

Leopold Ruzicka

Nobel Prize in Chemistry 1939



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“for his work on polymethylenes
and higher terpenes”

* 13.9. 1887 in Vukovar (now in Croatia)

† 26. 9. 1976 in Zurich

1920–1925 Privatdozent at
the University of Zurich

Of Perfumes and Partisans

Mid-January in 1940 was bitterly cold in Europe. It was a time to shudder, both meteorologically and politically. Fighting had broken out in various parts of the world in the wake of the German invasion of Poland, in September 1939. Because travel was drastically restricted, for the first time no central celebration for the Nobel Prizes was held in Stockholm. Instead, the awards

were presented in the laureates' home countries. The celebrations for Leopold Ruzicka took place on the morning of 16 January 1940, in the main lecture hall at ETH Zurich, where the Swedish ambassador, on behalf of the King of Sweden, presented Ruzicka with the Nobel medal and diploma. At the invitation of the president of the ETH board of directors, the guests afterwards enjoyed lunch at the Restaurant Huguenin on Bahnhofstrasse. The president of the University of Zurich and colleagues from the University's chemistry department also joined the party, as Ruzicka had earned the authority to teach (*venia legendi*) at both institutions. Before his professorship at ETH, he had taught and researched for some years as a Privatdozent at the University.

Ruzicka received his award for his work on polymethylenes and terpenes, the scientific names for odorous substances that, in nature, are produced by plants and animals. Ruzicka succeeded in identifying their structures and finding ways of synthesizing them – research that was important for scholarship and lucrative for the perfume industry. When holding the laureate's traditional acceptance speech, Ruzicka took the opportunity to reflect on his career. He still saw himself as the “eager and hard-working young chemist of 30 years ago, whose path led from Croatia to Switzerland, where, without ever forgetting the land of his birth, he discovered a beloved new home.”

Leopold Ruzicka indeed retained a lifelong connection with his country of

birth, and this bond even determined the first research he conducted in Zurich: His adviser, Hermann Staudinger, proposed an analysis of “Dalmatian insect powder.” Ruzicka, who was born in 1887 in the little town of Vukovar, then part of the Habsburg Empire, was able to obtain the raw material of the powder, the blossoms of a variety of chrysanthemum, through his relations in Dalmatia. Staudinger and Ruzicka were the first to identify in the blossoms the active ingredients of the insecticide pyrethrum, which remains today one of the most important biological insecticides. Cockroaches

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served as the experimental animals, and legend has it that, decades later, their progeny were still to be found infesting the cellars of the ETH chemistry building.

It was Hermann Staudinger who originally brought Ruzicka to Zurich. Previously Ruzicka's doctoral supervisor at the Technische Hochschule Karlsruhe, Staudinger took the gifted and industrious young man with him as his assistant upon being appointed professor of general chemistry at ETH in 1912. The relationship with the dominant Staudinger broke down in 1916, however, when Ruzicka chose his own



area of research for his habilitation. This decision also triggered a conflict with the president of the ETH board of directors, and Ruzicka consequently lost his assistant's position. Ruzicka now needed a new source of income to provide for himself and his wife, Anna, whom he had married in Karlsruhe. Salvation came through his work in the private sector. In 1921, after approaching various companies that manufactured fragrances, Ruzicka found a reliable partner in Naef & Cie. in Geneva, now known as Firmenich. He analyzed the odorous substances produced by the civet cat and the musk deer, both valuable to the perfume industry, and was able to define their chemical structure. In the process, he made a sensational discovery: 17-membered carbon rings. Up to then, chemists had questioned the existence of such large compounds. He also succeeded in creating synthesized carbocycles, thus allowing the materials to be mass produced at low cost. Following these successes, Ruzicka's name became increasingly well-known in professional circles.

Ruzicka moved to Geneva in 1926 as a research associate of the fragrance company. That he found himself back at ETH, as a professor, three years later was due to a change of leadership at that institution and thanks to some friendly support from the "competition" at the University of Zurich. Ruzicka had taught at ETH since 1918 and, from 1920, also at the University, where he had earned the respect of Paul Karrer, the head of the Department of Chemistry. Both Ruzicka's talent and his work ethic were legendary: He lived by his motto that "academic freedom consists in being allowed to work far harder than prescribed."

"Rutsch," as he was known to his students, was utterly devoted to his subject. Small in stature, he was an assiduous and skillful researcher who served as a role model to his colleagues and students. Upon learning that Staudinger would retire in 1926, Ruzicka applied for the succession at ETH. Paul Karrer, who himself had been approached, supported his colleague's candidature. Despite Karrer's recommendation, the young and eloquent lecturer Richard Kuhn, from Munich, was named to the chair. Because Ruzicka believed his chances in Zurich would be blocked for some time to come, he accepted

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an appointment at the University of Utrecht in 1927. Nevertheless, Ruzicka's stay in Holland would be short: Richard Kuhn left Zurich after just three years, and the professorship was again vacant. Karrer successfully applied his influence on the appointment committee, now led by the the new president Arthur Rohn, and Ruzicka could finally return to ETH.

Upon his appointment in 1929, Leopold Ruzicka became the first Swiss citizen to hold the chair for general chemistry at ETH since its establishment in 1855. He had acquired citizenship in Zurich in 1918 and, unlike his predecessor, was determined to settle in Zurich. Accordingly, after his appointment he immediately purchased a plot of land at Freudenbergstrasse 101 and built a house on it, complete with a large garden. At the chemistry

lab, Ruzicka also requested that significant investments be made to renew the increasingly outdated infrastructure. There then followed ten years of intensive and successful research. Ruzicka benefitted from his research experience in the perfume industry, and he succeeded in identifying the structure of many complex natural substances, including steroids. He was also able to synthesize the male sexual hormones androsterone and testosterone. In 1939, Ruzicka was awarded the Nobel Prize in recognition of his work.

During the Second World War, Ruzicka was a staunch supporter of both his new home country and the country of his birth. He served for two years in the Swiss Army, was active in assisting refugees, and gave chemistry lessons to interned Polish students at Winterthur's technical school. He also supported Josip Broz Tito's Communist partisans, who were fighting against the German and Italian occupying powers in the Balkans. As part of this endeavor, Ruzicka founded the "Yugoslavian-Swiss Aid Committee," which he also presided. His skillful lobbying ensured that part of the post-war Swiss aid reserved for neighboring countries would also benefit the new state of Yugoslavia. Upon becoming head of state, Marshal Tito rewarded Ruzicka with his personal friendship and a medal of honor.

The changes in global politics were reflected at the chemistry lab. In the 1930s, Ruzicka had many doctoral students, including Tadeus Reichstein, but after the war began, many of Ruzicka's staff emigrated to America. A new colleague came from eastern Europe in the person of his subsequent successor, Vladimir Prelog. After the war,



chemistry was once again a highly-sought subject, and student numbers rose sharply. Ruzicka, however, restricted himself to administrative leadership for a time. Shortly after the war, he used the income from American hormone patents to establish a foundation and, with the help of the funds, built up an exquisite collection of Dutch painting. Leopold Ruzicka became a connoisseur of art and bequeathed his collection to the Zurich Kunsthaus. The postwar period also brought change to Ruzicka's personal life: His first marriage ended in divorce in 1950, and a year later he married his secretary.

Leopold Ruzicka retired in 1957, but there was still much for him to do. In his

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sunny garden at Freudenbergstrasse 101, he cultivated a variety of alpine plants. He loved roses – indeed, Ruzicka means “little rose” in Czech – and loved photographing them. He even once described himself as a rose without thorns, which may be something of a misnomer for the self-confident professor with a good feel for power. Ruzicka regularly nominated chemists for the Nobel Prize, and only two of his recommendations failed to be awarded the prize. *Margrit Wyder*

Source: Margrit Wyder: *Einstein und Co. – Nobelpreisträger in Zürich*; Verlag NZZ Libro, Zürich 2015 **Illustration:** Aline Telek
Translation: University of Zurich

Made in Zurich:

The Biggest Carbon Rings

Flower scents and essential oils are among the most pleasant fragrances the world has to offer. In chemical terms, they are molecules produced by plants. When we inhale them, they activate our olfactory cells. Animals also produce odors that serve for reproduction or the defense of territory. Chemically, these substances are often related to one another, and many belong to the class of terpenes. The name comes from turpentine, a resin long used in painting. There are over 8,000 known terpenes.

Characteristic of these substances are ring-shape molecules; several rings are often interlocked, similar to honeycombs. But how large can a single ring be? The best-known is the benzene ring, which contains six carbon atoms linked in a regular hexagon. Before Ruzicka's work, rings with three to eight members had been discovered or produced in the laboratory. But because researchers had failed to achieve larger numbers of members, it was believed that such rings were energetically impossible.

Between 1921 and 1923, however, Ruzicka demonstrated the existence of rings with 15, and even 17 members. He discovered them in muscine and civetone – the main odorous substances of the musk deer and the civet cat – which were used in the perfume industry. Ruzicka also succeeded in synthesizing these substances, thus supplying Naef & Cie. with raw materials that could be produced in large quantities for their perfumes.

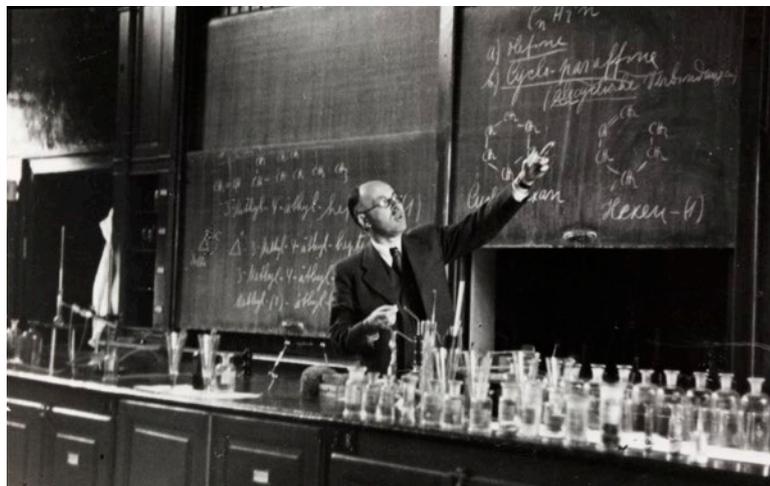
In further experiments, Ruzicka even succeeded in producing molecular rings with up to 34 members, an achievement that necessitated the revision of several theories on atomic bonding. In an article for the fiftieth anniversary of Naef & Cie., now known as Firmenich, Ruzicka emphasized

that “odorous substances have made no small contribution to the methodological, systematic, and theoretical aspects of the development of general organic chemistry.”

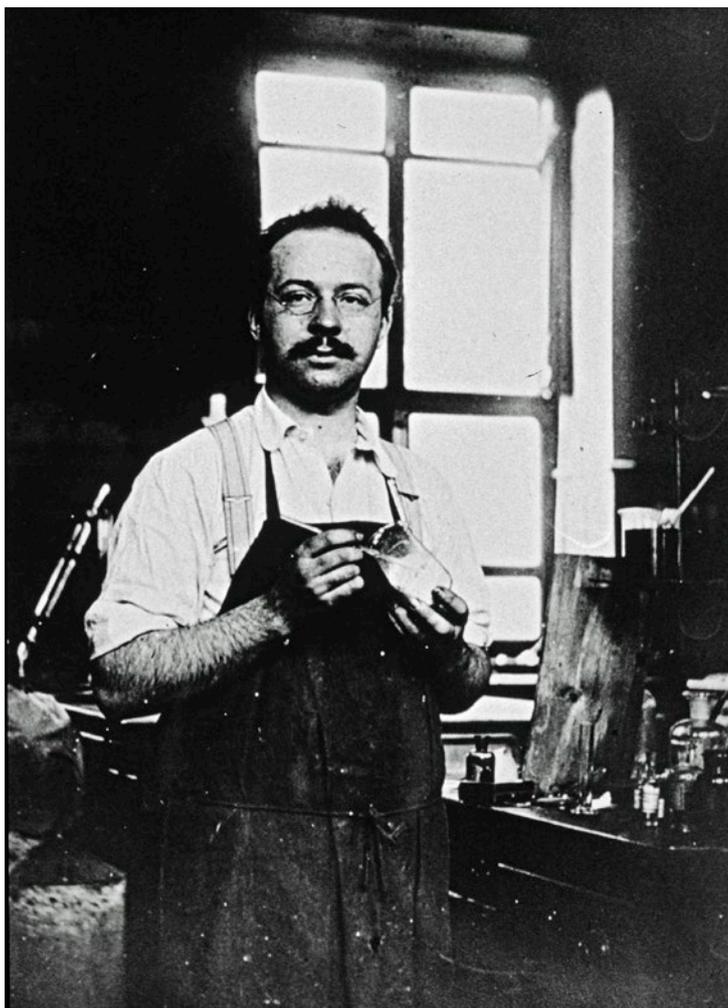
But Ruzicka was not only “Lord of the Carbon Rings”; in the 1930s, he was also at the forefront of hormone research. He recognized the close chemical relationship between the higher terpenes and the steroids, and he isolated the male sex hormone androsterone almost simultaneously with the German chemist Adolf Butenandt, who had already discovered the female sex hormone estrogen. Accordingly, the Nobel Prize Committee divided the Chemistry Prize for 1939 between Ruzicka und Butenandt, with the German chemist being explicitly honored for his hormone research, while the Swiss was singled out for his discoveries in the domain of odors. Through his close cooperation with Ciba in Basel, Ruzicka also played a significant role in the growth and prosperity of the chemical industry in Switzerland. (MW)



Leopold Ruzicka researched odorous substances and hormones, and served in the Swiss Army in the Second World War. Photo: ETH Library, archives



Leading expert on organic ring compounds: Leopold Ruzicka in the lecture hall. Photo: ETH Library, archives



Completely devoted to his work: Leopold Ruzicka as a young chemist. Photo: ETH Library, archives