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Dutch scientists in and close to biophysics

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When Tony (Watts) asked me to address you after dinner, he suggested I should speak for 30 minutes. It has been a long and exciting day and we have heard outstanding lectures in the forefront of biophysical studies today. We have enjoyed an excellent dinner offered by our hosts, and I believe I should limit my time. I will not even tell you any jokes because I feel I have already told many of them before. I have chosen for the topic of my address a subject which I feel is of great importance, in particular in a country which has contributed greatly to modern science, and in particular to biophysical science, which is the *raison d'être* for our being here tonight. It is generally accepted that the major contributions to science are generated in large and powerful countries and it gives me a special pleasure to review before you the contribution of a smaller but proud nation, The Netherlands, in the orchestration of modern science. We are well aware of the Dutch contributions to the humanities and arts over the ages, and I feel that the Dutch contribution to the sciences, should be properly stressed. I will briefly mention great and well known Dutch Scientists from earlier periods, yet the main purpose of my address is to bring to your attention Dutch scientist pioneers in fields close to biophysics in our own days of activity. I have personally met these outstanding personalities and I feel that their basic contributions should not be forgotten in a period of time when science is moving at such a fast rate that the young practitioners of the trade often do not remember the giants on whose shoulders they are privileged to stand in the accelerated pace of their own practice. However, this being an after-dinner speech, and not a historical essay, I would like to have your forgiveness for slight errors or inaccuracies which might have infiltrated my address.

Many years ago, when I was much younger, I read a fascinating book, 'The Microbe Hunters', by Paul de Kruif. This is when I became familiar with *Anthony von Leeuwenhook*, born in Delft in 1632 and died in the same city, not far from where we are now, in 1723. He was a pioneer in microscopy, examined blood capillaries, red blood corpuscules, ciliate protozoa, bacteria, rotifers, insects, mussels and yeast, using home-made instruments and a critical experimental approach. In 1680 he became a fellow of the British Royal Society, to whom he communicated his findings.

More recently, in the 19th century, we note Dutch scientists whose names have become household names in modern science. *Jacobus Henrikus van't Hoff* was born in Rotterdam in 1852 and died in Steglitz, Germany, in 1911. He studied in Delft and in Leiden and was Professor in Amsterdam and Berlin. He is well known for his work on stereochemistry and theory of solutions, chemical dynamics, osmotic and vapor pressures. He was a Nobel Laureate in 1901, the first year Nobel prizes were

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[1] Henryk Eisenberg was an early member of the Editorial Board of Biophysical Chemistry.

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awarded. *Johannes Diderik van der Waals* was born in Leiden in 1837 and died in Amsterdam in 1923. His doctoral thesis in 1873 dealt with the continuity of the liquid and gaseous states leading to the van der Waals equations of state of ideal and real gases, incorporating finite size and mutual interactions. He was awarded the Nobel prize in 1910. *Heik Kamerlingh-Onnes* was born in Groningen in 1853 and died in Leiden in 1926. He is known for his work in low-temperature physics and established in 1894 the Cryogenic Laboratory in Leiden for studies in superconductivity. He received the Nobel prize in 1913. *Petrus (Peter) Josephus Debije (Debye)* was born in Maastricht in 1884 and died in the USA in 1966. He held chairs in Zurich, Utrecht, Göttingen, Leipzig and Berlin, where he became Director in 1935 of the Kaiser Wilhelm Institut of Theoretical Physics. He left Germany at the outbreak of the war and settled in Ithaca, where I was privileged to meet him in 1952. Debye received the Nobel prize in 1936. He is well known to us for his pioneering work on dipole moments, specific heats of solids, Debye–Scherrer X-ray crystallography of powdered samples, light scattering of polymer solutions and the concept of the ionic atmosphere in the 1923 Debye–Hückel theory of electrolytes. *Fritz Zernicke* was born in Amsterdam in 1888 and died in Groningen in 1966. He received the Nobel prize in 1953 for his work on phase contrast microscopy, of major importance to biology, and thereby closes the circle to Leeuwenhook, with whom I started my discussion.

In the circle of my Dutch friends and mentors dear to me I count *Jan Joseph (J.J.) Hermans* who was born in Leiden in 1909 and was Professor in Groningen and Leiden before moving in 1958 to the USA. Since 1968 he has held the position of Professor of Physical Chemistry at the University of North Carolina, Chapel Hill, NC. J.J. belongs to the circle of pioneers in the field of polymer theory and I would like to mention in particular his article in 1948 in the Rec. Trav. Chim. Pays-Bas with *J.Th.G. Overbeek* (born 1911) on the dimensions of charged long-chain molecules in solutions containing electrolytes, being a pioneering combination of Kuhn statistics and von Smoluchovski and Debye–Hückel interionic attraction theory. Overbeek was Professor at the van't Hoff University in Utrecht from 1946 to 1981 and coauthored with *Evert J.W. Verwey* the classic text on the 'Theory of the Stability of Lyophobic Colloids', analogous to the work of Deryagin and Landau, published in 1948 by Elsevier, New York. Verwey was Director of Research in the N.V. Philips Gloeilampenfabrieken in Eindhoven, stressing the collaboration between Dutch industry and science. *A.J. Staverman* (1911–1993) was born in Groningen and was Director of Research at the TNO Polymer Institute in Delft and Professor of Physical Chemistry in Leiden (1957–1981), working on nonequilibrium thermodynamics of membrane processes. In his paper in the Trans. Faraday Soc. in 1952 he introduced phenomenological constants from which thermodynamic constants can be computed. More on the 'Thermodynamics of Irreversible Processes' is due to *S.R. de Groot* whose notable text carrying this title was published by North-Holland, Amsterdam, in 1950. *Ian Drenth*, Professor of Structural Biochemistry at the University of Groningen, is a major force in modern protein X-ray crystallography. Additional names coming to my mind are *Henk C. van de Hulst* for his theoretical work on the scattering of radiation in the atmosphere and by colloidal solutions, author in 1957 of 'Light Scattering by Small Particles', *J.A. Prins* who worked with F. Zernicke on the bending of X-rays in liquids as an effect of molecular arrangement, *H.C. Brinkman* for his work on the equation of state for liquids, and *H.A. Kramers*, for his contributions to quantum theory and statistical mechanics, leading inter alia to a better understanding of viscosity and its role in biological phenomena. I cannot, in the short time at my disposal, give details of the work of the scientists mentioned, and apologize to those glossed over because of the briefness of this address.

Much of the work discussed above was part of my daily fare when growing up in science in the laboratory of Aharon Katchalsky at the Weizmann Institute in Rehovot, and has remained significant in later years. It is interesting to note that much of Dutch science was, and maybe still is, published in Dutch, in a number of Dutch journals, indicating the strength and independence of Dutch science. Of interest to myself, I published an article in the J. Chem. Phys. in 1962, on sedimentation of multicomponent solutions in the ultracentrifuge, in which I showed that complex expressions for the buoyancy term in these systems can be replaced by an experimentally acces-

sible density increment term, at constant chemical potential of diffusible solutes. At that time I was not aware that A. Vrij, working in Overbeek's laboratory, had in his 1959 Ph.D. thesis written in Dutch, derived an identical expression. However, when in 1956, at the closing dinner in Jerusalem of the IUPAC Polymer Conference the visiting speakers were asked to say a few words in their own language, J.J. Hermans stated, in a light vein, that hardly any Dutch scientist uses the Dutch language anymore, and proceeded to deliver his comments in English.

Aharon was, with Michel Mandel, active in the preparations which led to the realization of 'Biophysical Chemistry' in 1973. When Aharon was killed by a terrorist attack in 1972 Michel decided to commemorate him by the 2nd Aharon Katzir Katchalsky Conference, which took place in Amsterdam in 1974.

I hope I have given you in these few moments a glimpse, with some light overtones, of the importance of Dutch science and biophysics in the past and in the present, and I would like once more to repeat how privileged we all are to attend this outstanding meeting in these beautiful surroundings, within 'cycling' distance of the places where most of the Dutch scientists mentioned here were born, lived and were creatively active. I would also like to thank Michel for providing some of the information used in this talk. I am sorry he is not with us tonight for reasons of health. We all wish him a speedy recovery and a return to a fully active life.