of the content of the universe (articles by Paul Frampton, Lars Brink, Pierre Ramond and Lay-Nam Chang). The first was developed with Jonas Lasinio, the second with Han. The article by Brink is especially valuable as it recounts in some detail the steps that led to Nambu being awarded the 2008 Nobel Prize. Brink was on the Committee from 2001, later its chairman, and was especially concerned about Nambu's state of health as the announcement date drew near. It is justifiably felt by many that this prize should have been given to him earlier.

As for Nambu the person, we read:

'He was surprisingly soft-spoken and modest for someone so wise and important.'

'His keen insights were driven by a marvellous and unique form of intuition. In a typical Japanese manner Yoichiro was unable to use the word "no".'

'Nambu had great human empathy.'

'...extraordinary display of physics, originality and conceptual power.'

'He was the ultimate gentleman scientist, with a big heart. And a unique perspective on all aspects of physics.'

All in all, this is a precious little book, giving us a fine portrait of a great and visionary physicist of the second half of the 20th century, insights into his ways of thinking and philosophy, and his wonderful human qualities.

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Annual Review of Medicine, 2016. C. Thomas Caskey, Mary E. Klotman and Peter Scardino (eds). Annual Reviews, 4139 El Camino Way, Palo Alto, California 94303-0139, USA. Vol. 67. vii + 530 pp. Price: US\$ 102.

Given the flood of medical literature in recent times, physicians face the continuous challenge of keeping up with the advances in general medicine. An effi-

cient way to update is to read the *Annual Review of Medicine*. Annual Reviews integrate, scrutinize and evaluate a wide range of studies of current interest and published during the recent past.

This volume has 33 articles. Nine of them deal with treatment of different types of solid and haematological malignancies. Three articles discuss therapy related to HIV infection. Mechanisms and treatment of immune or autoimmune diseases are the subjects of four reviews. Two articles focus on new vaccines. Pathogenic mechanisms, new pharmacological strategies, novel diagnostic tools and issues of public health are the other themes included.

Neglected tropical diseases (NTDs) such as malaria, tuberculosis, rota virus, HIV, respiratory syncytial virus and parasitic infections (hook worm, schistosomiasis and leishmaniasis) are the most common chronic and debilitating diseases of extremely poor people. Development of vaccines against these diseases confronts distinct challenges with respect to their manufacture, pre-clinical and clinical trials as well as successful marketing. Progress, opportunity and challenges in these areas are described by Hotez *et al.* They point out that despite tremendous potential for the development of novel NTD vaccines, there is no specific road map for ensuring that they are made accessible to the needy.

Approaches and challenges for the development of vaccines against dengue are the theme of an article by Guy *et al.* They begin by defining the questions which need to be answered during vaccine development and conclude with presentation of issues raised by clinical trials. One or more vaccines for dengue are likely to be available soon.

Given the undoubted increase in the burden of obesity, type-2 diabetes and non-alcoholic fatty liver disease (NAFLD) in India and the link of these risk factors with hepatocellular carcinoma (HCC), the article on mechanisms underlying their relationship would be of considerable interest to both clinicians and medical scientists. Notable findings of several studies on the association among HCC, NAFLD, type-2 diabetes and obesity are presented by Manengo *et al.* They also describe the molecular mechanisms of hepatocarcinogenesis in the absence of liver cirrhosis. These include adipose tissue-derived inflamma-

tion, oxidative stress and lipotoxicity, and stimulation of IGF-1 axis by hyperinsulinemia. Diet, gut microbiome and genetic factors are also relevant. The authors emphasize the importance of developing surveillance and prevention strategies.

Recent reports which suggest that a cure for HIV infection is possible have renewed optimism in developing treatment strategies and methods to evaluate interventions. Martin and Siliciano review the efforts in exploiting shock and kill strategy targeting latent HIV and developing small molecule latency reversing agents such as HDAC inhibitors, vaccines and genome editing tools for restoring memory CD4⁺ T cells.

The article by Luzuviago focuses on recent advances in our understanding of the basis of HIV-1 persistence in children and the usefulness of very early combination anti-retroviral therapy in restricting generation and preservation of long-lived CD4⁺ T cells that contain HIV-1 DNA and replication competent virus in children.

Novel vaccine designs aim to mimic natural evolution of protective neutralizing antibodies against HIV-1. Sadanand *et al.* describe the structural characteristics of neutralizing antibodies against HIV, their viral targets and strategies to elicit these antibodies in the development of an HIV vaccine.

A fascinating review is on new pharmacological strategies to increase cGMP. Impairment of the cGMP pathway is linked to pathogenesis of a variety of diseases which include obesity, dementia and cardiovascular diseases such as hypertension and heart failure. For treatment of these diseases, agents that enhance cGMP generation are being developed and evaluated. These drugs are either guanyl cyclase activators or phosphodiesterase inhibitors or neprilysin inhibitors. Progress in research in this area indicates that distinguishing between cGMP in different compartments of the cell could lead to intervention in a specific selected pathway.

In lower- to middle-income countries, young adults and women are particularly vulnerable to acute kidney injury and are at risk of death. Those who survive could develop chronic kidney disease and end-stage renal disease. Zuk and Bonnentre focus on novel pathogenic mechanisms for acute kidney injury and progression to chronic kidney disease discovered