History and Philosophy of Science
История и философия на науката

NOBEL LAUREATES IN CHEMISTRY FROM THE TERRITORY OF FORMER YUGOSLAVIA

Milan D. Stojković
Friedrich-Schiller-University of Jena, Germany

Abstract. Until the disintegration of the former Yugoslavia, SFRY (1991/92), for 74 years (from 1918) people of the region lived in a common country and a single common scientific and cultural-linguistic area (creating a unique school system, founding numerous school-educational institutions throughout the country, educating many generations of students in official Yugoslav languages). During the period between the two World Wars and after World War II Yugoslav chemists (of Yugoslav origin, born on the territory of the former Austro-Hungary), Fritz Pregl, Lavoslav Ruzicka (Ružička) and Vladimir Prelog, with their professional, scientific, practical (experimental) and cultural work, placed themselves (and the country where they were born, educated and gained their first knowledge) among distinguished world scientists, winners and holders of the prestigious international Nobel Prize. The aim of this scientific work is not only to present the lives and work of the abovementioned chemists, Nobel laureates, but also to overcome the existing cultural-political and scientific-educational differences among the former Yugoslav states that undoubtedly share common culture, language and science, which is proven and confirmed by the extensive work of these eminent scientists on the development of science and education in the former SFRY and the promotion of the common Yugoslav science in the world, who all „*former*" Yugoslavs can rightly be proud of.

Keywords: Yugoslav scientists, nobel laureates, chemistry

Introduction

The Former Yugoslavia, i.e. its former states and peoples, gave birth to three distinguished chemists and Nobel laureates in the 20th century.[1)] The reason why these chemists are not recognized as Yugoslav, but as Austrian and Swiss instead, is because they spent most of their lives and work abroad; however, they were born in parts of the former Yugoslavia under Austro-Hungarian reign (Slovenia, Croatia and Bosna and Herzegovina (BiH), from 1878 to 1918 Austria-Hungary). Some of them, like Prelog and Ruzicka, considered themselves Yugoslav, and, through their scientific and professional work, strengthened the links between Yugoslav science and foreign countries in the post-war period (after 1945).

Yugoslav Nobel laureates – chemists

Friderik „Fritz“ Pregl

Pregl was an Austrian chemist and physician of Slovenian origin, born in Ljubljana (German *Leibach*) in 1869 (under the rule of Austro-Hungarian Monarchy at the time). He finished grammar school in Ljubljana. He studied medicine at the University of Graz, which he finished in 1894. From 1894 to 1903 he was an associate lecturer to Professor Alexander Rollett. After the death of Professor Rollett in 1903, Pregl took his place. In 1904 and 1905 he studied at the University of Tubingen (Tübingen) under Professor Gustav von Hüfner (1840 – 1908), then with Friedrich Wilhelm Ostwald (1853 – 1932) at the University of Leipzig, and finally with Hermann Emil Fischer (1852 – 1919) at the University of Berlin. He conducted research in the field of chemical physiology. From 1905 to 1907 he worked at the Medico-Chemical Institute of the University in Graz, where he did research in the field of forensic chemistry. Within this research he examined albumin bodies. Due to lack of materials for the work, he investigated and searched for methods which demanded smaller quantity of substance for analyses of small quantities of elements in the substance. After the Nobel Prize a plethora of foreign students and DSc. seekers arrived in Graz to the Medico-Chemical Institute in order to train the micro-method mentored by Fritz Pregl.

From 1910 to 1913 he was a professor at the University of Innsbruck, where he perfected the method of the quantitative organic micro-analysis. In 1913 he came back to Graz, where he was the Dean of the Medical Faculty in 1916 – 1917, and Vice-Chancellor of the University of Graz in 1920 – 1921.[2)]

He won the Nobel Prize in Chemistry in 1923 for quantitative organic micro-analysis, which improved the technique of combustion train in elemental analysis (he perfected this method working with 3 – 5 mg of substance). He did not receive this prize for the invention of the method but for its development and improvement. Furthermore, he developed various methods for determining groups of atoms and improved the laboratory apparatuses necessary for his work, among which is the sensitive micro-scale.

He was a holder of several more significant recognitions: Lieben Prize for Chemistry (1914), then the title of a honorary doctorate of science at the University of Gottingen (Göttingen; 1920), in 1921 he became a member of the Academy of Science in Vienna. In 1917 his book „*Die quantitative Microanalyse*" was published in Berlin by J. Springer; the second (1923) and the third (1930) editions were published, while the 17th edition was printed in Vienna in 1958. His monograph was translated into English and French.

He died in Graz in 1930 after a short illness, at the age of 61. He never married, and entrusted a considerable amount of money to the Vienna Academy of Sciences and Arts for the development of micro-analysis. Part of the money represented the fund for awards for Austrian chemists who were engaged in this research. Since then the prize „*Fritz Pregl*" has been awarded by the Vienna Academy of Sciences.

Moreover, a square in Ljubljana was named after him. Since 2007 the prize Pregl has been awarded in Slovenia by the National Institute for the research work in the field of chemistry and outstanding achievements in this field.

Lavoslav Ruzicka

Ruzicka was born in Vukovar on September 13, 1887 in a peasant-crafts family[3)] (modern Croatia, District of Slavonia, then under the rule of Austria-Hungary) (Leginović, 1979). He finished school in Osjek, Slavonia. Then he went to Germany to the High Technical School in Karlsruhe, where he met chemist Hermann Staudinger (1881 – 1965). After obtaining his doctor's degree in 1910, he went to Switzerland as Staudinger's assistant (Leginović, 1979).

In 1918 he became a senior lecturer, and in 1923 honorary professor at the ETH in Zurich (Leginović, 1979). In 1921 he began cooperation with perfume manufacturers from Geneva. He was intensively engaged in investigating terpenes as basic raw materials in the perfume industry. In 1927 Ruzicka became a professor of Organic Chemistry at Utrecht University (Holland). In 1930 he returned to Switzerland, became a professor of Organic Chemistry again, and continued research in the area of steroids and terpe-

Lavoslav Ruzicka

nes. It was in his laboratory that the sex hormones androsterone and testosterone were synthesized.

In 1939 he shared the Nobel Prize with Adolf Friedrich Johann Butenandt (1903 – 1995) (for the sex hormones) and for the chemistry of polymethylenes and higher terpenes (Leginović, 1979). Before the very beginning of World War II he brought young experts to Zurich, among which was Vladimir Prelog from the Kingdom of Yugoslavia, who would take over his position of the organic laboratory manager in 1957, when Ruzicka retired. Apart from the Nobel Prize, he was also a holder of eight honorary doctorates, four in science, two in medicine, in life sciences, and in law. He received six medals (four of which were international, two British, two French, one Czechoslovak and one Swiss recognition) in the period from 1923 to 1966.

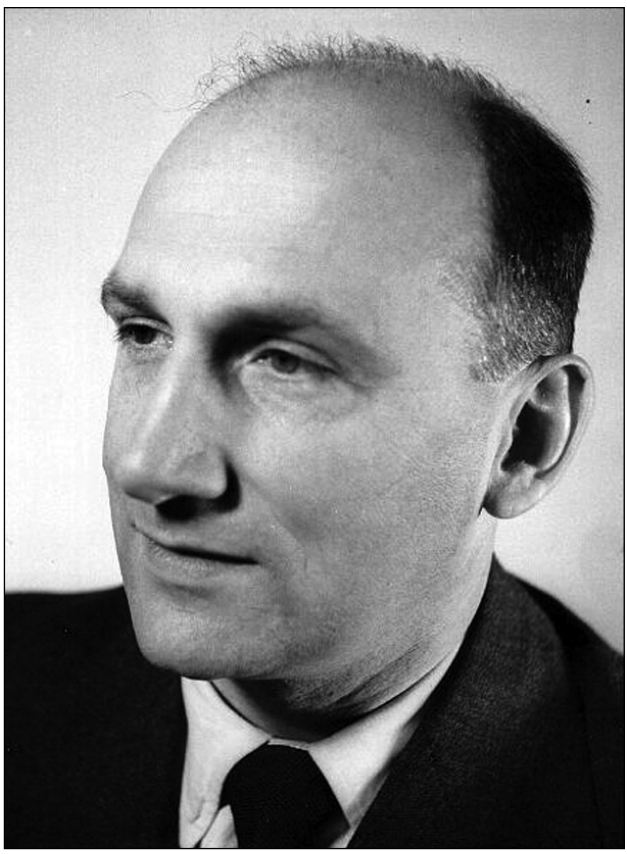
Moreover, he did research in the field of biochemistry, on the issues of evolution and origins of life, as well as biosynthesis of terpenes. He dedicated part of his research-scientific work to the education of young chemists (Vladimir Prelog). He worked on better organization of the academic and scientific work in the former SFRY (Leginović, 1979). He was the founder and the president (Leginović, 1979) of the Swiss-Yugoslav Society. The „*Ruzicka Award*" was established, which has been granted to successful young scientists in Switzerland.

Furthermore, he was first a member of the Serbian Royal Academy (SKA or SANU), first member of the Academy of Natural Sciences from April 9, 1947. He was a regular member of the SANU (Serbian Academy of Sciences and Arts): regular member (Department of Natural Sciences and Mathematics) from March 22, 1948, i.e. Foreign member (Department of Natural Sciences and Mathematics) from 31. VII 1960. Honorary member of the Yugoslav Academy of Sciences and Arts, department in Zagreb. In 1977 a museum was opened in his honour in Vukovar (Croatia) (Leginović, 1979), which was destroyed in the Civil War in 1991.[4)]

He died in Mammern, Switzerland, on the Constance Lake, north of Winterthur (the area of the German Switzerland) on September 26, 1976 (Leginović, 1979). He got married twice but had no children. His hobbies were old Dutch and Flemish paintings, alpine plants gardening and photography (Leginović, 1979).

Vladimir Prelog

Prelog was born in Sarajevo (BiH) on July 23, 1906 (Djokić, 1986), under the rule of the Austria-Hungarian Monarchy at the time. Before the outbreak of World War I (Sarajevo Assassination of Franz Ferdinand on March 28, 1914) he moved to Zagreb with his family, where he finished secondary school. In 1928 he completed his studies of engineering (from the Czech Technical University) in Prague with the title of a chemical engineer, after which he gained a DSc (Djokić, 1986) with Professor Emil Votoček. During the Great Depression (1929 – 1935) he worked in a private laboratory of J. D. Driz in Prague (Djokić, 1986), where he produced rare chemicals that were scarce on the market. In 1935 he was employed at the Technical University in Zagreb, where he lectured on organic chemistry and chemical engineering (Djokić, 1986). In the same year he began his research in the pharmaceutical factory „*Kaštel*" (Djokić, 1986) (today *Pliva*, one of the best-known pharmaceutical factories in the former Yugoslavia, along with the Slovenian Krka). Prior to the occupation of the Kingdom of Yugoslavia in 1941 and due to growing fascism, he fled the country to Switzerland at the invitation of friends, primarily Lavoslav Ruzicka. He continued his research at the ETH in Zurich (Djokić, 1986). In 1950 he was appointed full professor: the Swiss Federal Institute of Technology in Zurich (ETH); in 1957 he became head of the laboratory for organic chemistry at the



Vladimir Prelog

Federal Institute of Technology in Zurich (1957 – 1965), where Ruzicka had worked before him (Djokić, 1986). In 1959 he became a Swiss citizen. He was known as an excellent lecturer and mentor to numerous students.

At the time he was engaged in the research of stereochemistry, aspects of hilaritet (Djokić, 1986). Moreover, he distilled adamantane from oil, which has the structure of the diamond ($C_{10}H_{16}$;cycloalkane ant the simplest diamondoid). He (with Robert Sidney Cahn (1899 – 1981) and Christopher Kelk Ingold (1893 – 1970) formulated the so-called Cahn-Ingold-Prelog priority rule (introduced the so-called R/S system in organic chemistry), which describes and determines the stereochemistry of molecules (Djokić, 1986).

He was also a Foreign member of the SANU (Serbian Academy of Sciences and Arts) from mid-1981: Department of Natural Sciences and Mathematics. He became a Honorary member of the Croatian Academy of Sciences in 1986.

The Nobel Prize in Chemistry was awarded to him in 1975 (along with John W. Cornforth (b. 1917); stereochemistry of enzyme reactions) for work in the field of the stereochemistry of molecules and their reactions (Djokić, 1986). Furthermore, he was a Dr. h.c. at the following universities: in Zagreb, Liverpool, Paris, Brussels, Cambridge. He was awarded the *Prix Marcel Benoist* in1965, then the *Roger Adams Award* in 1969. He was a recipient of the Order of the Yugoslav Star with Sash (1977) and Order of the Yugoslav Flag with Golden Wreath (1986).

He died in Zurich (Switzerland) on January 7, 1998 at the age of 92. His ashes were interred at the Mirogoj cemetery in Zagreb. Although he declared himself a world citizen and Swiss patriot, there are still numerous debates on his nationality and citizenship because he was born in multiethnic Bosnia, grew up in Zagreb, and was a Yugoslav citizen.

Conclusion

Historically, culturally, scientifically and linguistically, the total number of Nobel laureates in the territory of the former Yugoslavia is four: three Nobel Prizes for Chemistry (in the field of science) and one in the field of Literature (Ivo Andric). It may be interesting to mention that the best-known and most respected Serbian scientist and inventor Nikola Tesla was born in Croatia, region Lika, northern Dalmatia, Croatia (the former Military Frontier), while novelist and writer Ivo Andric was born into an intermarriage (Serbo-Croatian) in BiH. Ruzicka was of Czech-German descent, while Prelog was of Croatian descent and born in BiH, studied, worked and lived in the Kingdom of Yugodslavia. Pregl was of Austrian-Slovenian descent and born in Ljubljana (Slovenia). Their multi-ethnic background, a common language and culture (the former yugoslav scientific and cultural-linguistic realm) testify not only to the overall contribution of Yugoslav scientists to European and world science but also generally to the common Yugoslav science and culture in the 20th century. With their professional, scientific and even cultural work, these scientists strongly promoted the development of the science and society in the former Yugoslavia in the period after World War II.

NOTES

1. Officially, there was only one Yugoslav-Serbian Nobel laureate, in the field of literature, writer Ivo Andric (Nobel prize for Literature, 1961).
2. There is a museum dedicated to the life and work of Fritz Pregl and forenzic chemistry at Karl-Francenz University in Graz. In February 2008 the author of this article, as a scholar of this Faculty, later as a DSc student (for a month), visited the namesake Museum of Fritz Pregl.
3. Lavoslav's great-grandfather had originally been a Czech, who had settled in Slavonia from the area of Upper Austria. His wife, Lavoslav's great-grandmother, had come from the old German area of Wurtemberg or Württemberg.

4. Nowadays there is an open conflict of the two former Yugoslav republics, Serbia and Croatia (Ruzicka was born in Vukovar in the territory of present-day Croatia, region Slavonia. In the period from 1991 to 1995, it became part of the Republic of Srpska Krajina, formed during the Civil War in the former Yugoslavia) over the nationality of Ruzicka and his patriotic orientation. Was he a Yugoslav, Croatian or Serbian scientist? Certainly, historical and scientific facts speak in favor of the fact that he was primarily a Yugoslav scientist, who spent most of his life and work abroad (Switzerland). He was also largely engaged in the development of science in the former SFRY, and, as a member of the Yugoslav Academy of Sciences and SANU, he equally belonged to both.

REFERENCES

Leginović, M.B. (1979). *Nobelovac - hemičar Lavoslav Ružička*. Bačka Palanka: Amaterska muzeološka sekcija jugozapadne Bačke.

Djokić, S. (1986). *Vladimir Prelog; 50 godina znanstvenoistraživačkog rada u Plivi*. Zagreb: Istraživački institut.

✉ **Mr. Milan Stojkovic**
School of Chemistry and Sciences,
Working Group Teaching of Chemistry,
Friedrich-Schiller-University of Jena,
August-Bebel-Street 6-8
07743 Jena, Germany
E-mail: milan.stojkovic@uni-jena.de