



Linus Pauling

SOCIETAS CHEMICA CROATICA  
ANNO MCMXXVI ZAGRABIAE CONDITA

LINUS PAULING

HONORI NOBIS TRIBUIMUS TIBI NOTUM FACERE TE  
IN CONSENSU ANNUO MCMXXXVII

OB EXIMIA IN CHEMIA MERITA, OB STIMULANTEM  
IN HAC DISCIPLINA APUD NOS EFFICIENTIAM NEC NON OB  
ARTUM NEXUM, QUI IAM TOT ANNOS TIBI EST  
CUM SOCIETATIS NOSTRAE COMMENTARIIS,  
QUI CROATICA CHEMICA ACTA INSCRIBUNTUR,

SOCIUM HONORIS CAUSA

SOCIETATIS CHEMICAЕ CROATICAE

ELECTUM ET RENUNTIATUM ESSE.

DATUM ZAGRABIAE ANTE DIEM VI KALENDAS IUNIAS ANNO  
MCMXXXVII.

Secretarius:

V. Hlady  
Dr. V. Hlady

Praeses:

R. Jakopčić  
Prof. Dr. R. Jakopčić

## Linus Pauling — Honorary Member of the Croatian Chemical Society

It is very easy and at the same time extremely difficult to write about Linus Pauling. It is easy because he is a citizen of the world, widely known to people through his vigorous rallies for peace and disarmament or perhaps because of his campaigns for the cause of better health and well-being by vitamins and adequate nutrition. Linus Pauling is known to every chemist as a great architect of modern chemistry. However, these aspects by no means comprise all of his activities. He is a personality with enormous range of interests, wide horizons and universality which could be matched perhaps only by the great men of the renaissance. Indeed, it is difficult to find a person of this century who made so many important contributions to so widely different branches of natural sciences. It is impossible to cover all of his scientific achievements in a short article like this implying that the present text will be necessarily a torso.

Linus Pauling entered the field of sciences rather early and his rise was meteoric. After graduating in chemical engineering at Oregon Agricultural College and fulfilling all requirements for Ph. D. at the California Institute of Technology, he joined the teaching staff of the latter. As a recipient of the Guggenheim fellowship, he visited Europe in 1926 and stayed there for almost two years. Most of the time he spent in Munich at Arnold Sommerfeld's Institute for theoretical physics, but important spots of his tour were Niels Bohr's Institute in Copenhagen and E. Schrödinger's group in Zürich too. That was the time of the quantum theory fever and Pauling was at the very source of the emerging new physics. He quickly realized that quantum mechanics is the key for understanding the structure of matter at the atomic and molecular scale. By using this new tool, Pauling resolved a puzzle of the electronic structure of methane, which in turn did not conform well with the idea of the L-shell consisting of the two s and six p electrons according to the Lewis octet principle. As early as 1928, sixty years ago, he introduced a concept of hybridization which is one of the milestones in the development of the quantum theory of chemical bonding. It is difficult to surpass this model in its elegance, simplicity and a high degree of information content. L. Pauling is one of the pioneers in X-ray studies of the structure of crystals and electron diffraction investigations of molecular geometries of compounds in the gaseous phase. Combining his knowledge of quantum theory with measured data he coined six fundamental rules which rationalize crystal structures. A. Rich and N. Davidson write in a preface to their book, *Structural Chemistry and Molecular Biology*, that »His work, more than that of any other individual, has led to the general realization that molecular structure is the central and most fruitful theme of modern chemistry«. Pauling's seminal ideas profoundly changed chemistry providing it with a firm quantum mechanical foundation. His contributions laid down a basis for valence bond theory and a concept of resonance which experience a renaissance nowadays. He

quantified the idea of electronegativity and explained the ionic character of the covalent bond. The main characteristic of his approach was to understand the quintessence of phenomena and to describe it in a fundamental but simple manner. It is generally said that a model description reached the Pauling's point, if it gives a reasonable agreement with experiment in a most economical way. In other words, a model at Pauling's point is the best in the sense of the Occam's razor principle. His work on chemical bonding in the thirties resulted in a monumental classical book *The Nature of the Chemical Bond and the Structure of Molecules and Crystals: an Introduction to Modern Structural Chemistry*, Cornell University Press, Ithaca, NY, 1939. This »bible« had overwhelming impact both on chemical education and on research in organic and inorganic chemistry, mineralogy, biochemistry, molecular biology and medicine. All three editions of this book have been explicitly cited in over 16,500 publications since 1955, which is an absolute record in the history of natural sciences.

He made important contributions to the theory of metals and revealed features of one- and three-electron bonding. His work on the structure of large biological molecules has led to a discovery of the  $\alpha$ -helix — a major breakthrough in studying proteins which in turn are of paramount importance. L. Pauling nearly missed unraveling the double-helix structure of DNA and lost a race with Watson and Crick, probably because he was deprived of some X-ray data presented at the conference in England, where he was not allowed to go because the U. S. State Department withheld his passport.

In 1954 he was awarded the first Nobel prize for his work on chemical bonding. At that time he became very active in the peace movement writing articles and crusading against nuclear weapons and radioactive fallout caused by nuclear tests. His authority of a renowned scientist and a Nobel prize laureat helped him to collect 11,000 signatures of intellectuals from all over the world on a petition to ban atomic bomb explosions. This petition presented to the Secretary General of the United Nations had a strong impact. The very day when nuclear powers United States, Soviet Union and Great Britain signed a limited test-ban treaty that put an end to atomic explosions in the atmosphere, Nobel Prize Committee in Oslo announced that Linus Pauling had been awarded the Peace Prize for 1962. Coincidence in timing was by no means accidental. Pauling's social and political activity shows his integrity, responsibility and human dimension. It required, however, a lot of civil courage. One should recall that Magazine *Life* headlined his Nobel Peace Prize as a »Weird Insult from Norway«. Pauling has been subpoenaed by the Internal Subcommittee of the Senate and cross-examined about his petition activities. He risked a jail sentence by refusing to give the names of people who helped him in promoting his petition. Earlier he publicly characterized McCarthy as a »cancer on a body of politics« showing that L. Pauling is not only one of the leading scientist in the 20th century but also one of the moral leaders of the world just like A. Einstein and some others.

A lot of his efforts were devoted to the study of the molecular basis of medicine. He discovered that sickle cell anemia is a genetic disease involving abnormal haemoglobin. Pauling put forward a theory of anesthesia and founded orthomolecular medicine — a new branch of medicine where pre-



vention and treatment of illnesses is achieved by varying concentration of substances which are normally present in the body. The last twenty years his interest was focused on nutrition and the role of vitamins in preserving good health and the well-being of people. He is a proponent of »megascorbic« therapy of various illnesses ranging from common cold to cancer much to the discomfort of the medical establishment and old fashioned nutritionists. But, what counts is A. Szent-Györgyi's comment that vitamin C was discovered twice — once by himself and again by L. Pauling, or as somebody put it lapidary »the mainstream converges with Pauling's opinion twenty years later«. Today, Pauling at the age of 87 works at his own institute in Palo Alto being as productive as ever. His latest book *How to Live Longer and Feel Better*, W. H. Freeman, New York, which appeared in 1986, is a best-seller.

Linus Pauling has contacts with our theoretical chemistry centered in Zagreb, or to be quite specific — at the Ruđer Bošković Institute, which last for a number of years. He showed a lot of interests for the development and applications of the hybridization model, theoretical studies of vitamin C and related systems and, last but not least, for in vitro experiments on the value of vitamin C and its derivatives in killing off various malignant tumor cells. His comments and generous advice were invaluable. In November 1974 Linus Pauling came to Dubrovnik as a member of International Committee of universalists. The other member of Committee were Philip Noel-Baker, Ava Pauling, Aurelio Peccei and Ivan Supek. They prepared the Dubrovnik Statement on general and complete disarmament freedom and human rights, which was later renamed as Dubrovnik-Philadelphia Statement at the Congress of World Unity (Philadelphia, 1976). L. Pauling contributed a paper on hybridization (with Z. S. Herman) to the special issue of *Croatica Chemica Acta Conceptual Quantum Chemistry, Models and Applications*, Part I and Part II, Vol. 57, Nos. 5 and 6 (1984), which I had the pleasure of editing. These two volumes aroused a world-wide interest and got very favourable reviews. L. Pauling wrote an introduction and a superb chapter on theory of metals, alloys and intermetallic compounds (with Z. S. Herman) for the book *Modelling of Structure and Properties of Molecules*, Z. B. Maksić, Ed., Ellis Horwood, Chichester, 1987, which in fact represents Proceedings of the first Yugoslav Symposium on Molecular Sciences held in Zagreb (May 28—30, 1986). He is the honorary president of the Scientific Committee of the Symposium *The Electronic Structure and Properties of Molecules and Crystals*, which will take place in Cavtat (August 29—September 3, 1988). L. Pauling will participate at the Symposium and deliver the main plenary lecture.

In recognition of all his contributions and as a small token of gratitude for his stimulating influence in promoting molecular sciences here, our chemical community elected Linus Pauling as a honorary member of the Croatian Chemical Society. He is also the first recipient of our Society's Božo Težak Medal. We are all very proud at the same time that Linus Pauling, one of the greatest scientists in the history according to the British magazine *New Scientist*, is now a member of our Chemical Society.

Z. B. MAKSIĆ