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The first independent pharmacognosy institute in the world and its founder Julije Domac (1853–1928)

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Received February 23, 2011, accepted April 8, 2011

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Pharmazie 66: 720–726 (2011) *doi: 10.1691/ph.2011.1025*

The aim of this article is to describe the foundation and development of the first distinct Institute of Pharmacognosy in the world and to provide a biography of its founder Julije Domac. The Institute was founded in 1896 as a separate institution at the University of Zagreb, Croatia, part of the Austro-Hungarian Empire at the time. In other European university centers, pharmacognosy institutes were founded together with pharmacology, botany, pharmaceutical or general chemistry. Julije Domac (1853–1928) graduated pharmacy from the University of Vienna (1874) and received his Ph.D. from the University of Graz (1880) with a paper elucidating the structure of hexene and mannitol obtained from manna. He lectured pharmacognosy at the University of Zagreb (1887–1924), wrote chemistry and pharmacognosy textbooks, and co-wrote the Croatian-Slavonian Pharmacopoeia.

1. Introduction

The establishment of the modern University of Zagreb (1874) and its natural science departments (1876) opened the way for the development of natural and mathematical sciences in Croatia (Kućan 1996).

The efforts of pharmacists and professors from the Faculty of Philosophy in Zagreb established *Farmaceutski učevni tečaj* (1882), pharmaceutical university studies at the Faculty of Philosophy (Memorial book 1900). Julije Domac started to teach Pharmacognosy as a *suplent* (part-time lecturer) in 1887, then as an associate professor (1896), a full professor (1899), and finally as the founder and director of the *Institute of Pharmacognosy* (1896) at the University of Zagreb. In other European university centers, pharmacognosy institutes were not independent, but operated together with botany, pharmacology, general chemistry, pharmaceutical or technological chemistry (Vrgoč 1936).

2. Genealogy of Julije Domac

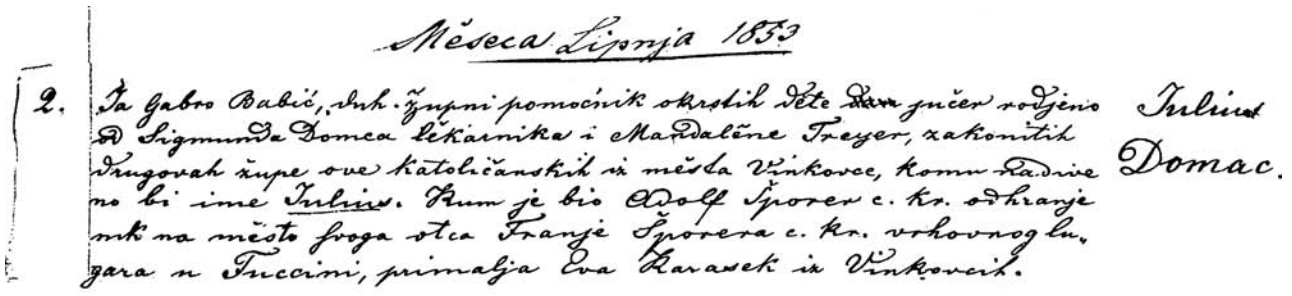
Historical records of the family of Julije Domac are going back to the 17th century, when they lived near Mostar in Bosnia and Herzegovina. Fleeing from the Turks, they moved to Croatia, to the village of Andrijevci near Slavonski Brod in the region of Slavonia. A part of the family moved to the village of Privlaka near Vinkovci, where they founded a large family. During the demobilization of the Military Frontier (the Austro-Hungarian military organization on the border with the Ottoman Empire), one of the descendants, Mato Domac, bought a pharmacy in Vinkovci from the military authorities in 1804. The pharmacy, called *Zum Österreichischen Adler* (*At the Austrian Eagle*), was opened in 1806.

When Mate Domac died, the pharmacy was inherited by his son Josip Domac (1784–1839), who had six children. His youngest son Sigismund (1814–1887) studied pharmacy in Budapest. After his father's death in 1839, he took over the pharmacy. He was briefly the mayor of Vinkovci. He married Magdalena Treyer (1822–1907), with whom he had five children: Franz (1842–1885), Alojzija (1843–1843), Sophie (1848–1931), Alfred (1850–1869) and *Julije* (1853–1928). After twenty years of marriage, Magdalena left Sigismund and went to Vienna, where she remained for the rest of her life. When he was sixty, Sigismund got sick and called his youngest son Julije, who graduated pharmacy in 1874, to take over the family pharmacy. Julije Domac came back and took over his father's pharmacy in Vinkovci. Soon he married Judita Albrecht (1858–1922), with whom he had six children: Božidar (1879–1941), Matija (1881–1942), Wilhelmina (1884–1965), Julije (1886–1933), Branimir (1889–1962) and Judita (1891–1967) (Inić 2009).

2.1. Biography of Julije Domac

Julije Domac was born in Vinkovci on 1 June 1853 as the fifth and youngest child. His name was entered into the birth register as Julius (Fig. 1), but he often used the name Julije in his works. His education and vocation were strongly influenced by his father, Sigismund Domac, who was a pharmacist and the owner of a pharmacy.

After three years of pharmacy practice, which he undertook in his father's pharmacy while attending a gymnasium, Julije passed the pharmacy practice exam (*Tyro exam*) in 1871 (Fig. 2). Next year, he graduated from the gymnasium with excellent marks. Aside from Croatian, Domac learned German, Latin and Greek. He also had calligraphy classes and played violin. In all the grades, his general success was described as: *highest mark with excellence, No. 1*, except the seventh grade: *highest mark with excellence, No. 2*.


Měseca Lipnja 1853

2. Ja Gabro Babić, duh. župni pomoćnik okrstih dete Dara gučer rođeno
od Sigmunda Domca ljekarnika i Magdalene Freyer, zakonitih
drugovah župe ove katoličanskih iz města Vinkovce, komu kadrive
no bi ime Julius. Kum je bio Adolf Šporer c. kr. odhranje
nik na město svoga otca Franje Šporera c. kr. vrhovnog lu,
gara u Treccimi, primalja Eva Karaseki iz Vinkovcih.

Julius
Domac.

Fig. 1: **E**ntry relating to Julije Domac in the register of births (1853), with the generous permission of the Archdiocese Central Archives in Đakovo, Croatia

In 1872, Domac became a student of pharmacy in Vienna (Fig. 3) where he spent four years attending lectures in natural sciences. Zoology was lectured by Prof. L. K. Schmarda (1819–1908) and K. F. Claus (1835–1899), botany by Prof. E. Fenzl (1808–1879) and J. A. Böhm (1833–1893), mineralogy by Prof. A. E. Reuss (1811–1873) and G. Tschermak (1836–1927), geology by Prof. E. Suess (1831–1914), physics by Prof. V. Lang (1838–1921). Chemistry lecturers were globally renowned: Prof. A. Lieben (1836–1914), F. Rochleder (1819–1874) and F. C. Schneider (1812–1897). Pharmacognosy was lectured by Prof. A. E. Vogl (1833–1909), and history of philosophy with logic and aesthetics by Prof. R. Zimmermann (1824–1898) and F. Brentano (1838–1917). Domac graduated pharmacy in Vienna in 1874.

At the third year of his studies, Domac went to the chemical laboratory of Prof. Lieben, where he did scientific work. At the same time, he specialized in microscopic pharmacognosy exercises with Prof. Vogl.

Because of his father's illness, Domac left Vienna University (1876) and returned to Vinkovci, where he took over the family pharmacy. However, since he was asked by many of his professors, especially Lieben, to rededicate himself to science, and as he liked university teaching, he sold the pharmacy (1879). With the recommendation of Prof. Lieben, he went to the new university chemical laboratory in Graz, to work for the world-renowned Prof. Leopold von Pebal (1826–1887). In accordance with Lieben's wishes, Domac made gas analyses that were beyond the capabilities of the Vienna laboratory at the time (Batistić and Mirković 1924).

In 1880, he received a Ph.D. in Philosophy and Pharmacy from the University of Graz (Fig. 4) with the thesis: *Über das Hexylen aus Mannit* (Domac 1880). His work determined the place of the double bond in hexene obtained from alcohol mannitol and proved that it was a derivative of normal hexane. It also proved the structure of mannitol, extracted from *manna* (dried juice of flowering ash, *Fraxinus ornus* L.), which had been unknown until then.

He independently published the results of his Ph.D. research in *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften* (Domac 1881a) and in a Viennese chemical journal, *Monatshefte für Chemie* (Domac 1881b). His second research paper, *Über die Einwirkung der Unterchlorsäure auf Hexylen*, was published in *Justus Liebig's Annalen der Chemie*, a leading chemical journal of the time (Domac 1882). In that paper, Domac described the reaction between hexene and chlorine dioxide and confirmed the structure of hexene obtained from mannitol. His papers were reviewed in *Beilstein's Handbuch der organischen Chemie* and in *Chemisches Zentralblatt*. It was suggested that J. Domac may be recognized as the first Croatian in the chemical sciences in the modern meaning of the term (Grdenić 1999).

By publishing scientific papers, he met the conditions to qualify as assistant professor in chemistry at Vienna University in 1882. However, his financial difficulties (he lost his property in an unfortunate turn of events) forced him to interrupt his university career and go back to Vinkovci (which was bad for science but good for Croatian pharmacy). He wanted to work as a teacher, so he refused several jobs in the chemical factories


Nos infrascripti lecturis volumus facimus, ingenuum ac probum adolescentem

Domatz Julium

patria Winkovcensem, tirocinio apud dominum Domatz Sigmundum, artis pharmaceuticae magistrum, a die XV mensis Augusti anni MDCCCLXXI per annos tres debite peracto nobis ab illius magistro ad obtinendum artis pharmaceuticae sodalitium praesentatum fuisse. In hunc ergo finem eundem juxta ritum praescriptum ex arte pharmaceutica tentatum et laudabilis facti progressu edentem specimina artis pharmaceuticae sodalem agnovimus ac declaramus. In quorum fidem et pacem litterae sigillo gremii pharmaceutici munitae ac nostra manu subscriptae tribuimus.

Winkovce, die [illegible] Augusti MDCCCLXXI.

Fig. 2: *Tyro* diploma of Julije Domac for passing the pharmacy practice exam (1871), Inventory No. P4301, courtesy of the Town Museum of Vinkovci (TMVk), Croatia

Fig. 3: Domac as a student of pharmacy in Vienna (around 1874). Original photo in the possession of the Domac family

of Vienna (Archives 1895). After returning to Croatia, Domac was appointed temporary assistant teacher at the Royal Great Gymnasium in Zemun in 1882 (Report 1883). Next year, he passed the state exam in Vienna for secondary school teachers of chemistry and natural sciences. By the order of the Royal Government in Zagreb, he became a full professor at the same gymnasium in 1884 (Report 1884), where he worked until 1886, when he went to the Royal Great Gymnasium in Zagreb.

In 1887, Domac was appointed as *suplent* of pharmacognosy at the University of Zagreb. It means he had two jobs, as a university *suplent* and as a secondary school professor, until 1896, when he became associate professor of pharmacognosy (Archives 1896). The fact that his annual salary as an associate professor was 540 florins losses than his salary as a secondary school teacher and a university *suplent* shows his love for imparting experience and knowledge to pharmacy students.

To advance his knowledge, Domac traveled across most of the Austro-Hungarian Monarchy, visiting the Royal University of Budapest and the universities of Prague and Innsbruck. He went all over Germany, Switzerland and Italy, including a longer stay in Paris and a shorter one in London, examining the organization of chemical, pharmaceutical and polytechnic university institutes.

Domac was a full professor of pharmacognosy from 1899 untill his retirement in 1924. He was the dean of the Faculty of Philosophy in 1901/02 (Archives 1901) and the rector of the University of Zagreb in 1911/12 (Archives 1911).

Aside from the mentioned scientific papers, Domac published textbooks on organic and inorganic chemistry, a university pharmacognosy textbook, the pharmacognosy section of the Croatian

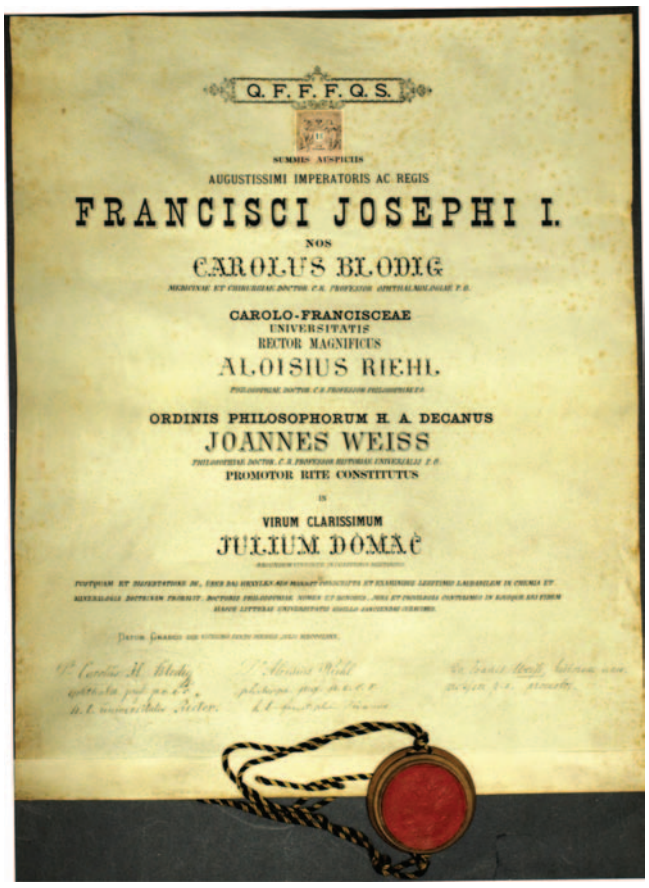


Fig. 4: Ph.D. diploma of J. Domac from the University of Graz (1880), Inv. No. P4303, courtesy of TMVk.

pharmacopoeia, and numerous specialized and popular scientific papers related to chemistry and pharmacognosy.

In 1955, the Croatian Pharmaceutical Society introduced the *Julije Domac Medal* as an award for exceptional achievements in pharmacy.

3. The foundation of the modern University of Zagreb (1874) and its natural science departments (1876)

In 1669, the emperor and king Leopold I issued a decree in Ebersdorf whereby the *Academy of Zagreb* received its university rights and privileges, as well as the authority to award academic titles. However, 1874 is considered the year when the University of Zagreb was founded as a modern university. The law of 05

Fig. 5: The university chemical department building at the Academy Square (today's Strossmayer Square 14), where the Pharmacognosy Institute was initially located. Photo around 1895.

January 1874 founded the *Royal University of Franz Joseph I in Zagreb* (Memorial book 1875). At the time, the Department of Mathematics and Natural Sciences of the Faculty of Philosophy had the following curriculum: mathematics, physics, chemistry, mineralogy and geology, zoology and botany. It was necessary to find qualified lecturers and to equip the cabinets and laboratories with scientific instruments and collections. For this reason, lectures in these subjects began two years later, in 1876.

Professors were selected among candidates from other Central European university centers (Prague, Vienna and Budapest), who had studied under renowned scientists (A. W. Hofmann, A. Lieben, E. Mach and others). Having arrived in Zagreb, they brought contemporary scientific knowledge to the university and significantly influenced the development and organization of scientific research in Croatia in the late 19th century. It opened the University not only to the humanities, but also to natural sciences and mathematics (Dadić 1982).

3.1. The foundation of Pharmacy studies at the University of Zagreb (1882)

The order of the Royal State Government Department for Religion and Teaching of 11 October 1882 founded the university studies of pharmacy in Zagreb, called *Farmaceutički učevni tečaj* (Pharmaceutical Teaching Course), within the Faculty of Philosophy.

The Faculty of Philosophy already had the departments and professors for the basic subjects: chemistry, physics, mineralogy, botany and zoology. For pharmacy studies to start operating, they needed to found the department of pharmacognosy and pharmaceutical chemistry and to create a botanical garden of medicinal herbs. Therefore, pharmacists and professors from the Faculty of Philosophy worked from 1877 to 1882 to introduce pharmaceutical studies at the University (Memorial book 1983).

At that time, according to the regulations of the Austrian part of the Monarchy, pharmaceutical studies were associated with medical studies, so it was concluded that the foundation of pharmaceutical studies would be deferred until the establishment of a faculty of medicine. However, the opening of the Faculty of Medicine was not even discussed yet, because of the lack of funds (it started operating only in 1917).

The Faculty of Philosophy and the Academic Senate tried to establish pharmaceutical studies so that the Department of Mathematics and Natural Sciences of the Faculty of Philosophy could be as complete as possible before the opening of the Faculty of Medicine. In 1881, three professors from the Faculty of Philosophy: G. Janeček (1848–1929), professor of chemistry, B. Jiruš (1841–1901), professor of botany, and V. Dvořak (1848–1922), professor of physics, submitted a final proposal for the establishment of pharmaceutical studies to the Faculty Council (Malnar and Grdinić 1983).

The decision of the Emperor Franz Joseph I of 4 October 1882 and the order of the Royal State Government Department for Religion and Teaching of 11 October of the same year opened university pharmaceutical studies in Zagreb, called Pharmaceutical Teaching Course, and approved the "scientific basis and examination course for MA and Ph.D. in pharmacy". It would be attended by pharmacy interns, as part-time university students, who had successfully completed at least four grades of comprehensive school, did some practice in a public pharmacy, passed the related exam, and worked as pharmacy assistants in a public pharmacy for another two years.

At that time, it was a two-year course. First year included the basic natural science subjects: physics, mineralogy, zoology, botany and general (inorganic and organic) chemistry. Second year had subjects in pharmaceutical chemistry and pharmacognosy, as well as laboratory work. According to the *scientific basis* from 1882, there were three rigorous exams: two theoretical, in basic and specialized subjects (pharmacognosy, chemistry, pharmaceutical chemistry, knowledge of pharmacy laws and orders) and one practical (analytical chemistry). A pharmacy Ph.D. required a maturity exam, excellent marks in all three MA exams and one year of theoretical studies of chemistry. Candidates had to write a scientific paper in chemistry and pass the fourth rigorous exam. The same rules applied as for a philosophy Ph.D. (Memorial book 1934).

At the time, Southeast Europe had no other higher education institution for pharmacy, so students from Bulgaria, Serbia, Slovenia and other neighboring countries came to Zagreb to study pharmacy.

Pharmacognosy (the science of medicinal raw materials of natural origin) was taught by Prof. Bohuslav Jiruš. The *scientific basis* required the subject to be taught three hours per week in both second-year semesters, but only in theory. Although it was not obligatory, attending students could do practical exercises in the *microscopic diagnosis of drugs*. Professor B. Jiruš founded the pharmacognosy collection, which was the basis for teaching pharmacognosy. By 1886, the collection consisted of around 850 specimens of drugs and a large number of pharmacognosy samples for the microscope. After Professor Jiruš left for Prague (1886), pharmacognosy was taught by the *suplent* Gustav Janeček. Upon the proposal of the Faculty Council of the Faculty of Philosophy, and by a government decision, Julije Domac was appointed *suplent* of pharmacognosy in October 1887. He became associate professor of pharmacognosy in 1896, at the time of a fundamental change in the "scientific basis of pharmaceutical training and examination course for pharmacy MA". Pharmacognosy was taught eight hours per week in both semesters of the second year, "with theoretical lectures and microscope practice", which gave pharmacognosy the prescribed number of hours for full professorship. Domac was appointed full professor of pharmacognosy on 3 May 1899 (Archives 1899b).

3.2. Julije Domac founds the Pharmacognosy Institute of the University of Zagreb

The Pharmacognosy Institute (later also called *Department of Pharmacognosy*) was founded by Julije Domac and opened on 22 March 1896 (Library 1896a). The establishment of the Pharmacognosy Institute was approved by the State Government Department for Religion and Teaching in its reply of 14 January 1896 (Library 1896b).

The Pharmacognosy Institute was the fourth scientific department at the University of Zagreb, after physics, botany and chemistry. By separating the pharmacognosy institute from the botanical one, Prof. Domac was the first to turn pharmacognosy into an independent science in practice (Vrgoč 1924; Minařik 1971). At other European universities, pharmacognosy institutes did not operate as independent institutions.

A. E. Vogl (1833–1909), the pharmacognosy professor of Domac, was the director of the pharmacological and pharmacognosy department, a single unit of the Vienna University (Domac 1910). In the pharmaceutical institute of Innsbruck, the pharmacognosy department was founded together with the pharmacology in 1886. The founder and director of these two departments was Vogel's student J. Moeller (1848–1924). Only in 1925, pharmacognosy and pharmacology separated into independent institutes (http://www.uibk.ac.at/). In 1893, Alexander. Tschirch (1856–1939), a professor of pharmacy and pharmacognosy in Bern, founded a pharmaceutical institute

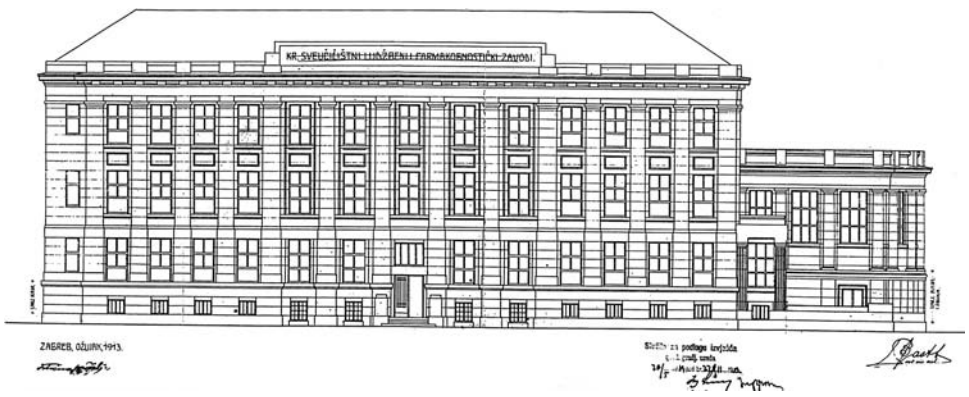


Fig. 6: Project for the front of the Chemistry and Pharmacognosy Departments building from 1913 at the Mažuranić Square (today's Marulić Square 20), Zagreb, courtesy of the State Archives in Zagreb, Croatia.

where the pharmacognosy department operated together with pharmaceutical chemistry and applied botany (Friedrich and Schmidt 1990). The Pharmacognosy Institute of the University of Budapest separated from the Pharmacology Institute only in 1914, when it was renamed the Institute for Pharmacognosy and Toxicology (http://www.sote.hu/).

Pharmacognosy started developing as a part of pharmaceutical sciences in the 18th century. Its founders were J. B. G. Guibourt (1790–1867), a French pharmacist, J. Pereira (1804–1853), an English pharmacist and physician, and T. W. C. Martius (1796–1863), a German pharmacist who determined its goals and tasks. Great contributions to the development of European pharmacognosy were made by F. A. Flückiger (1828–1894), a Swiss pharmacist and pharmacognosy professor at the University of Bern, and later a professor and director of the pharmaceutical institute in Strasbourg, D. Hanbury (1825–1875), an English pharmacist, A. E. Vogl, and A. Tschirch (Schelenz 1904; Med. Encyclopedia 1967).

The first location of the Pharmacognosy Institute was the first floor of the university chemical department building at the former Academy Square in Zagreb (today's Strossmayer Square 14) (Fig. 5).

The interior of the Institute was designed according to the preliminary design of Julije Domac. They had a microscope room, a pharmacognosy collection, a hall for student practice, a professor room, a registry and a storage area. On 10 February 1896, Domac wrote a cost estimate for furnishing the Pharmacognosy Institute and sent it to the State Government Department for Religion and Teaching. His cost estimate included masonry and carpentry, furniture and a *List of teaching equipment, instruments and utensils, which should be obtained for the furnishing of the Pharmacognosy Institute*.

For the initial construction and furnishing of the Pharmacognosy Institute, the state government approved the requested amount of 3,762 florins and 37 cents. (1,200 florins for engineering works, 620 florins for carpentry, 213 florins for furniture and 1,729 florins and 37 cents for the learning equipment and instruments. In 1898, another 662 florins and 77 cents were approved for the completion of the pharmacognosy collection (Archives 1898).

The institute had enough space for twenty students (and more if needed). The pharmacognosy collection contained around 1,400 samples of drugs, exhibited in cylindrical glass jars and boxes, as well as some 300 permanent microscope samples. The collection was put in a special room. The specialized library included books about pharmacognosy and similar disciplines, as well as the scientific journals of the age. With time, another ten microscopes were procured, which made it possible for more than thirty students to be present, while the drug collection increased

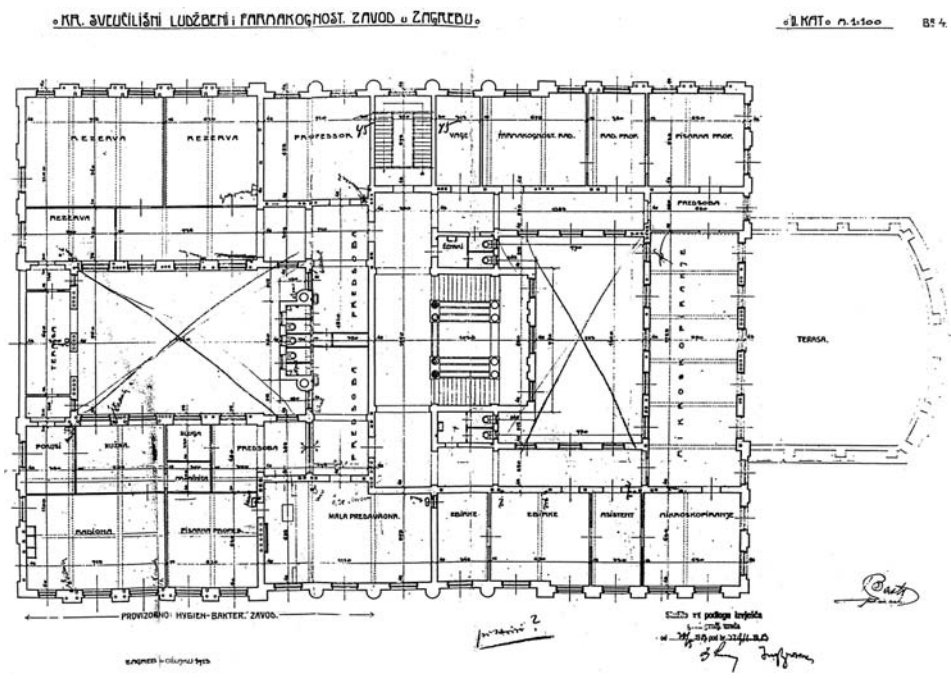


Fig. 7: Project for the Pharmacognosy Departments according to the idea of J. Domac (1913), courtesy of the State Archives in Zagreb, Croatia.

to 1,800 samples (Memorial book 1925). Today, the collection has more than 3,000 drugs.

The rising number of students and the introduction of modern teaching practices created the need for a bigger space. In 1913, construction started on a new building, with the intention to contain the Chemical and Pharmacognosy departments (Fig. 6). The Pharmacognosy Department was constructed according to Domac's design (Fig. 7).

During the First World War, the building was unfinished, but it had a roof, so it was used for the needs of the army. When the war ended in 1918, it was used by French soldiers (Deželić 1977). In 1920, the building was given over to the town authorities, which used it for the recently established chemistry laboratory of the Technical College. In the same year, Domac wrote to the dean of the Faculty of Philosophy: "*. . .I hope that the new chemistry laboratory, which has been ceded to the Technical College, will be returned by the Government to the University for the needs of the Pharmacognosy Department...*" (Archives 1920). Thanks to the efforts of Prof. Domac, the second floor of the new building welcomed the Department of Pharmacognosy, which still stands at the same place as part of the Faculty of Pharmacy and Biochemistry.

Considering the arrangement and purpose of the rooms, Domac, as the director of the Department, ensured the conditions for the development of teaching and scientific research. Figure 7 shows that the Department had 12 rooms, a large microscope hall with 44 seats and a smaller microscope hall with 16 seats. Next to the professor's room, there was a microscope room intended for the professor and a spacious room with five chemical desks for pharmaceutical/chemical research of drugs for scientific purposes and a specially separated room for analytical balances. Two rooms were intended for the drug collection, including a small lecture room. A specialized library contained around 500 specialized books and the most important scientific journals of the time.

Even today the library of the Department of Pharmacognosy contains a collection of rare old books and manuscripts, such as the *incunabula* (books printed in Europe in the 15th century) called *Hortus sanitatis* (The Garden of Health) by Joannes de Cuba from 1498, *Kräuterbuch* by Hieronymus Bock from 1546, and *Commentarii in libros sex Pedacii Dioscoridis de materia medica* by Pietro Andrea Mattioli from 1544 (Grdinić 1997).

In 1996, to celebrate the centenary of the Pharmacognosy Institute of the University of Zagreb, founded by Julije Domac, a special stamp was printed with the portrait of Prof. Domac.

4. Conclusion

The foundation of the modern Croatian University of Zagreb (1874) and its natural science departments (1876) opened the way for the development of natural and mathematical sciences. A pharmaceutical course was founded at the Faculty of Philosophy (1882), as the only pharmaceutical study in Southeast Europe.

In 1887, Julije Domac taught pharmacognosy as a *suplent*, then as an associate professor (1896) and as a full professor (1899). He was the founder and director of the Pharmacognosy Institute of the University of Zagreb. The foundation of the Institute is important because it was the first independent institute of its kind in the world. In other European university centers, pharmacognosy and its departments operated together with botany, pharmacology, general chemistry, pharmaceutical or technological chemistry.

Domac made his greatest contribution to science in Vienna, which had better conditions for the advancement of science at a time when Croatian science had only just started its development through university institutions. His independent science papers solved the structure of hexene and mannitol. When he published these papers in international journals of chemistry, he became the first Croatian to give a valuable contribution to chemistry.

After he returned to his homeland, his scientific research was less intense, because he dedicated himself to the foundation and development of the study of pharmacy at the Zagreb University.

Acknowledgments: We are grateful to all those who helped gather documents and photos for this manuscript: Danijel Petković (Town Museum of Vinkovci, Croatia), Marko Landeka (Croatian State Archives in Vinkovci), Vlatko Dolančić (Archdiocese Central Archives in Đakovo, Croatia), the Domac family (Julija and Julije Domac), Ivan Kurjak (Archives of the Faculty of Philosophy, University of Zagreb), Archives of the University of Zagreb, State Archives in Zagreb and the Library of the Pharmacognosy Department of the Faculty of Pharmacy and Biochemistry, University of Zagreb.

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