A HISTORY OF CHEMISTRY IN TURKIYE FROM 1700 to 1913

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The adventure of the Islamic civilization in human history is remarkable. The Islamic civilization was followed by a rapidly rising and developing construction process, unprecedented in any other civilization. Only the Islamic Civilization was founded on a scientific structure. It is clear that, although the power that establishes civilizations is thought to be concrete things such as technology, art and architecture, the driving forces behind all these concrete achievements and power are mentalities with comprehensive and analytical thinking ability and implemented ideas. According to some scholars, “Chemistry” means “black” in the Ancient Egyptian language, while according to others, it is derived from the Greek word “khymeia” meaning “to melt”. Within the scientific tradition, Islamic scholars have given names to chemistry such as el-hikme, ilmü’l-hacer, ilmü’t-tedbîr, ilmü’s-san’a and ilmü’l-mîzân. With these definitions, they accepted that chemistry is not only a theoretical science but also a technical business, and that it envisages the idea of measure and balance. In el-Fihrist, İbnü’n-Nedîm recorded the science of chemistry with the terms ilmü’s-san’a, ilmü sınâati’l-kîmiyâ’ and sınâatü’l-kîmiyâ’. Islamic scholars such as Harizmi and Ibn Sina considered chemistry a sub-branch of natural sciences. The introduction of chemistry to the Islamic world began with Muslim scholars following the legacy of the ancient chemists of the Alexandrian School.

BURSALI ÖMER ŞİFAİ (1742)

"The Father of Iatrochemistry in Ottomans"

Ömer Şifai from Bursa, is one of the 18th century physicians and is originally from Sinop. There is no information about the birth date of Şifai, who is the grandson of the scholar Sheikh Hasan Fatih and the son of the physician Abbas Efendi, who was the head of medicine. (They are known as Kasabzade). Having lost his parents at an early age, Şifai firstly goes to Konya and then to Cairo for his education. Meanwhile, he becomes a member of the Mevlevi sect and rises to the rank of ''dede''. He focused on his studies on medicine in line with the suggestion of Sheikh Hasan Halveti. He learns Latin and French languages and reads medical works written in these languages. There is a rumor that he studied medicine in Italy. After completing his education, he returned to Bursa and continued his duties as a physician and chief physician at Yıldırım Hospital until 1742 (1746 in some sources). He is known as "Bursalı Ömer Şifai Dede" because he worked and died here.

Although he was raised in Islamic culture, Şifai was influenced by the Westernization movement that started in the Ottomans and included iatrochemistry in his works. Spread of iatrochemistry has occurred due to the development of chemistry and biology as well as the advancement of technology. Salih b. Nasrullah and Ömer Şifai from Bursa made translations under the influence of the iatrochemistry movement. Şifai, who was the teacher of Ali Münşi from Bursa, is one of the leading names of the iatrochemistry movement in the Ottomans, founded by Paracelsus (1493-1541) in the 16th century. Although the iatrochemistry movement was not accepted at the beginning, it became widespread due to its adoption in the 17th and 18th centuries and influenced the physicians in the Ottoman Empire. He is generally on medicine, but it is also known that he has three works on chemistry. These works written in the field of chemistry are:

- Mürşidü'l-Muhtar fi İlmi'l-Esrar
- Cevheru'l-Ferid fi Tıbbi'l Cedid (Tıbb-ı Cedid-i Kimya)
- Minhacü'l-Şifa fi Tıbbi'l Kimyai

Ömer Şifai's work known as "Mürşidü'l-Muhtar fi İlmi'l-Esrar" includes various metals and compounds formed as a result of applying certain chemical treatments to these metals. It is explained which disease these compounds should be used in and how they should be used. It can be described as an important work on ancient chemistry. The work named "Dibacatü Murşid el-Muhtar fi İlm el-Asrar" is the introduction part of this work and a copy of the work is located at Istanbul University. The introduction section includes the following regarding the content of the work: The first tutorial is on the distillation of acids; The second training is on the distillation of volatile chemicals; third drill, distillation of rare oils; The fourth training is on the extraction of mercury and minerals known as "ecsad" in ancient chemistry. Fifth drill, removal of sulfur; sixth drill, removal of salts and sulfuric acid; seventh drill, obtaining frequently used distillates; The eighth training is about getting rid of calcification and foreign substances. The ninth training is about dyes extracted from mines and chemicals; tenth training, artificial lead extracted from incomplete mines; eleventh, training in the philosopher's stone and obtaining gold from it; the twelfth drill is about various arts related to chemistry.

This work of Ömer Şifai is different from the works of the alchemical period. It can also be seen as the beginning of the transition to the modern chemistry period in the Ottomans. However, the work is important in the context of the emergence of chemical terminology in the Ottomans. The edition-critique of this text was made and translated into today's Turkish. The work reveals the studies on chemistry in the 18th century. The names of the work are not the same in all copies of the work, which has copies in different places such as Izmir Museum, Istanbul University, Cerrahpaşa History of Medicine, Manisa Museum, British Museum.

Although it is stated in Bedi N. Şehsuvaroğlu's work titled Turkish Medical History that Şifai's second and third works are different works, in the article titled "Ömer Şifai, a Representative of the Iatrochemistry Movement in the Ottoman Empire" by Esin Kahya, It is stated that the works named "Cevheru'l-Ferid fi Tıbbi'l Cedid" and "Minhacü'l Şifa fi Tıbbi'l Kimyai" are different copies of the same work. In this work, the author's name is "Ömer Şifai b. Sheikh Hasan Sinob''.

In his work, Şifai primarily includes the opinions of medical scholars, but also adds his views on iatrochemistry. Şifai states that iatrochemistry is actually based on alchemy, basically on the views of Hermes Trismegistus (3rd century BC). The work includes the ideas of not only Paracelsus, but also scientists such as Sennert (1637) and Cordelius (b. 1546). In the work, the relationship between the earth and the universe is mentioned, and the mutual relationship between humans and the basic structures of living and non-living beings is also included. It also emphasizes the importance of fire in

Chemistry of Ottomans at the 18th century.

the analysis and synthesis of matter. If there is a relationship between living and nonliving beings based on the laws of chemistry, then the physician must have knowledge of chemistry. One should know not only the minerals and their uses, but also their components, structures and effects on living things. It is necessary to use chemicals to treat it.

In this case, a physician who does not have knowledge of chemistry should not use them, because they may cause harm rather than cure. For this reason, Ömer Şifai provides information about some chemical compounds and mixtures such as alcohol, salt and stone. Şifai offers lots of information about healing waters in his works. Healing waters, which contain many beneficial substances in their structure, purify and treat the human body, therefore, they are quite useful. In addition, potions and alcohol are also mentioned in the work. According to Şifai, the basic ingredients are alcohol, water and oil. While the components of alcohol are explained in the work, he also mentions that a still was used during its synthesis. In his description of the still, he states that obtaining alcohol is a chemical process. He states that alcohol production is basically based on color change and that alcohol is obtained by treating some metals. The first information about alcohol production is found in Egyptian papyrus (Leiden papyrus). According to Şifai, colors are symbols of some metals. When the color changes, the structure of the substance also changes. He also stated in the work how paints and compounds made from paint were prepared. In the section on oils, especially vegetable oils such as rose, olive and walnut oil are emphasized.

Balsam preparations are also included. Oils, alcohols, etc. are used in the work. Different solutions and compositions are

also included. These are generally new compositions obtained as a result of mixing the mentioned compositions. In the salt section, there are sulfur and mercury compounds. Unlikely today, they divided salts into two: volatile and nonvolatile. Şifai, which also includes tartar and stones, also provides information about the composition of the stones. The work called Cevheru'l-Ferid fi Tıbbi'l Cedid contains the translation of Paracelsus's work and the date of translation is 1700. Around 25 simple and compound medicines are included in the work. Preparation methods and medicinal effects of drugs are also included. The work is important because it contains various chemical instruments. There are 13 copies of the work, which has copies in different regions, in the Islamic Medical Manuscripts catalogue. He also benefited from the work of Paracelsus in his work titled Minhacü'l-Şifa fi Tıbbi'l Kimyai. It is also known as Gayat el-Menafi fi Tedbir el-Marza or el-Şifai fi Tıbb-ı Kimya-yi, copies are available in the Cerrahpaşa History of Medicine and Islamic Medical Manuscripts Catalogue.

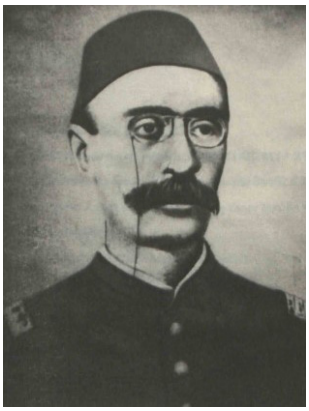
The 18th century is important for the development of scientific activities in the Ottomans. The reason for this is that in the 18th century, chemistry emerged as a modern branch of science by separating from the alchemical tradition through medicine. Iatrochemistry has an important place in the emergence of chemistry as an independent branch of science in the Ottomans. While Ottoman medicine was carried out through the works of physicians such as Ibn Sina and Ebubekir Râzi in the previous centuries, since the 18th century, Ottoman medicine has been carried out with inspiration from the medical knowledge and tradition of the West. Iatrochemistry, which has influenced Ottoman physicians since the 18th century, is a movement introduced by Western physicians. While this movement was tried to be aligned with the Ottoman alchemical tradition by physicians such as Ömer Şifai, on the other hand, it was used only in its application part by physicians such as Ali Münşî. In this context, the works written by Ömer Şifai from Bursa on iatrochemistry have a scientifically important place. This work covers basic topics such as the structure and formation/change of matter, which are the theoretical foundations of chemistry.

Şifai's works on alchemy, pharmacy and medicine also contain information about his understanding of matter. The works written by Şifai are seen as the main sources in terms of revealing the understanding of matter of the period. Also in his works, there are well-known names such as Cildeki, Cabir b. Hayyan. According to Şifai, all metals can turn into gold, but changes in the combination rates and purity levels of sulfur/mercury cause the formation of metals other than gold. The first work that talks about the understanding of matter in the Ottomans is Başhoca İshak Efendi's work called Mecmua-ı Ulum-ı Riyaziye. In the last 28 pages of the fourth volume of the work, there is information about modern chemistry concepts such as element, compound, atom, molecule and gas. As a result of the Westernization movements that started in the Ottomans in the 17th century, new scientific works emerged. The works that emerged in this context were initially translated from different languages such as French and Latin, but in the following period, only translated works were not included. During the translation, the authors also added their opinions on scientific issues. This situation led to the emergence of a new scientific terminology in the Ottomans. Although it may cause some disruptions over time, it can be thought that this situation has a positive impact on the formation and establishment of scientific terminology.

According to Şifai, metals, which are composed of four elements: earth, air, water and fire, also emerge from their dry-moist, hot-cold binary pairs and mercury-sulfur principles. The basis of this view is based on the mercury-sulfur theory. Ömer Şifai can be seen as an alchemist in both material and spiritual senses, because he has goals such as turning worthless metals into gold and achieving immortality. It also suggests that the soul and body must be purified and matured in order to achieve these.

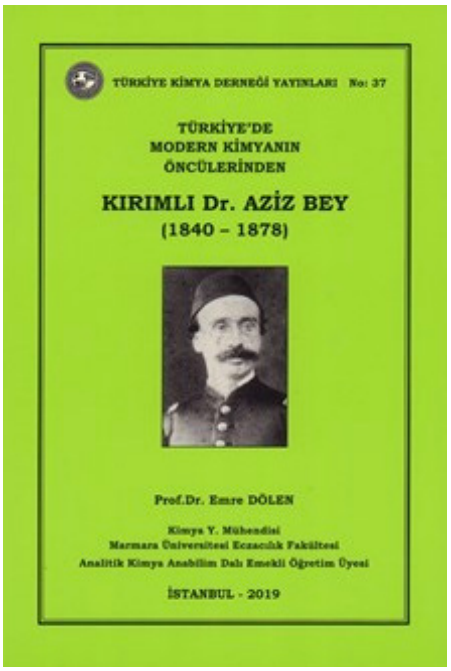
KIRIMLI AZİZ BEY (1878)

"The Pioneer of Turkish Education in Chemistry and Medicine in



Ottomans"

İdris Efendi, the son of Ali, was born in 1802 in Bahçesaray, Crimea. İdris Efendi migrated to İstanbul in 1839 and then his son Aziz was born in Istanbul in 1840. İdris Bey passed away in İstanbul in 1873. Dr. Aziz Bey (1840-1878) took the name "Kırımi" or



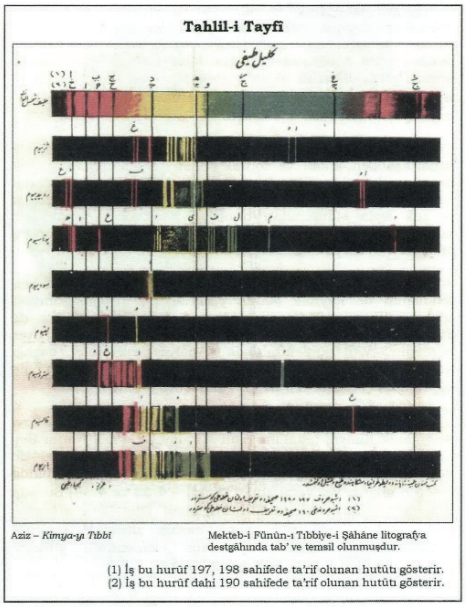
Crimean Aziz.

"Kırımlı" because his father was from Crimea, is one of the pioneers of modern chemistry in Türkiye. Kırımlı Aziz Bey, who learned Arabic and Persian with private lessons, completed his eleven years of education at Mekteb-i Tıbbiye-i Şâhâne at the age of 15, and in 1855, and received his medical diploma in May 1866 and graduated with the rank of ''kolağası''.

Crimean Aziz, who took internal diseases and science chemistry courses, also served as the director of the Mülk-i Tıbbiye. Eyüb Sultan founded the Cemiyet-i Tıbbiye-i Osmaniye with his colleagues in Beşir Ağa Madrasa in 1862. Like Derviş Pasha, Crimean Aziz also made efforts to translate medical education into Turkish. In line with this purpose, he made great efforts to open the Medical School. In accordance with the request of Mekteb-i Tıbbiye-i Şâhâne, he was not assigned to the army, but was appointed as "Assistant Teacher" to internal diseases in august 1866. Thanks to his efforts, he convinces those who are against doing science in Turkish. He was appointed head of the Medical Society in 1873 and continued his duty there until 1878.

The founders of Hilal-i Ahmer.

Qırımlı Dr. Aziz Beyniñ kitabı İlm-i Emrâz-ı Umumiyye



Crimean Aziz has two important works. The names of his works are ''Chemistry of Medicine'' and ''Chemistry of Uzvi''. He also has another work called ''Kaşalot ve Andan Hasıl olan İspermeçet ve Anber''. This work was published in the thirty-sixth issue of Mecmua-i Fünun in 1866. In this article, the properties of white spermaceti and anberine are discussed. In the work titled Kimya-yi Uzvi, the history of chemistry and chemical terms (terms), including İslamic chemists, as well as the tools and equipment used in the laboratory, mines, acids, nonmetals and the elements of air are mentioned. In writing this book, the work of French chemist Charles A. Wurtz (1884) was taken into consideration. The work, the copy of which cannot be identified, includes Mir'at-ı Mekteb-i Tibbiye, Tanzimat, Meşhur Adamlar, Turkish Science History Bibliography, Science and Technology in the Ottomans, Chemistry and Industry, The First Textbooks That Transferred Western Science to Türkiye, there is a bibliography in publications such as Chemical Symbols and Formulas in the Ottomans.

Chemistry of Medicine, published in Istanbul in 1871, consists of two volumes. This work is the second Turkish chemistry book written. The first volume was published in 1868 and the second volume was published in 1871. In the first volume of the 930 pages book, the relationship between chemistry and medical science, the history of chemistry, Cabir b. Hayyan, Ibn Sina, Ebu-l Kasım, ''esami-i musannifin ve musannefat'', ''istidrad'', terms of chemistry, terms of chemistry of efrenciye, terms specific to acids, transformation of Türkiye into efrenciye, rhymes of chemistry, experiment to be used in chemistry, ozone, incident material, chlorine, sulfur, match, nitrogen, bromine, air pollution, types of nitrogen, phosphorus and phosphorus match ink, arsenic and chlorine, arsenic, carbon, boron, silicon and boron acid are introduced. In the first 70 pages of the book, the history of chemistry and the development of Western chemistry are mentioned. According to Crimean Aziz, "The Ottomans, one of the Islamic countries, spent their time in wars and tried to expand their borders, and for this reason, they did not find the time to solve the problems related to science and science by spending their innate talents on the science of war."

In the second volume of the work, the general properties of minerals, acids and their divisions, compounds of sulfur, the properties and effects of chlorine inks, the chemical properties of chlorine, phosphorus compounds of ammonia, the properties of minerals such as iron, tin, aluminum, copper, mercury, gold and platinum are mentioned. It is understood that he benefited from the works of Charles A. Wurtz, a French chemist and medical doctor at the Strasbourg Faculty of Medicine, while carrying out his studies. Additionally, information was compiled by referring to different sources. The work includes "Traite Element de Chimie Medicale", "Histories des Doctrines Chimiques", "Dictionnaire de Chimie Pure at Applique", "La Theories des Atomes Dans la Conception Generales du Monde", "La Theorie Atomique", "Traite de Chimie Biologique" It was written using various foreign sources such as. When we look at the content of the book, it is understood that it follows Europe closely. Some Turkish chemistry terms are used in the content, and chemical symbols are shown using letters from the Ottoman alphabet. The chemistry symbols used by Aziz Kırımlı were used until the switch to Latin letter symbols in 1920. There are prints in the Mektebi Tıbbiye Printing House in Istanbul, Ahmet Vefik Pasha Catalogue, Özege Collection, and İbrahim Hakkı Konyalı Foundation Library.

Chemistry is a science that studies both living and non-living entities and macro-micro dimensions. Since the scope of chemistry, which has many branches, is very broad, it is necessary to make evaluations on a periodic basis. Ottoman knowledge has benefited from Western science since the mid-18th century. However, it has undergone a rapid change since the second half of the 18th century. They followed Western science by translating some or all of the products of Turkish and Muslim scientists and tried to fill in the people in these fields. The 18th century can be seen as the beginning of new chemistry (kimya-yı cedid). By the 19th century, Western science had gradually progressed by adding new elements, and it was not among the products of Ottoman scholars and had not been fully translated. The new era of chemistry actually includes both the modernization of medicine and the transition from alchemy to chemistry. The earliest branch of science to become active was medicine, and with this tool, iatrochemistry also developed rapidly and had an impact on scientists in the East. This enabled chemistry to reach the Ottomans earlier than other positive sciences.

One of the leading figures of Ottoman chemistry in the 19th century was Crimean Aziz, the first director of civil medicine. Crimean Aziz, who was a student of Dervish Pasha, followed his teacher's line and made an effort to have the chemistry symbols in Ottoman language. It is possible to see this system, which continues to be used by Vasil Naum, in the chemistry books he translated and wrote. For this reason, a school of medicine using Arabic letter symbols emerged, but over time, the use of Latin letter symbols began to be accepted in the writing of non-medical publications. At this stage, a process that adopted both systems took place. During the transition period, the French tradition was followed by always writing the indices indicating the atomic numbers at the top. Chemistry came under German influence from the end of the 19th century, causing modern chemistry education to be freed from French influence and shaped according to the German method. Since the 1920s, chemistry symbols in Arabic letters have completely disappeared. The period between the 19th and 20th centuries in the Ottoman Empire is the transition period from chemical science to modern chemistry. During this period, Crimean Aziz developed a new systematic using his own unique method in chemistry. By the 19th century, the lack of common symbols and systematic caused some problems among chemists. During this period, various chemists used different notation and naming methods. The lack of a common chemical language and systematic, as well as different representations of compounds, has led to a loss of time in the progress and transfer of this branch of science and to falling behind Western science. The basis of the chemical symbol system, which consists only of letters, was established in 1814 by J. J. It is based on the system developed by Berzelius. This system, developed from the Latin alphabet, was accepted by all countries except the Ottomans. There are many chemists who came after Derviş Pasha and Kırımlı Aziz. These chemists have produced translated and copyrighted works on the science of chemistry and its applications.

DERVİŞ MEHMET EMİN PAŞA (1879)

"The Father of Modern Physics and Chemistry in Ottomans"

Dervish Mehmet Emin Pasha, who was born in Istanbul in 1817, had a bright educational life since his childhood. In 1829, when he was twelve years old, he entered the Mühendislikhane-i Berr-i Hümayun and received training from Başhoca İshak Efendi there. Dervish Pasha, who graduated from Mühendislikhane-i Berr-i Hümayun with a high degree, worked in units such as cartridge mills, gunpowder mills and foundries affiliated with Tophane-i Amire in 1834-35. He is also among the students who will be sent abroad at Mekteb-i Harbiyye-i Şahane. He first went to England and studied in London, then went to France to complete his education and returned home after receiving technical training at Ecol Des Mines (Mining Technical School) in Paris for three years.

Dervish Pasha, who served in different positions in various institutions of the Ottoman Empire, primarily served as the chief engineer of Ergani and Keban mines. After this duty, he taught physics and chemistry at the Mekteb-i Fünun-ı Harbiye with the rank of "mirliva". In October 1846, Sultan Abdülmecit (1839-1861), the sultan of the period, liked Derviş Pasha's explanations about the flight of balloons and ordered him to increase his rank from the third rank to the rank of "Erkan-ı Harp Mirlivalığı (brigadier general)". Dervish Pasha, who completed the writing of Usul-ı Kimya four months later, immediately started printing the book. Dervish Pasha, who was appointed to the Directorate of Mekteb-i Fünun-ı Harbiye in 1847 with the rank of "ferik (lieutenant general)", became a member of the Council of Vala in 1858. In the same year, he was appointed head of the delimitation commission on the Iranian border.

When he returned to Istanbul, he became the "Chief of Education" in 1859 and the "Undersecretary of Education" in 1861. In 1861, he was appointed to the St. Petersburg embassy. In 1867, he was elected as the Minister of General Military Affairs. Dervish Pasha, who was appointed as the Head of the Maadin-i Humayun Administration established during the reign of Sultan Abdülaziz (1861-1876), became the governor of Aleppo as vizier in 1870 in order to control the events in Lebanon. Dervish Pasha was made a member of the Reform Council and Minister of Education in 1872, and governor of Ankara in 1873. He is assigned to the Military Congress in Paris, where he is appointed by the state as delegate, and then he is promoted to the rank of "mareshal". After the 1877-78 Ottoman-Russian War, known in history as the "93-War", he was assigned as a civil servant to determine the border of Bessarabia. He gave the opening speech at the first Darülfünun, which opened on January 13, 1863, and gave the first course of the Darülfünun on physics. Dervish Pasha, who worked as a physics and chemistry teacher at Darülfünun, died in Istanbul on December 31, 1878. His death date is given as January 5, 1879 in some sources.

Dervish Pasha produced works in the fields of physics, chemistry and geography. One of his works is the book titled "Alat-ı Kimyeviyenin Tarifatını Mübeyyin Risale", which talks about the instruments used in chemistry experiments. Another work of his is the physics textbook called "Usul-i Hikmet-i Tabiye". Derviş Pasha, who wrote this work for the students of Darülfünun, mentions ecsam-ı mevzune in the first article of the work. In the second article of the work, he touches upon the issues of informal matters. In the book, topics such as the ratio of forces with speeds, instruments of mass, weight, barometer, evacuated instruments, some instruments produced by air pressure, pumps and relative weight are discussed. The first edition of this work was printed in the Ahmet Vefik Pasha Catalogue, with 454 pages, in Istanbul Matbaa-i Amire in 1865, and the second edition was printed in Istanbul Mekteb-i Sanayi printing house in 1871.

The first volume of his work titled Usul-ı Kimya includes nonmetals and metals. The second volume contains various salts and their properties, vegetable and animal substances, but this volume could not be published. The work, which is seen as the foundation of the beginning of modern chemistry in Türkiye, conveys the chemical knowledge of its age at a high level. In this work, the subjects of imtizac-ı kimyeviye (chemical combination) and ıstılahat-ı kimyeviye are taken as basis.

The definition of chemistry is included in the introduction part of the work. For example, the atom is called "partial individual" and the molecule is called "individual substance". The active forces in the formation of compounds are explained and chemical combination, that is, synthesis (imtizac-ı kimyeviye), is mentioned. Atomic weights (meter) are defined and chemical terms and symbols are discussed in the terminology section. Some of these terms were translated into Turkish, while some remained in their French originals. In the Istılahat-ı Kimyeviye section, Dervish Pasha stated that each science has its own terms and that these terms facilitate the studies in the relevant branch of science.

Although it would be appropriate and convenient to use French chemical terms in chemistry books to be published in Turkish in the future in Türkiye, Dervish Pasha does not deem it appropriate to use foreign terms, considering that our language has little similarity with European languages. For this reason, he uses translations whenever possible, and if translation is not possible, he uses element names in French. The number of elements known at that time was fifty-four. On the other hand, although the names of the seven metals known to the ancients

The books about Ottoman Chemistry.

have been used for a long time, the elements discovered later are named according to some properties of these seven elements. It is seen that the elements and compounds mentioned in the book are used in fields such as military, medicine, metallurgy and mineralogy.

Considering the combination of 100 parts of oxygen and 12.5 parts of hydrogen during the formation of water, the meter of oxygen was accepted as 100, and the meter of other elements was compared with oxygen. As of the period when the book was written, the meters of the elements were determined in this way in Europe. This book was taught as a textbook at Darülfünun for approximately 20-25 years. Afterwards, books written by Kırımlı Aziz Bey and Vasil Naum Bey began to be used in Darülfünun.

The inductive method has been applied in the content of the work, which consists of fifty chapters, and there is an expression from the specific to the general in the way the subjects are discussed. In the work, important compounds are discussed one by one, which is the exact opposite of today's chemistry textbooks. In today's chemistry books, topics are treated in units and explained from the general to the specific.

In the section on chemistry titled "Third Treatise on the Special Natural Sciences Namely New Chemistry Which Includes Dissociation and Combination of Matter" in the work titled Mecmua-yı Ulum-ı Riyaziye (Collection of Mathematical Science), Başhoca İshak Efendi explains that chemistry, a new science, is used in the military industry. Talks about its importance for ın Usul-ı Kimya, the use of chemistry for military purposes is mentioned. Başhoca İshak Efendi used the word "new" at the beginning of the section on chemistry, this word does not appear in any of the other parts of the book. The main reason for this situation is to draw attention to the difference between old and new chemistry. İshak Efendi defines new chemistry as "analysis and synthesis of substances". He also says, "chemistry is an art that shows and distinguishes the structure of substances and their different characteristics and combinations." This indicates that practical science is described in two branches as "analysis" (dissociation) and "synthesis" (composition).

Based on this, he says, "it is understood that new chemistry (kimya-ı cedid) can only be seen in the light of analysis and synthesis." In fact, this definition is an incomplete definition, but it may be deemed appropriate since it will be used for military purposes. Another inference that can be made from this definition is that chemistry is seen as both science, science and art. This definition actually stems from the fact that although chemistry is mentioned as a science in European books, it is sometimes referred to as an art in medieval books. In subsequent chemistry books published in Turkish, the word art was dropped and referred to as practical science.

It is thought that Derviş Pasha, who mentioned famous French chemists such as Claude Louis Berthelot and Antonie Laurent Lavoisier in his work, compiled his work from several different sources due to his education abroad for many years. As a justification for this, Dalton, Rutherford, Bronsted, Gay-Lussac, Monsieur Dulang, Berzelius, Lavoisier, Thenard, Turner, Volter, Birand, Magnus, Thomson, Monsieur Davi, Priestly, Pallard, Faraday, Coulomb, Bilard, Liebig are cited in the content of the book, Paracelsus, Agricola, Valentine, Monsieur Duma, Monsieur Arfudson, Monsieur Gregory, Monsieur Stromier, etc. known chemists such as are given as examples. In addition, the fact that different regions such as Saxonia, Bohemia, China, Transylvania, America, Austria, Catalonia, Spain, Hungary, Africa, Kenya, Mexico, Russia, Siberia, Ural, France, Venice, Genoa and London are mentioned in the book is an indication that various sources were used in the writing of the book. In Usul-ı Kimya, which is thought to be compiled from L. J. Thenard's "Traite de Chimie Theorique et Pratique" and Edward Turner's "Elements of Chemistry", the figures of the synthesis of some substances are

added to the end of the book in the form of four lithographic plates. The work downloaded from the Özege Collection was printed in the Ahmet Vefik Pasha Catalog in Dar-al Tiba'at al-Amire in Istanbul, with three hundred and eighty-six pages (the first volume is one hundred and eighty-three pages).

When the chemical symbols in the Ottomans are examined, all of the states that used alphabets other than the Latin alphabet adopted the chemical symbols derived from Latin letters as they were. The Ottomans developed a new chemical symbol system using Arabic letters. On the other hand, Dervish Pasha, who showed the symbols of the elements in Latin letters, used the method of the Swedish chemist J. J. Berzelius, which was used in Europe until the 1840s, in writing the formula. While Dervish Pasha was stating the oxide formulas, he expressed the formulas by placing dots as many as the number of oxygen atoms on the symbol of the element. If the element symbols were written in Arabic letters, he wrote the formulas using Latin letter symbols to prevent the dots placed on the oxygen atom from being confused with the dots of the Arabic letters. For example, if the dot is not placed in the letter "ز", which symbolizes the zirconium element, it may cause confusion as "ر" may be perceived as the rhodium element. For this reason, Dervish Pasha preferred to symbolize the elements with Latin letters rather than Arabic letters.

He also draws a horizontal line over the element's symbol to represent two atoms of an element. If it has more than two atoms, it puts indices on the symbol of the element to indicate them. This form of writing was abandoned in Europe in the 1840s, however, since Dervish Pasha's work was dated 1848, it seems to coincide with the chemistry knowledge of the period. While specifying the formulas of compounds from the second class, he puts a "+" sign between the formulas of compounds from the first class. However, he followed a unique method in representing the reactions.

He did not use formulas when illustrating the reactions; instead, he wrote the compounds showing the elements that make them up and schematized them by showing the changes that occurred during the reaction and the displacements between the elements with lines. This different method used by Dervish Pasha is similar to Jean Girardin's method. Apart from this, Dervish Pasha, like Başhoca İshak Efendi, used some chemistry terms with different meanings. For example, he preferred to use the term "air" instead of "gas", and sometimes used the terms "steam" or "smoke". The first use of the term "air" was by Hekimbaşı Mustafa Behçet Efendi in 1803. Additionally, the term "nitrogen" was used for the first time in this book. Dervish Pasha sometimes preferred to use the term "nitrogen" and sometimes "air-ı memati". In the table showing the elements, the symbol of iron is given as "F" instead of "Fe", so a typo has been made here.

In the first part of the content of the book, the chemical and physical properties of the elements, as well as when and by whom these elements were discovered and how they were obtained are mentioned. In this context, it can be said that the book contains both chemistry knowledge and information about the history of chemistry. The compounds formed by elements with hydrogen, oxygen, sulfur and halogens are shown in tables, and the name, symbol and composition of the compound formed are described. The text of the work, in which a different method was followed in terms of printing, was printed with printing letters, but the tables and reaction equations in the form of diagrams in the text were printed on top of it by the lithography method. An example of this is that the overlaps, tables, and equations on page two hundred and seventy-one of the book are handwritten. Additionally, formulas using Latin letters are included in the tables. The method of obtaining frequently used important compounds, that is, the revenue method, is also given.

In the second part of the book, first the general properties of metals are mentioned, and then metals are discussed one by one. The grouping of metals is the same as Thenard's method. In the last part of metals, information about alloys is given. At the end of the book are the copper, silver and gold rates of coins of different countries. The different reaction methods are included in the form of four lithographs at the end of the book.

When writing compound formulas in Ottoman Turkish, the name of the second element is written first and then the name of the first element. For example, kibrit-i hadid (FeS). In addition, the naming of acids, bases, salts and oxides is different from today. Namely; citric acid is written as hamiz-ı limoni or gallic acid is written as hamizi-ı limoni. Apart from this, the naming of nitrogen and oxygen is based on their function on living things. For this reason, while oxygen is called "air-ı vital", that is, air of life, nitrogen is called "air-ı memati", that is, deadly air. Sulfur is called "match" because this naming is inspired by the Arabic word for the element sulfur. On pages one hundred nine and one hundred eleven of the book, oxide and hydride compounds of phosphorus are mentioned. The method Dervish Pasha used when naming compounds is clearly seen here.

The use of units such as grams and liters in Dervish Pasha's work shows that this book keeps up with its age, although units such as parts and volumes are also included. Based on this, it is understood that the work reflects the transition period in the development of chemistry, because Ottoman units (endaze, fathom, fersah, dirham, okka, etc.) were used for many years in the works written after Usul-ı Kimya. The transition to the metric system in the Ottomans could only take place in the 20th century. When we look at the laboratory equipment mentioned in the book, it can be seen that it has caught up with its period. For example, crucible, rurber oven, wolf bottle, retort, etc. It is possible to reach this conclusion based on such materials.

Dervish Pasha can be described as a scholar ahead of his time. Dervish Pasha, who was successful both scientifically and militarily, had many government services. Dervish Pasha, who served in the field of physics and chemistry education in our country, rose to the rank of marshal and took part in the domestic and foreign policies of his period. The fact that he received education abroad did not disrupt his identity as an Ottoman intellectual. On the contrary, he made an effort to ensure that the language of education and terminology were Turkish. Since there were no physics and chemistry textbooks in Turkish before his time, he is considered a pioneer in the translation of the terms physics and chemistry into Turkish. In addition, there are praises for Allah, the prophet and the sultan in the introduction part of his books. He wrote his books not only for academic purposes but also to contain important information for use in the military and industry. For these reasons, he is seen as the father of modern physics and chemistry in the Ottomans.

ANTONIE CALLEJA (KALYA BEY) (1893)

"One of the Pioneers of Modern Pharmacy in Ottomans"

Antonie Calleja (Kalya Bey) (1806-1893), who came to the Ottoman Empire after receiving his pharmacy education in Paris (Italy in some sources), originally came from a family of pharmacists. Kalya Bey, a student of Pierre Eugene M. Berthelot (1827-1907), was brought to give chemistry lessons at Mekteb-i Tıbbiye-i Şahane in 1844. Kalya Bey, who is described as someone who does not like ostentation, is dedicated to his profession and is knowledgeable, teaches inorganic chemistry at Mekteb-i Tıbbiye-i Şahane while taking courses in the pharmacy department, and this continues until his retirement in 1888.

Mr. Kalya, who first taught practical lessons in French, taught his lessons in Turkish after the language of education changed to Turkish since 1879. Kalya Bey, who had a special place in medical students learning chemistry, also trained successful chemists in his field such as Vasil Naum (1885-1913). Vasil Naum Bey, who was appointed as an assistant teacher next to Kalya Bey, took on the task of teaching inorganic chemistry at Mekteb-i Tıbbiye-i Şahane since 1886, following his teacher. Vasil Naum Bey's inorganic medicinal chemistry book titled İlm-i Kimya-yı Gayr-i Uzvi-i Tıbbi is originally a Turkish translation of Kalya Bey's French lecture notes. This work, written in two volumes, appeared in 1883 (Volume 1) and 1884 (Volume 2). The second edition of the work was made in 1900. While nonmetals and their compounds and general chemistry topics are included in the first volume, metals and their compounds topics are included in the second volume. Kalya Bey, who was given the rank of "Ûlâ evveli", opened and ran pharmacies in Eminönü and Beyoğlu while giving lectures. Kalya Bey, who died at the age of 87 (April 21, 1893), was buried in the Latin Catholic Cemetery in Feriköy. Antonie Calleja, who was brought from Europe to provide a good education for students studying in pharmacy, has a different position in Ottoman history. 19th century Ottoman chemistry changes with the return of students sent to Europe. Kalya Bey, on the other hand, is from a family of pharmacists and came to the Ottoman Empire after receiving pharmacy education. Vasil Naum, who translated the lecture notes he gave during his teaching career into Turkish, wrote the book on inorganic medicinal chemistry called İlm-i Kimya-yı Gayr-i Uzvi-i Tıbbi.

In the first volume of the book, which consists of two volumes, the definition of the science of chemistry and objects, chemical terms and their division, classification of physical parts, various terms of organic parts, how oxygen is obtained, properties of water, H, Si, B, S, P, N, Br, Cl, NH_3, arsenic, diamond, air components, various waters and some chemicals are discussed. The second volume includes chemistry topics such as both physical and chemical properties of minerals, their fractionation, alloys, Fe, Mg, NaCl, Sn, Cr, Pb, Sb, Au, Pt, NH_3, Al.

Kalya Bey, a successful pharmacist, can be considered one of the cornerstones of modern chemistry studies in the Ottoman Empire. The fact that he taught both chemistry and pharmacy shows that he was a knowledgeable person. From time to time, teachers were brought from abroad to Ottoman schools. While this sometimes resulted in a positive outcome, sometimes it did not yield the expected result. Kalya Bey is a turning point in Ottoman chemistry. Because until then, while the Ottomans were sending their own students abroad for education, Kalya Bey was brought from France as a trained teacher. "Before Ûla; Kalya Bey, who was known as the "civilian rank equivalent to pasha", continued to work as a pharmacist as well as a teacher for many years. His ability to teach both French and Turkish makes him privileged. In addition to teaching well-known chemists and physicians, he published a new chemistry book by translating his lecture notes into Turkish. While the change in the language of education has caused some terminological difficulties, in some cases it has led to the emergence of new works. Sultan Abdülmecid enters Kalya Bey's lecture during laboratory work, and applauds and glorifies Kalya Bey, who is doing the phosphine experiment.

While Kalya Bey was doing her pharmacy internship in her father's pharmacy in Bahçekapı, most of the pharmacies in Beyoğlu were destroyed in the great fire that broke out on July 24, 1831, and the number of remaining pharmacies was stated as twenty-five. Mr. Kalya is effective in issuing a decree regarding the remaining pharmacies. He also had a great role in the preparation of the first regulation regarding the pharmacy profession in the Ottomans. Kalya Bey went down in history as an important figure in Ottoman modern medicine and chemistry, as he was also a founding member of the Cemiyet-i Tıbbiye-i Şahane (1856) and Cemiyet-i der Eczacıyan Asitane-i Aliyye (1879).

KİMYAGER DOKTOR ALİ RIZA BEY (1904)

"The Pioneer of Organic, Biochemistry & Stereochemistry in the Ottomans"

Dr. Ali Rıza Bey is the son of Cafer Nami Bey, one of the clerks of Amed-i Kalemi was born in Istanbul in 1867. Dr. spent his childhood in Vaniköy. Ali Rıza Bey first goes to the primary school, then to the secondary school and then to the Medical High School. Ali Rıza Bey, who grew up at Mekteb-i Tıbbiye-i Military School (Military Medical School), is one of the most successful students trained at the School of Medicine. He graduated from here as a doctor captain on March 24, 1888. 6 months after completing his education in the Ottoman Empire, he was sent to Paris to continue his education. He worked for about a year in the private chemistry laboratory of the Val de Grace Military Medical School in Paris. He then continues his education at Intendance de la Ville de Paris. Here he learns the applications of analytical chemistry on biochemistry and medicine. Dr. Mr. Ali Rıza also takes care of the school's clinical chemistry laboratory. Here, he makes students do simple analyses, and his practice is appreciated by his students. Then he worked for another year with Prof. Dr. Armand Gautier (1837-1920) in the organic chemistry laboratory of the Paris Medical Faculty. Taking lessons from great chemists and working together with them. Dr. Ali Rıza Bey attracts the attention of his teachers with his successes. He was elected as a member of the French Chemical Society due to his studies on succinic acid and his successful study abroad. He carried out academic studies throughout his life with the chemist George Deniges, whom he met in France.

Dr. Ali Rıza Bey returned to the country four years later and was appointed as a teacher at Civil and Military Medical Schools. He took the Chemistry and Analysis courses in these schools. Additionally, Dr. continues to work at the Yıldız Palace pharmacy. Ali Rıza Bey studied both analytical and biochemistry. Dr. has many services to the country. Ali Rıza Bey was deemed worthy of the rank of "Right Commander" by the Ministry of Internal Affairs dated October 1899, and Vasil Naum Bey and himself were awarded the 3rd degree Ottoman medal. He took part in the analysis of Karahisar-ı Sahib mineral water in Afyon and the application of filling conditions and method. In addition, there are studies on the collection and distribution of Kağıthane waters (Hamidiye water). Dr., who teaches organic and biochemistry at Darülfünun. Ali Rıza Bey also works as a chemist at Etfal Hospital. Dr. Tevfik Sağlam emphasizing that Ali Rıza Bey and his geology/mineralogy teacher İbrahim Lütfi Pasha were real scientists, he said: "There was a very rich stone collection in the Medical School for mineralogy. They would bring them to the classroom and show them to us. During the exam, their labels would be removed and we would be asked to recognize them." The analytical and physiological chemistry courses taught in the last part of the third year of the chemistry department were taught by chemist major Dr. Ali Rıza Bey gives it. The chemist, who died in 1904, was buried in Istanbul Eyüp Cemetery.

It is possible to consider Dr. Ali Rıza Bey's life in two periods. The first is the period he spent at Mekteb-i Tıbbiye-i Şahane, Mekteb-i Tıbbiye-i Mülkiye and Darülfünun, that is, between 1892 and 1902. During these years, he wrote his work titled Kimya-yı Uzvi. In the meantime, he carried out numerous analyzes by constantly conducting experiments in the chemistry laboratory of Mekteb-i Tıbbiye-i Şahane. He teaches biochemistry and analytical chemistry at Mekteb-i Tıbbiye-i Şahane and Mekteb-i Tıbbiye-i Mülkiye. In addition, he also took

the organic chemistry course at Mekteb-i Tıbbiye-i Mülkiye. He is appointed as a chemist member to the Cemiyet-i Tıbbiye-i Mülkiye. In February 1899, upon the offer of the military service, he was promoted to the rank of major. He taught biochemistry and organic chemistry at Darülfünun, which was opened on 31 August 1900. Participating in the 3rd International Congress of Applied Chemistry held at the University of Vienna in 1898, Dr. Ali Rıza Bey, representing the country, gained information about current scientific issues.

The second part of his life was between May 1902 and January 1904, that is, the short-term but productive period he spent as a chemist at Şişli Etfal Hospital-i Âli. He was appointed to this position after being dismissed from his teaching position at Darülfünun. Dr. from Hamidiye Etfal Hospital. Following Cevad Mazhar Bey's departure, Dr. Ali Rıza Bey was brought. In a letter dated June 30, 1903, chemist Dr. Ali Rıza Bey was given the title of district governor (lieutenant colonel) and this situation was reported to the military service. Dr. Following the early death of Ali Rıza Bey, Cevad Tahsin Bey (1874-1944) was appointed to biochemistry courses at Darülfünun with the memorandum dated January 30, 1904.

Dr. Ali Rıza Bey has a work called Kimya-i Uzvi (Organic Chemistry). Kimya-yı Uzvi, a detailed and important book, includes medical and pharmacy applications. The first volume of the book, which is planned to be written in two volumes, is designed for aliphatic compounds and the second volume is designed for aromatic compounds. The second volume could not be written due to the early death of the author. Information is given about what organic chemistry is and its scope, and its subjects are covered in detail. It contains information about elements and compounds, and the elements are classified and introduced one by one. The work includes straight chain saturated/unsaturated aliphatic compounds, heterocyclic and acyclic compounds. In addition, the uses of substances such as bromoform, chloroform, acetates and tartrates used in pharmacy and medicine are explained, and the preparation of antiseptics is also described.

While writing the formulas and equations, Arabic letter symbols were used in accordance with the medical tradition. Terms and substance names are given in French. The book contains in-depth information on how chemical formulas are found and organic analysis. The cryoscopic method and the methods used by Victor Meyer (1848-1897) are explained in detail. Viktor Meyer (German chemist, worked as an assistant in Heidelberg and Strasbourg, became a professor at Zurich Polytechnic and Heidelberg, published works titled "Traite de Chimie Organique" and "Tables pour l'Analyse Quantitative" in 1891) in finding vapor densities The derivation of the formulas he used is also included. Open and cyclic formulas of organic compounds, which were the first in Ottoman chemistry, are given.

In naming compounds, the nomenclature system based on the numbering of carbon atoms validated by IUPAC is used today. There is also information about stereochemistry and formulas. Formulas of substances showing both the optical isomer and the cis-trans isomer are also included. The print of the work was included in the Özege Collection and Mekteb-i Tıbbiye-i Mülkiye Printing House, consisting of 870 pages. The bibliography of the work is included in the works titled "Mir'at-ı Mektebi Tıbbiye", "Turkish Famous People" and "Tanzimat", "Chemical Symbols and Formulas in the Ottomans".

Ottoman modern chemistry education, which is thought to have started with the arrival of Kalya Bey (Antonie Calleja) (1806-1893) from France to Türkiye in 1844, was started by Dr. Crimean Aziz Bey (1840-1878) and chemist Dr. Ali Rıza Bey (1847-1904) continues it. It is known that the teachers who made great efforts for the development of chemistry worked in the chemistry laboratory at Mekteb-i Tıbbiye-i Şahane. Chemistry teachers who work on their own fields attach importance to applied sciences by conducting experiments and analysis here. Dr. Ali Rıza Bey is an influential name in Ottoman chemistry in the last quarter of the 19th century. Thanks to the education he received abroad, he had the opportunity to work with great teachers, thus simultaneously following Western science and transferring it to his country. He drew a new direction for Ottoman chemistry by conveying his knowledge in his work titled Kimya-yı Uzvi. He transferred new chemistry topics such as stereochemistry, optical isomers, cis-trans isomers, numbering of carbons, and numbering of cyclic compounds from the West to the Ottoman Empire.

Dr. worked both as a lecturer and as a student educator until his death. Ali Rıza Bey is one of the shining scientists of the last period of the Ottoman Empire. He is the teacher of names such as Mustafa Muhlis Ünal, Mustafa Nevzat Pısak, Fehmi Rıza Anlı, Osman Nuri Eralp, İbrahim Ethem Ulagay, Mustafa Hakkı Nalçacı. Although his working life was difficult due to the severe socio-economic conditions of his country, he is a teacher who has been influential in many fields. The works he wrote, the students he educated, the training he received and the titles he held as major, doctor and chemist clearly demonstrate this situation.

VASIL NAUM (1913)

"The Pioneer of Inorganic Medicinal Chemistry in the Ottoman Empire"

Vasil Naum, considered one of the pioneers of inorganic medicinal chemistry in the Ottoman Empire, was born in Aleppo in 1855. Vasil Naum graduated from Mekteb-i Tıbbiye in 1885 and immediately afterwards worked as the assistant of Antonie Calleja (1815-1893), who taught inorganic chemistry at this school for 48 years. Naum, who taught inorganic chemistry between 1885 and 1891, took on the task of teaching inorganic chemistry after Calleja. Antonie Calleja is the owner of the famous work titled İlm-i Kimyay-ı Gayr-ı Uzvi-i Tıbbi and this work was translated into Turkish by Vasil Naum. Vasil Naum gave lectures on chemical drills and metallurgy at Darülfünun Faculty of Science in 1908-1909, and has the rank of first class honorary and the 3rd degree Mecidi medal. In addition, he is a member of the Civil Society of Medicine and died in Istanbul in 1913.

Vasil Naum translated the book of his teacher Antonie Calleja and wrote the inorganic book "İlm-i Kimya-yı Gayr-i Uzvi-i Tıbbi". The work consists of two volumes. In the first volume, the description of the science of chemistry, the description of objects, chemical terms, their division, the classification of the physical parts, the terms of the organic parts, the production of oxygen, hydrogen, minerals (silicon, boron, diamond, sulfur, phosphorus, arsenic), nitrogen, bromine, chlorine, the composition of air, the properties of water, fresh and brackish waters, sea water, shibh-i maadini ink, carbon dioxide, ammonia and other chemicals are mentioned. In the second volume of the work, subjects such as physical and chemical properties of minerals, division of minerals, alloys, iron, magnesium, salt, tin, chromium, lead, antimony, gold, platinum, ammonia and aluminum are mentioned.

The book includes the Turkish and French names of the elements, their Arabic and Latin letter symbols and atomic weights. Also in the book, the subjects of classification of chemistry, definition, recipe of substances, crystal, precipitation, chemical terms, relativity, chemical meter, hydrogen, oxygen, water and all kinds of things, silicon, air, advice of miya are mentioned. The prints of the work are in the Mekteb-i Tıbbiye-i Şahane Printing House, Özege Collection. It is included in the Özege Collection, the first volume of which is six hundred and twenty-three pages and the second volume of which is five hundred and thirty-four pages. The second edition was printed in Istanbul

Mekteb-i Tıbbiye-i Şahane Printing House. The first volume is in the Özege Collection, with six hundred and six pages, and the second volume with five hundred and thirty pages plus two pages. The bibliography of the work is available in places such as Mir'at-ı Tıbbiye, Tanzimat, Aykut Kazancıgil's Science and Technology in the Ottomans, History of the Faculty of Medicine, Chemical Symbols and Formulas in the Ottomans.

In the Ottomans, chemistry courses were taught first as general chemistry courses and then as organic and inorganic chemistry courses in the late 19th century. In addition, analytical chemistry course was also added to the curriculum. Subjects between physiology and chemistry are given under the name of pathology since the discipline of biochemistry has not yet developed. While these subjects are not included in Kırımlı Aziz's work titled "Kimya-yı Tıbbi", they are seen in his work titled "İlm-i Emraz-ı Umumiye".

Vasil Naum wrote a book on medical inorganic chemistry and ensured that it was taught in schools for many years. Naum, who increased his knowledge and experience alongside a scientist like Antonie Calleja, transferred his knowledge to his students and works. Vasil Naum filled the gap that existed in the field of chemistry in the Ottoman Empire at the turn of the 20th century. He supported Crimean Aziz's struggle for education in his native language and published the books he translated and wrote in this way. In this way, 19th century using Arabic letters. Ottoman medical tradition emerged.

One of Vasil Naum's most important contributions to Ottoman science is undoubtedly the students he educated. While talking about the education, Tevfik Sağlam, one of the famous physicians of this period, talked in detail about organic chemistry, botany and dissection (anatomy) courses and praised his teacher Vasil Naum, who taught inorganic chemistry in this class. Tevfik Sağlam; "To tell the truth, I have never received the same pleasure from any other organic chemistry course as I did from Vasil Naum's courses." He clearly demonstrated the value of the teacher by saying.

Conclusion

There are also scientists who we can identify as having produced valuable works in the branches of chemistry, but whose lives and works we cannot find sufficient information about in the sources. However, we hope that the inclusion of the names we have included in our study by obtaining significant information about them in the text will shed light on further studies in these areas.

Acknowledgements (Sahin):

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KİMYASAL SEMBOLLER, FORMÜLLER VE ADLANDIRMA

Symbols of elements used by Dervish Pasha and Aziz Kırımlı.

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