Ottoman scientific literature during the 18th and 19th centuries

Emre DÖLEN

Technology may be broadly defined as the sum of methods used in the production of materials to meet human needs. Conceived thus, technology grows mainly through the accumulation of empirical knowledge and there is little relationship between technology and science. At least this was the pattern until the end of the Middle Ages. Prior to modern times, the transfer of technology was realised chiefly through the recruitment of skillful craftsmen.

Ancient science was transferred to the Islamic world through translations. It was further enhanced by notable Islamic contributions, and later transferred back to Europe, again by means of translations. During the Middle Ages, there was no major difference in the understanding of science in the East and in the West. The scientific revolution triggered a radical change.

With the scientific revolution, interaction between science and technology gradually intensified until towards the middle of the 19th century, when the two became inseparable. Empirical apprehension no longer sufficed for producing and applying technology effectively. The time span between scientific inventions and their industrial applications shrank dramatically. William Perkin's discovery of the first synthetic dye in 1856, and its use in industrial production during the same year is a telling example. Science thus became essential to the development and the use of new technologies.

Prodded by military defeats, the Ottoman Empire tried from the mid-17th century to keep up with Western technological innovations. Its focus on adopting Western technology led it to ignore the scientific roots of this technology; the mere transfer of techniques was thought sufficient. This attitude emerged even more clearly at the turn of the 19th century.

The first Turkish printing house was founded in 1727 by İbrahim Müteferrika. Most of the publications in the early years of the printing house were history books or dictionaries. In 1732, some science books were also published, such as the Müteferrika's *Füyuzat-ı mıknatısiyye* (Usefulness of magnetism) and Kâtip Celebi's *Cihannüma* (Geography and astronomy). Between 1792-1794, Müteferrika's printing house published translations of three books on military technology by the French marshall Sébastian le Prestre de Vauban

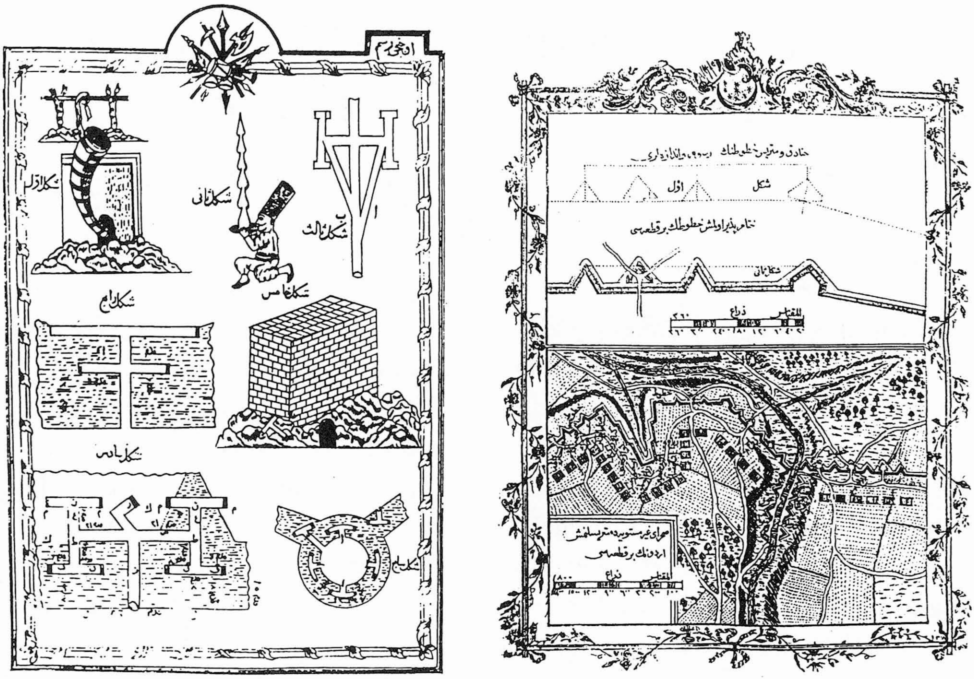


Fig. 1 A plate from Vauban's *Fenn–i lağım* (Mining techniques) (left) and a plate from Belidor's *Fenn–i harb* (War techniques) (right).

(1633–1707) and Bernard Forest de Bélidor (1697–1761): the *Fenn–i lağım and Usûl–i harbiyye* from Vauban's *Traité de mines* and *Traité de l'attaque*; and the *Fenn–i harb* from Bélidor's *Traité de siège* (Fig. 1).

Medicine

European medical knowledge of Renaissance entered in the 17th century as the anatomy book *Risale–i tesrih–i ebdan* (Treatise on the anatomy of human body, 1632) reveals. This book by Şemseddin Itaki, includes some features of 16th century of European anatomists such as Andreas Vesalius and Juan de Valverde de Hamusco. Paracelsus' views on medicine and chemistry were introduced with a delay of 150 years by the Ottoman physicians Salih b. Nasrullah (d. 1699), Ömer Sinan el–İzniki (18th century), Dervish Ömer Şifai (d. 1742), and Ali Efendi (18th century). As a result, a movement called *tıbb–ı cedîd* (new medicine), highly influenced by Paracelsian medicine, emerged. Şanizade Ataullah Efendi's (1771–1826) book *Mir'âtü'l–ebdân fî teşrih–i azâ'il–insan* (Mirror of bodies and the anatomy of human organs), compiled from Western medical writings, was published in 1820 (Fig. 2). Thus a bifurcation appeared between the "old medicine" based on the Islamic medical tradition, and the "new medicine" introduced from Europe through translations and compilations.

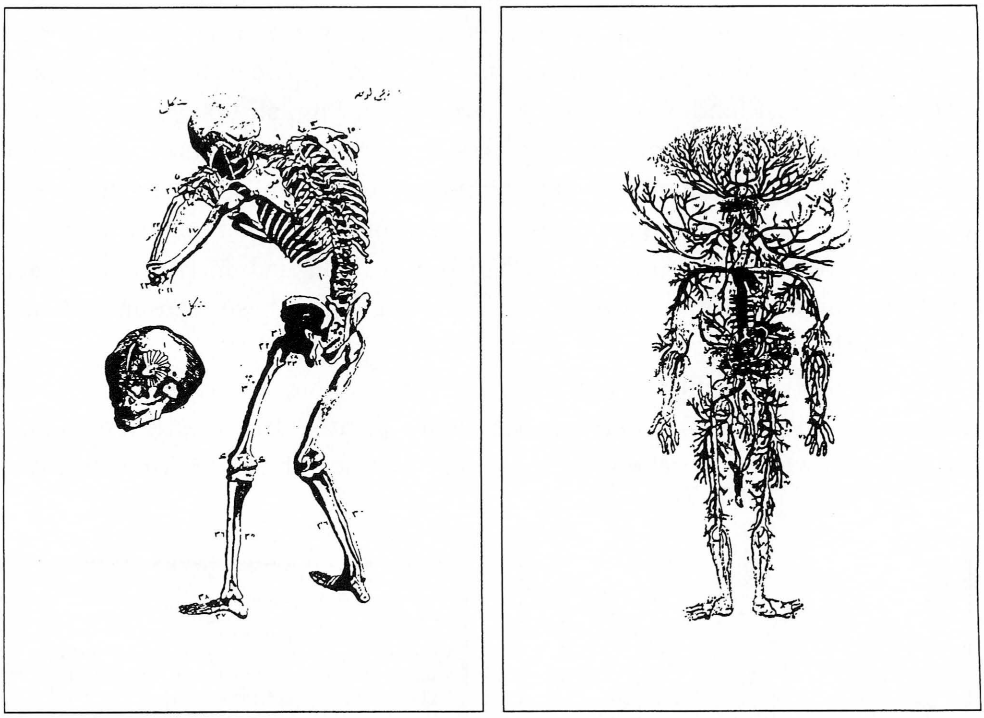


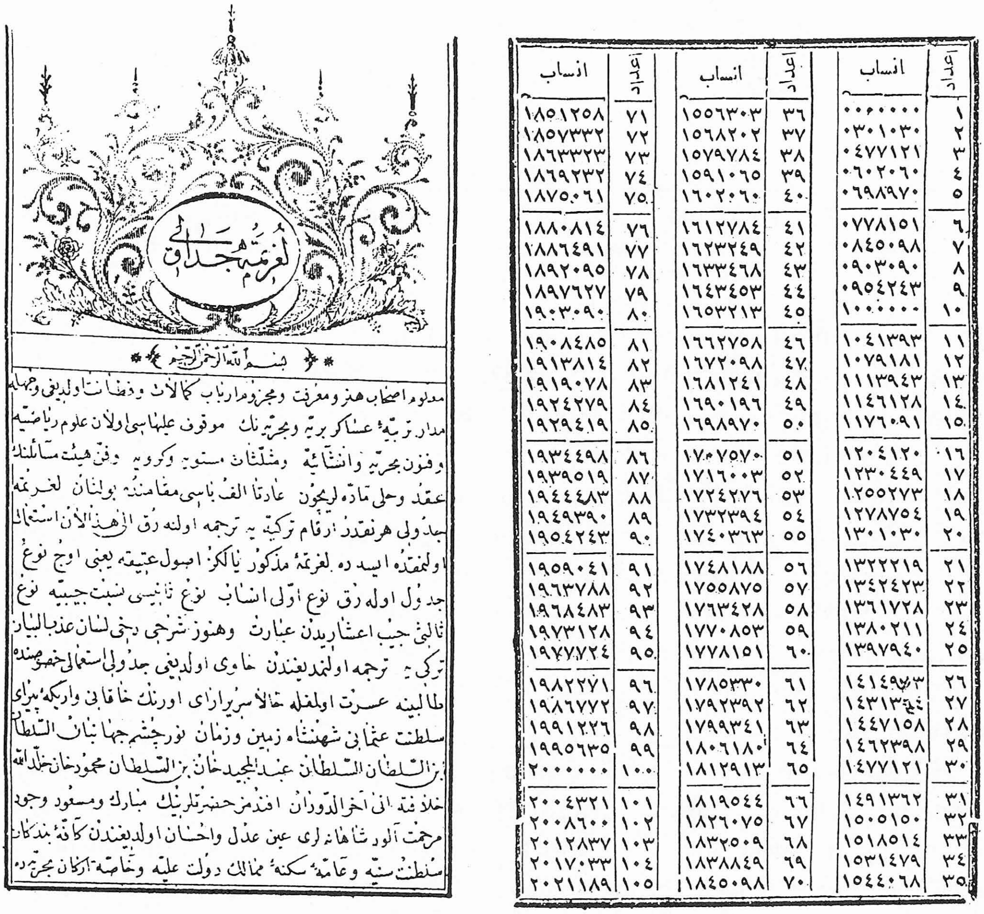
Fig. 2 Two anatomical plates from Şanizâde Ataullah Efendi's book *Mir'âtü'l–ebdân fî teşrih–i azâ'il–insan* (Mirror of bodies and the anatomy of human organs, 1820). Human skeleton (left) and circulatory system (right).

The teaching of modern medicine started in the Tıphane–i Amire (School of Medicine), which was founded in 1827. This school was reorganized in 1839 under the name of Mekteb–i Tıbbiye–i Şahane (Imperial School of Medicine). Instruction there started in French, and French books were used directly until 1871, when Turkish was designated as the official language. From then on, the number of printed medical books in Turkish increased rapidly. The foundation of the Mekteb–i Tıbbiye–i Mülkiye (Civil School of Medicine) in 1867, where teaching was given in Turkish, played an important role in the formation of Turkish medical literature.

Mathematics

Towards the end of the 18th century, the Mühendishane–i Bahri–i Hümayun (Imperial School of Naval Engineering) and the Mühendishane–i Berri–i Hümayun (Imperial School of Military Engineering) were established in 1775 and 1793 respectively. During these years, experts in shipbuilding, fortification, artillery and warfare were recruited from France. The printing house of the Imperial School of Military Engineering, established in 1797, started publishing works on mathematical sciences and engineering. *Logaritma cedveli* (Tables of logarithms), *Humbara cedveli* (Tables of bombardment) and *Usûl-i hendese* (Elements of geometry) were published in 1798 (Fig. 3). The latter was translated by Hüseyin Rıfkı Efendi from John Bonnycastle's English text. Hüseyin Rıfkı made other translations and compilations from the same author. Until 1806, about five books on geometry and trigonometry were published, and some were reprinted. The number of printed books on science and technology was small when compared with the total number of books published on various subjects. About one hundred copies of each were printed, since these were meant to be used as textbooks.

From mid-19th century onwards, as the number of secondary schools increased, many books on mathematics were printed and used in secondary education. However, there was little by way of research and original contribu-



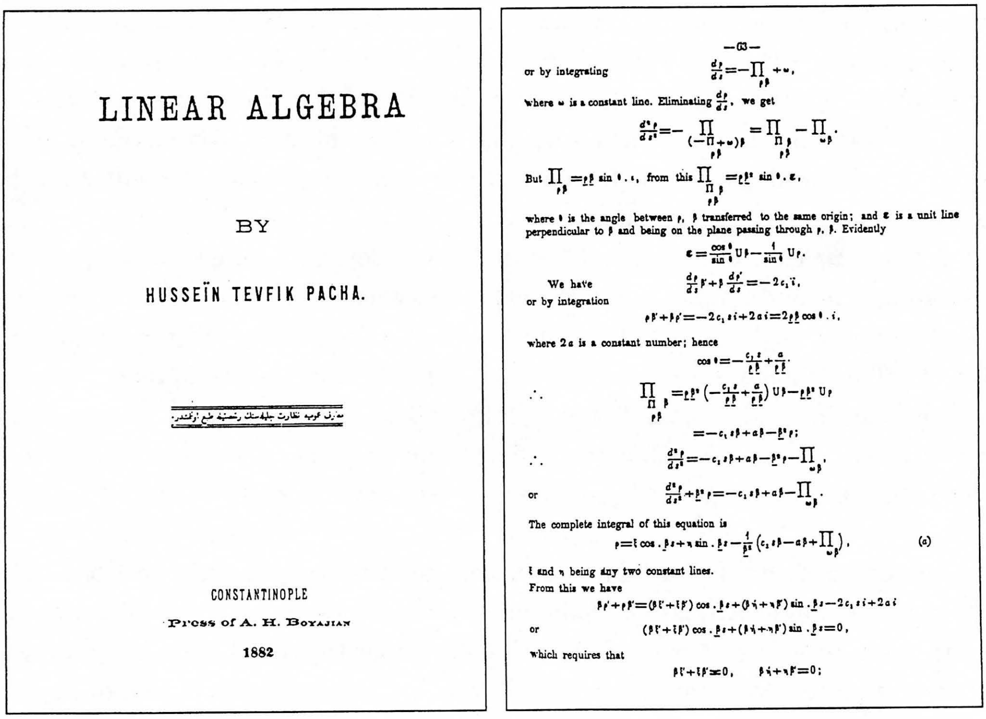
لغرتمه جداولی

بسم الله الرحمن الرحيم

معلوم اصحاب هنر ومعرفت ومجزوم ارباب كمالات ووقوفات اولديغى وجهله
مدار تربيهٔ عساكر بريه وبحريه نك موقوف عليهاسى اولان علوم رياضيه
وفنون بحريه وانشائيه ومثلثات مستويه وكرويه وفن هيئت مسائلنك
عقد وحلى ماده لريچون عادتا الفباسى مقامنده بولنان لغرتمه
جدولى هر نقدر ارقام تركيه يه ترجمه اولنه رق ازهند الآن استعمال
اولنمقده ايسه ده لغرتمهٔ مذكور يالكز اصول عتيقه يعنى اوچ نوع
جدول اوله رق نوع اولى انساب نوع ثانيسى نسبت جيبيه نوع
ثالثى جيب اعشاريدن عبارت وهنوز شرحى دخى لسان عذب البيان
تركى يه ترجمه اولنمديغندن حاوى اولديغى جدولى استعمالى خصوصنده
طالبينه عسرت اولمغله حالا سرير آراى اورنك خاقانى واريكه پیرای
سلطنت عثمانى شهنشاه زمين وزمان نورچشم جهانبان السلطان
بن السلطان السلطان عبد المجيد خان بن السلطان محمود خان خلد الله
خلافته الى آخر الدوران افندمز حضرتلرينك مبارك ومسعود وجود
مرحمت آلود شاهانه لرى عين عدل واحسان اولديغندن كافهٔ بندكان
سلطنت سنيه وعامهٔ سكنهٔ ممالك دولت عليه وخاصهٔ اركان بحريه ده

اعداد	انساب	اعداد	انساب	اعداد	انساب
١	٠٠٠٠٠٠٠	٣٦	١٥٥٦٣٠٣	٧١	١٨٥١٢٥٨
٢	٠٣٠١٠٣٠	٣٧	١٥٦٨٢٠٢	٧٢	١٨٥٧٣٣٢
٣	٠٤٧٧١٢١	٣٨	١٥٧٩٧٨٤	٧٣	١٨٦٣٣٢٣
٤	٠٦٠٢٠٦٠	٣٩	١٥٩١٠٦٥	٧٤	١٨٦٩٢٣٢
٥	٠٦٩٨٩٧٠	٤٠	١٦٠٢٠٦٠	٧٥	١٨٧٥٠٦١
٦	٠٧٧٨١٥١	٤١	١٦١٢٧٨٤	٧٦	١٨٨٠٨١٤
٧	٠٨٤٥٠٩٨	٤٢	١٦٢٣٢٤٩	٧٧	١٨٨٦٤٩١
٨	٠٩٠٣٠٩٠	٤٣	١٦٣٣٤٦٨	٧٨	١٨٩٢٠٩٥
٩	٠٩٥٤٢٤٣	٤٤	١٦٤٣٤٥٣	٧٩	١٨٩٧٦٢٧
١٠	١٠٠٠٠٠٠	٤٥	١٦٥٣٢١٣	٨٠	١٩٠٣٠٩٠
١١	١٠٤١٣٩٣	٤٦	١٦٦٢٧٥٨	٨١	١٩٠٨٤٨٥
١٢	١٠٧٩١٨١	٤٧	١٦٧٢٠٩٨	٨٢	١٩١٣٨١٤
١٣	١١١٣٩٤٣	٤٨	١٦٨١٢٤١	٨٣	١٩١٩٠٧٨
١٤	١١٤٦١٢٨	٤٩	١٦٩٠١٩٦	٨٤	١٩٢٤٢٧٩
١٥	١١٧٦٠٩١	٥٠	١٦٩٨٩٧٠	٨٥	١٩٢٩٤١٩
١٦	١٢٠٤١٢٠	٥١	١٧٠٧٥٧٠	٨٦	١٩٣٤٤٩٨
١٧	١٢٣٠٤٤٩	٥٢	١٧١٦٠٠٣	٨٧	١٩٣٩٥١٩
١٨	١٢٥٥٢٧٣	٥٣	١٧٢٤٢٧٦	٨٨	١٩٤٤٤٨٣
١٩	١٢٧٨٧٥٤	٥٤	١٧٣٢٣٩٤	٨٩	١٩٤٩٣٩٠
٢٠	١٣٠١٠٣٠	٥٥	١٧٤٠٣٦٣	٩٠	١٩٥٤٢٤٣
٢١	١٣٢٢٢١٩	٥٦	١٧٤٨١٨٨	٩١	١٩٥٩٠٤١
٢٢	١٣٤٢٤٢٣	٥٧	١٧٥٥٨٧٥	٩٢	١٩٦٣٧٨٨
٢٣	١٣٦١٧٢٨	٥٨	١٧٦٣٤٢٨	٩٣	١٩٦٨٤٨٣
٢٤	١٣٨٠٢١١	٥٩	١٧٧٠٨٥٣	٩٤	١٩٧٣١٢٨
٢٥	١٣٩٧٩٤٠	٦٠	١٧٧٨١٥١	٩٥	١٩٧٧٧٢٤
٢٦	١٤١٤٩٧٣	٦١	١٧٨٥٣٣٠	٩٦	١٩٨٢٢٧١
٢٧	١٤٣١٣[illegible]	٦٢	١٧٩٢٣٩٢	٩٧	١٩٨٦٧٧٢
٢٨	١٤٤٧١٥٨	٦٣	١٧٩٩٣٤١	٩٨	١٩٩١٢٢٦
٢٩	١٤٦٢٣٩٨	٦٤	١٨٠٦١٨٠	٩٩	١٩٩٥٦٣٥
٣٠	١٤٧٧١٢١	٦٥	١٨١٢٩١٣	١٠٠	٢٠٠٠٠٠٠
٣١	١٤٩١٣٦٢	٦٦	١٨١٩٥٤٤	١٠١	٢٠٠٤٣٢١
٣٢	١٥٠٥١٥٠	٦٧	١٨٢٦٠٧٥	١٠٢	٢٠٠٨٦٠٠
٣٣	١٥١٨٥١٤	٦٨	١٨٣٢٥٠٩	١٠٣	٢٠١٢٨٣٧
٣٤	١٥٣١٤٧٩	٦٩	١٨٣٨٨٤٩	١٠٤	٢٠١٧٠٣٣
٣٥	١٥٤٤٠٦٨	٧٠	١٨٤٥٠٩٨	١٠٥	٢٠٢١١٨٩

Fig. 3 The first page of *Logaritma cedavili* (Tables of logarithms) published for the Imperial Naval Academy in 1852 (left) and a sample page (right).



LINEAR ALGEBRA

BY

HUSSEÏN TEVFIK PACHA.

CONSTANTINOPLE
Press of A. H. Boyajian
1882

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or by integrating $$\frac{d\rho}{ds}=-\prod_{\rho\beta}+\omega,$$

where ω is a constant line. Eliminating $\frac{d\rho}{ds}$, we get

$$\frac{d^2\rho}{ds^2}=-\prod_{(-\prod_{\rho\beta}+\omega)\beta}=\prod_{\prod_{\rho\beta}\beta}-\prod_{\omega\beta}.$$

But $\prod_{\rho\beta}=\underline{\rho\beta}\sin\theta.\iota$, from this $\prod_{\prod_{\rho\beta}\beta}=\underline{\rho\beta}^2\sin\theta.\varepsilon$,

where θ is the angle between ρ, β transferred to the same origin; and ε is a unit line perpendicular to β and being on the plane passing through ρ, β. Evidently

$$\varepsilon=\frac{\cos\theta}{\sin\theta}U\beta-\frac{1}{\sin\theta}U\rho.$$

We have $$\frac{d\rho}{ds}\beta'+\beta\frac{d\rho'}{ds}=-2c_1 i,$$
or by integration

$$\rho\beta'+\beta\rho'=-2c_1 si+2ai=2\underline{\rho\beta}\cos\theta.i,$$

where $2a$ is a constant number; hence

$$\cos\theta=-\frac{c_1 s}{\underline{\rho\beta}}+\frac{a}{\underline{\rho\beta}}.$$

∴ $$\prod_{\prod_{\rho\beta}\beta}=\underline{\rho\beta}^2\left(-\frac{c_1 s}{\underline{\rho\beta}}+\frac{a}{\underline{\rho\beta}}\right)U\beta-\underline{\rho\beta}^2U\rho$$

$$=-c_1 s\beta+a\beta-\underline{\beta}^2\rho;$$

∴ $$\frac{d^2\rho}{ds^2}=-c_1 s\beta+a\beta-\underline{\beta}^2\rho-\prod_{\omega\beta},$$

or $$\frac{d^2\rho}{ds^2}+\underline{\beta}^2\rho=-c_1 s\beta+a\beta-\prod_{\omega\beta}.$$

The complete integral of this equation is

$$\rho=\xi\cos.\underline{\beta}s+\eta\sin.\underline{\beta}s-\frac{1}{\underline{\beta}^2}\left(c_1 s\beta-a\beta+\prod_{\omega\beta}\right), \qquad (a)$$

ξ and η being any two constant lines.
From this we have

$$\beta\rho'+\rho\beta'=(\beta\xi'+\xi\beta')\cos.\underline{\beta}s+(\beta\eta'+\eta\beta')\sin.\underline{\beta}s-2c_1 si+2ai$$

or $$(\beta\xi'+\xi\beta')\cos.\underline{\beta}s+(\beta\eta'+\eta\beta')\sin.\underline{\beta}s=0,$$

which requires that

$$\beta\xi'+\xi\beta'=0,\qquad \beta\eta'+\eta\beta'=0;$$

Fig. 4 The title page of the *Linear algebra* (1882) (left) and a sample page (right).

tions in mathematics. Hüseyin Tevfik Pash from Vidin (1832–1901) was one of the few persons who made original contributions in mathematics. His book titled *Linear algebra* was published in English in Istanbul in 1882 (1^{st} edition) and 1892 (2^{nd} edition) (Fig. 4).

Astronomy

The first book introducing modern astronomy to the Ottoman world was Tezkireci Köse İbrahim Efendi's translation of the French astronomer Noel Durret's (d. 1650) astronomical tables. The translation was completed between the years 1660–64 and named *Sajanjal al–aflak fi ghayat al–idrak* (The mirror of the heavens and the purpose of perception). The second work introducing modern astronomy to Ottoman readers was al–Dimashki's work based on Janszoon Blaeu's work in Latin, briefly known as the *Atlas major.* Blaeu's geographical work was presented in 1668 to Sultan Mehmed IV, who then ordered its translation. Al–Dimashki started the translation in 1675 and completed it in 1685. These two works introduced the concept and principles of the "new astronomy" indirectly and in a general way.

These were followed by translations of *Atlas coelestis* and *Geographica* *generalis* by Bernhard Varenius in 1733 and 1751 respectively. The latter was translated under the title of *Tercüme–i kitab–ı Coğrafya* (Translation of the book of geography). All these translations were not printed, and remained in manuscript form. Kâtip Çelebi's geography book titled *Cihannüma* was published in 1732 by İbrahim Müteferrika, who discussed modern astronomy and gave detailed information on the heliocentric system in the supplement that he appended to the printed version.

As the *Zij* (Astronomical tables) of Ulugh Bey was judged inadequate in reckoning time and for preparing the calendar, various astronomical tables were translated and used in the 17th and 18th centuries, beginning with those of Noel Durret. The translation of the astronomical tables of Alexis Claude Clairaut, Jacques Cassini and Joseph Lalande followed in 1664, 1767, 1772, and 1826, respectively. Clairaut's table tracked the movements of the moon, and was translated under the title of *Rasad–ı kamer* (Observations of the moon).

Modern astronomy was taught in the imperial engineering schools. The lectures of Hüseyin Rıfkı, one of the chief instructors of the Imperial School of Military Engineering, were published in 1831 under the title *Medhal fi'l–coğrafya* (Introduction to geography). *Mecmua–i ulûm–i riyaziye* (Compendium of mathematical sciences) by Hodja İshak Efendi (1748–1836), chief instructor at the same school, was published between 1830–1834 in four volumes. 250 pages of the fourth volume were devoted to astronomy. While books introducing modern astronomy were printed and used in the educational institutions in the beginning of the 19th century, an Arabic book on "old astronomy", namely the *Fethiye* of Ali Kuşcu (15th century), was translated into Turkish and printed in 1824 in the printing house of the Imperial School of Military Engineering. For a while, then, the old and the new astronomy coexisted side by side.

Physics

The earliest printed book on physics was the *Mebahis–i fenn–i buhar* (Articles on Steam Technology, 1854), translated by Mehmet Salih Pasha for use at the *Mekteb–i Bahriye* (Naval Academy). Another book, the *İlm–i cerr–i eskal* (Mechanics, 1862) by Mehmed Tahir Pasha, was used as a textbook at the *Mekteb–i Harbiye* (Imperial School of Military Arts) (Figs. 5 and 6). Both works dealt with practical knowledge. The first book on general physics was the *Usûl–i hikmet–i tabiiye* (Elements of physics), by the chemist Derviş Pasha (1817–1879). Printed in two volumes in 1864 (Fig. 7), this book consisted of 454 pages and included 24 plates (Fig. 8). It is clear that this book was used as a textbook in several schools, since a second edition was published in 1870. It also contained

Fig. 5 The title page (left) and the first page (right) of *Ilm-i cerri-i eskal* (Mechanics, 1862).

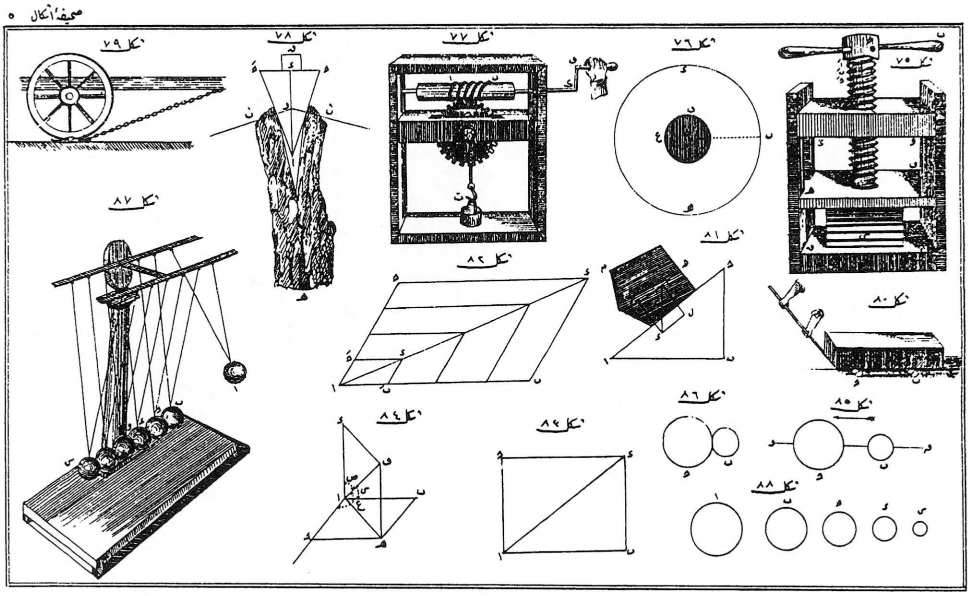


Fig. 6 Plate V from *Ilm-i cerr-i eskal* (Mechanics). Lithography.

Fig. 7 Chemist Derviş Pasha (1817–1879).

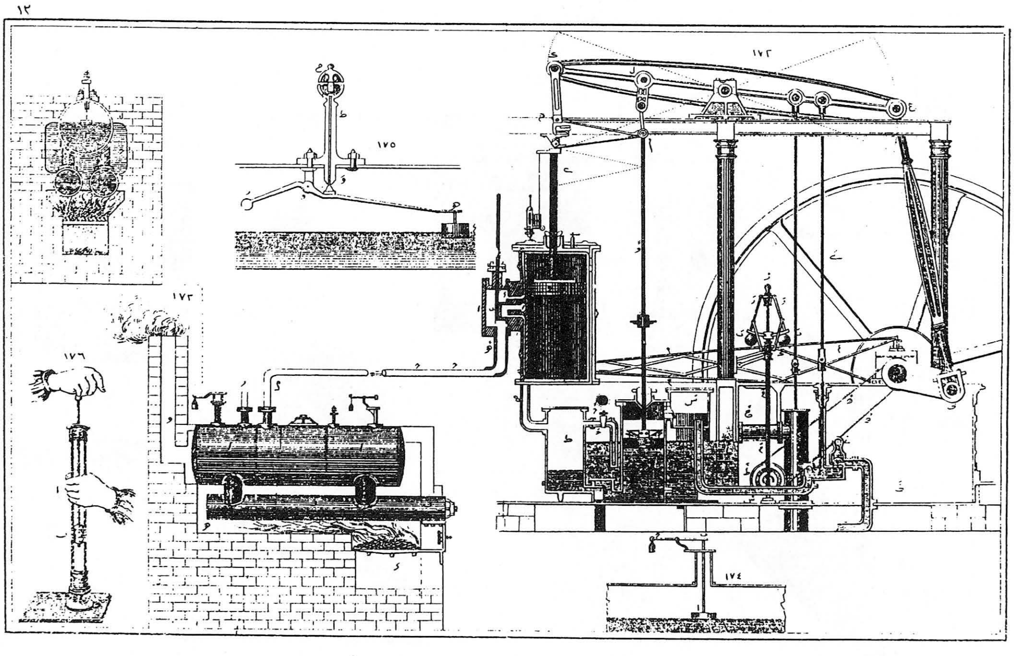


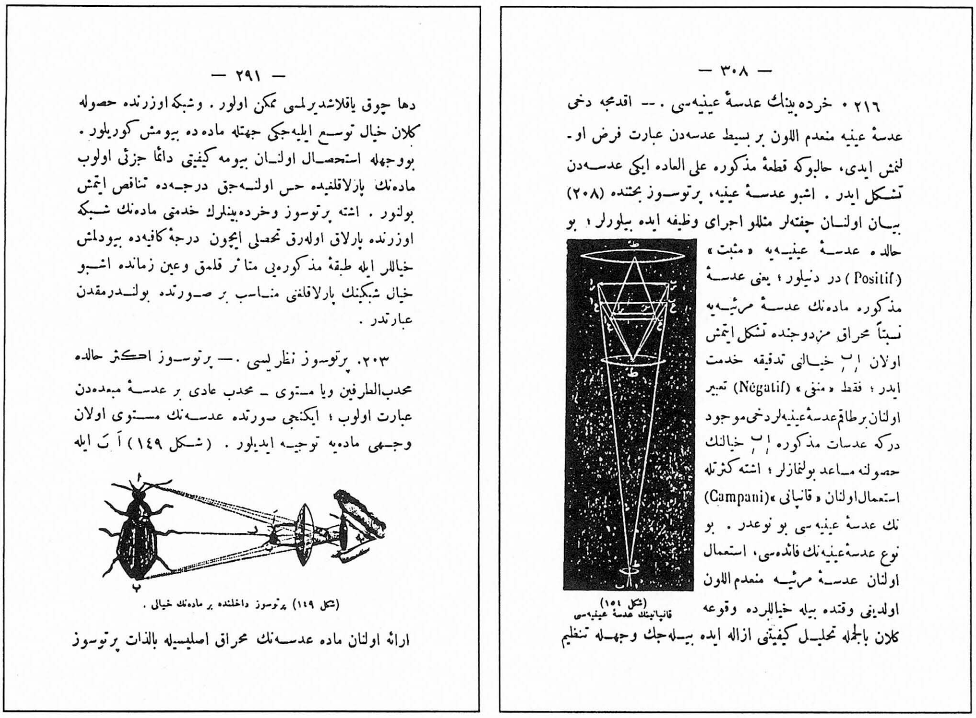
Fig. 8 Steam engine (Plate XII) from *Usûl–i hikmet–i tabiiye* (Physics, 1870)

information about steam and steam engines.

The *Traité élémentaire de physique*, by the French physicist A. Ganot, was translated under the title of *İlm–i hikmet–i tabiiye* (Physics) by Antranik Kirkciyan, an instructor at the *Mekteb–i Tıbbiye–i Şahane* (Imperial School of Medicine). It first appeared in three volumes in 1876, and a second edition was published between 1886–1891.

The *Kavaid–i tahavvülat fî harekât–i zerrat* (Variation rules in the movements of particles, 1882) by Ali Sedad Bey introduced the subject of thermodynamics. *İlm–i hikmet–i tabiiye* (Physics, 1886), was translated from a text by H. Gossen by Ahmed Tevfik Bey, one of the teachers of the Imperial School of Medicine (Fig. 9) and dealt with acoustics and geometrical optics (mirrors and lenses). Major Ali Rıza Bey, one of the teachers of the *Hendese–i Mülkiye* (School of Civil Engineering) and the Imperial School of Military Arts wrote the two–volume *Fenn–i mihanik–i riyazi ve makineler* (Rational mechanics and machines, 1890) (Fig. 10).

Just after the discovery of X–rays by W. Konrad Röntgen (1845–1923) in 1895, Esad Feyzi (1874–1902), assistant in medical physics in the Imperial School of Medicine, obtained X–rays with some apparatus in the physics laboratory. He used these rays during the 1897 Ottoman–Greek War to detect the bullets and



— ۲۹۱ —

دها چوق یاقلاشدیرلمسی ممکن اولور . وشبکه اوزرنده حصوله
کلان خیال توسع ایلیه‌جکی جهتله ماده‌ده بیومش کوریلور .
بووجهله استحصال اولنان بیومه کیفیتی دائما جزئی اولوب
ماده‌نك پارلاقلغیده حس اولنه‌جق درجه‌ده تناقص ایتمش
بولنور . اشته پرتوسوز وخرده‌بینلرك خدمتی ماده‌نك شبکه
اوزرنده پارلاق اوله‌رق تحصلی ایچون درجهٔ کافیه‌ده بیودلمش
خیاللر ایله طبقهٔ مذکوره‌یی متاثر قلمق وعین زمانده اشبو
خیال شبکینك پارلاقلغنی مناسب بر صورتده بولندرمقدن
عبارتدر .

۲۰۳. پرتوسوز نظریسی .— پرتوسوز اکثر حالده
محدب الطرفین ویا مستوی ـ محدب عادی بر عدسهٔ مبده‌دن
عبارت اولوب ؛ ایکنجی صورتده عدسه‌نك مستوی اولان
وجهی ماده‌یه توجیه ایدیلور . (شکل ۱۴۹) آ بَ ایله

(شکل ۱۴۹) پرتوسوز داخلنده بر ماده‌نك خیالی .

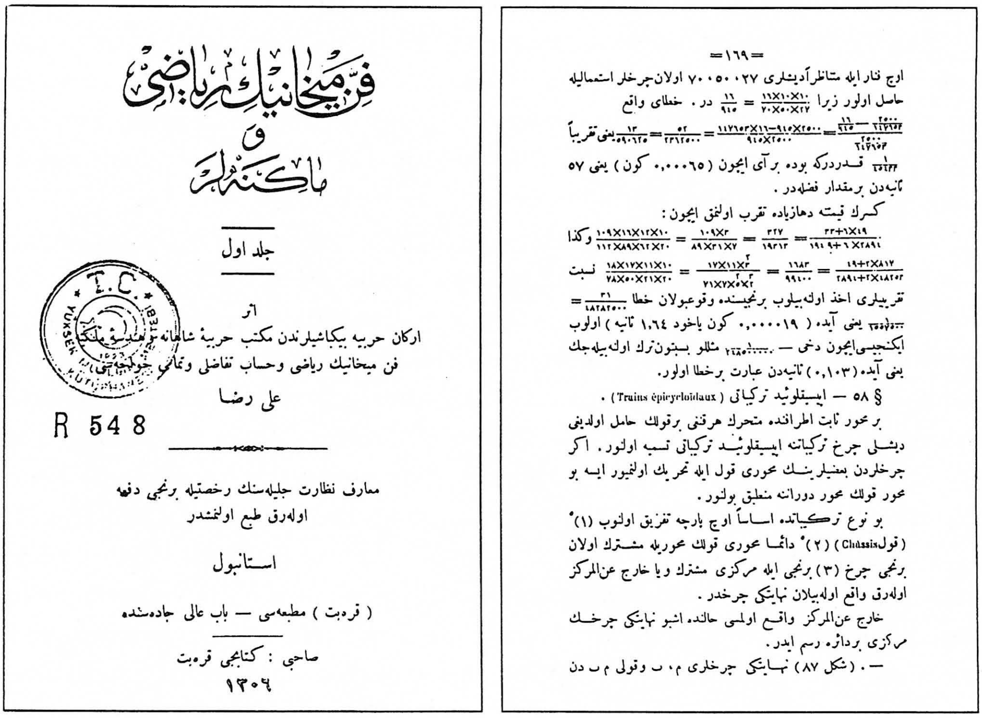
ارائه اولنان ماده عدسه‌نك محراق اصلیسیله بالذات پرتوسوز

— ۳۰۸ —

۲۱۶ . خرده‌بینك عدسهٔ عینیه‌سی . — اقدمجه دخی
عدسهٔ عینیه منعدم اللون بر بسیط عدسه‌دن عبارت فرض او-
لنمش ایدی، حالبوکه قطعهٔ مذکوره علی العاده ایکی عدسه‌دن
تشکل ایدر . اشبو عدسهٔ عینیه، پرتوسوز بحثنده (۲۰۸)
بیان اولنان چفته‌لر مثللو اجرای وظیفه ایده بیلورلر ؛ بو
حالده عدسهٔ عینیه‌یه «مثبت»
(Positif) در دنیلور ؛ یعنی عدسهٔ
مذکوره ماده‌نك عدسهٔ مرئیه‌یه
نسبتاً محراق مزدوجنده تشکل ایتمش
اولان اَبَ خیالی تدقیقه خدمت
ایدر ؛ فقط «منفی» (Negatif) تعبیر
اولنان برطاقم عدسهٔ عینیه‌لر دخی موجود
درکه عدسات مذکوره اَبَ خیالنك
حصوله مساعد بولنمازلر ؛ اشته کثرتله
استعمال اولنان «قانپانی» (Campani)
نك عدسهٔ عینیه‌سی بو نوعدر . بو
نوع عدسهٔ عینیه‌نك فائده‌سی، استعمال
اولنان عدسهٔ مرئیه منعدم اللون
اولدیغی وقتده بیله خیاللرده وقوعه
کلان بالجمله تحلیل کیفیتی ازاله ایده بیله‌جك وجهله تنظیم

(شکل ۱۵۴)
قانپانینك عدسهٔ عینیه‌سی

Fig. 9 Two pages from *Ilm–i hikmet–i tabiiye* (Physics, 1886) (Left p. 291 ; right p. 308).



فن میخانیك ریاضی

و

ماكنه‌لر

جلد اول

اثر

اركان حربیه بیكباشیلرندن مكتب حربیهٔ شاهانه و مهندسخانهٔ ملكیه
فن میخانیك ریاضی وحساب تفاضلی وتمامی خواجه‌سی

علی رضا

معارف نظارت جلیله‌سنك رخصتیله برنجی دفعه
اوله‌رق طبع اولنمشدر

استانبول

(قره‌بت) مطبعه‌سی — باب عالی جاده‌سنده

صاحبی : كتابجی قره‌بت
١٣٠٦

Fig. 10 The title page of the first volume of *Fenn–i mihanik–i riyazi ve makineler* (Rational mechanics and machines, 1890) (left) and a sample page (right p. 169).

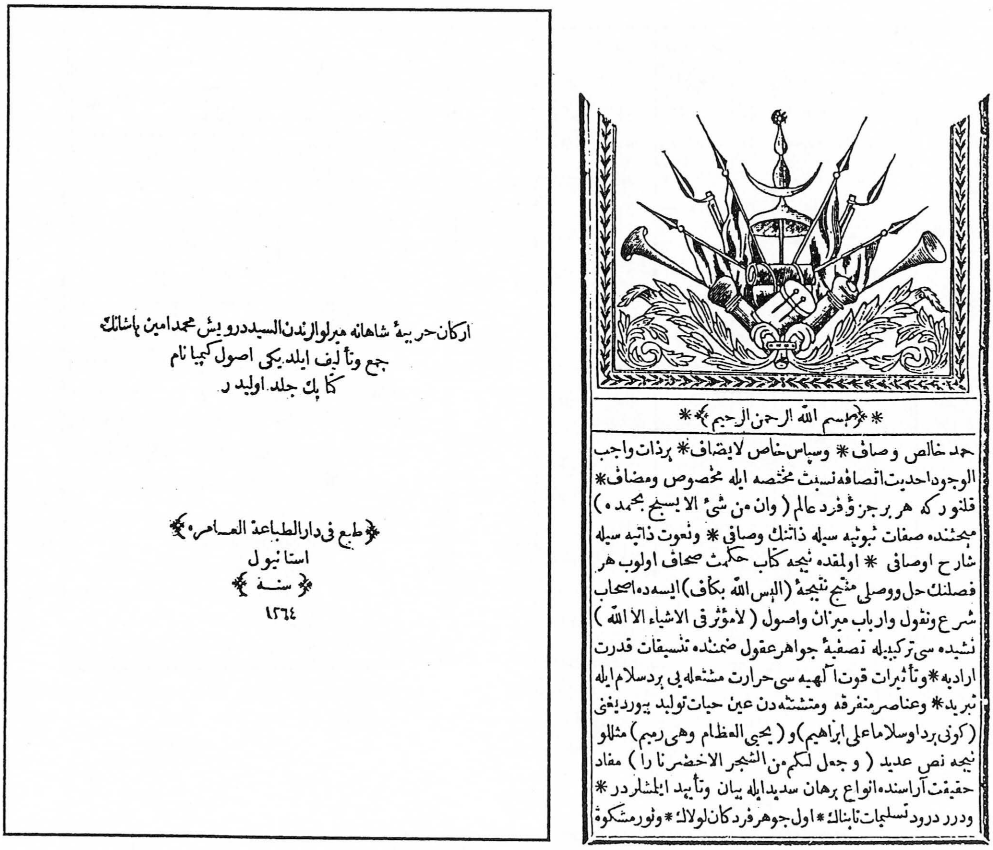
fractures in soldiers' bones. However, the book he wrote in 1898 about the use of X–rays in war surgery went unpublished.

About fifteen books on physics were published in the 19th century. These were either translations of, or compilations from, French sources.

Chemistry

The fourth volume of Hodja Ishak Efendi's *Mecmua*, introduced modern chemistry. This 25–page text was based on Antoine Laurent Lavoisier's (1743–1794) *Traité élémentaire de chimie* (1789). Although chemical formulas and equations started to be used in Europe from 1815 onwards, these were not included in Hodja İshak Efendi's text. The text is notable, though, for its attempts to forge a chemical terminology in Ottoman Turkish.

Usûl–i kimya (Elements of chemistry, 1848) by Derviş Pasha (1817 – 1879) was the first chemistry book published in Turkey, and dealt with general and inorganic chemistry (Fig. 11). The author studied chemistry and mining engineering in London and Paris, and succeeded in summarizing the chemical knowledge of the time. In his book, the symbols for the chemical elements and the chemical formulas were based on the system of Jöns Jacob Berzelius (1779–



ارکان حربیهٔ شاهانه میرلوالرندن السید درویش محمد امین پاشانك
جمع وتألیف ایلدیکی اصول کیمیا نام
کتابك جلد اولیدر

﴿طبع فی دار الطباعة العامره﴾
استانبول
﴿سنه﴾
١٢٦٤

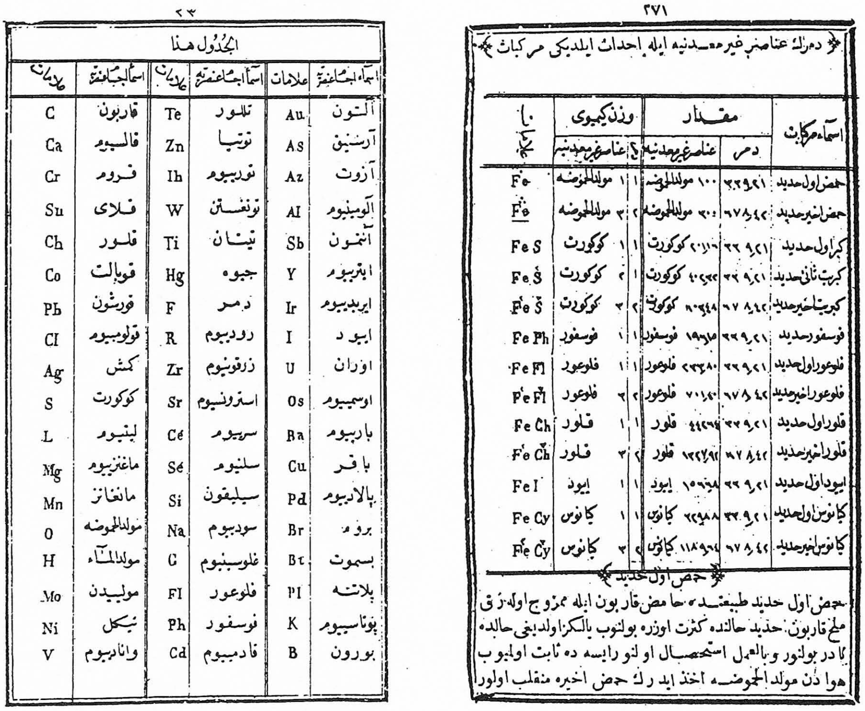
* ﴿بسم الله الرحمن الرحیم﴾ *

حمد خالص وصاف * وسپاس خاص لایضاف * بر ذات واجب
الوجود احدیت اتصافه نسبت مختصه ایله مخصوص ومضاف *
قلنور که هر بر جزء وفرد عالم (وان من شیء الا یسبح بحمده)
مبحثنده صفات ثبوتیه سیله ذاتنك وصافی * ونعوت ذاتیه سیله
شارح اوصافی * اولمقده نیجه کتاب حکمت صحاف اولوب هر
فصلنك حل ووصلی منتج نتیجهٔ (الیس الله بکاف) ایسه ده اصحاب
شرع ونقول وارباب میزان واصول (لا مؤثر فی الاشیاء الا الله)
نشیده سی ترکیبیله تصفیهٔ جواهر عقول ضمننده تنسیقات قدرت
ارادیه * وتأثیرات قوت الٓهیه سی حرارت مشتعله یی بردسلام ایله
تبرید * وعناصر متفرقه ومتشتته دن عین حیات تولید بیوردیغی
(کونی برداوسلاما علی ابراهیم) و (یحیی العظام وهی رمیم) مثللو
نیجه نص عدید (و جعل لکم من الشجر الاخضر نارا) مفاد
حقیقت آراسنده انواع برهان سدید ایله بیان وتأیید ایلمشلردر *
ودرر درود تسلیمات تابناك * اول جوهر فرد کان لولاك * ونور مشکوة

Fig. 11 The title page (left) and the first page (right) of *Usûl–i kimya* (Elements of chemistry, 1848).

1848) (Fig. 12). By contrast, the equations for chemical reactions were written schematically, in a totally different manner than those encountered in European texts. In these equations, Dervis Pasha represented chemical substances with words instead of chemical formulas, and used arrows to depict the interrelationships of elements contained in the reactant substances (Figs. 13 & 14). This book was the only chemistry textbook used for about 20 years, and it played an important role in the establishment of Turkish chemical terminology.

Aziz Bey of Crimea (1840–1878), a leading figure in the movement to teach medicine in Turkish, was also the author of *Kimya–yi tibbî* (Medical chemistry, vol. 1, 1868, vol. 2, 1871), so titled because it was meant to be a textbook for the Civil School of Medicine. With separate volumes devoted to nonmetals and metals, this was the most comprehensive work on inorganic chemistry written in Turkish (Fig. 15). Aziz Bey compiled this work from various French chemistry books. He relied especially on Adolph Würtz's (1817–1884) treatise, a work



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الجدول هذا

اسماء اجسام عنصریه	علامات	اسماء اجسام عنصریه	علامات	اسماء اجسام عنصریه	علامات
آلتون	Au	تللور	Te	قاربون	C
آرسنیق	As	توتیا	Zn	قالسیوم	Ca
آزوت	Az	توریوم	Ih	قروم	Cr
آلومینیوم	Al	تونغستن	W	قلای	Su
آنتمون	Sb	تیتان	Ti	قلور	Ch
ایتریوم	Y	جیوه	Hg	قوبالت	Co
ایریدیوم	Ir	دمر	F	قورشون	Pb
ایود	I	رودیوم	R	قولومبیوم	Cl
اوران	U	زرقونیوم	Zr	کمش	Ag
اوسمیوم	Os	استرونسیوم	Sr	کوکورت	S
باریوم	Ba	سریوم	Cé	لیتیوم	L
باقر	Cu	سلنیوم	Sé	ماغنزیوم	Mg
پالادیوم	Pd	سیلیقون	Si	مانغانز	Mn
بروم	Br	سودیوم	Na	مولدالحموضه	O
بسموت	Bt	غلوسینیوم	G	مولدالماء	H
پلاتنه	Pl	فلوعور	Fl	مولیبدن	Mo
پوتاسیوم	K	فوسفور	Ph	نیکل	Ni
بورون	B	قادمیوم	Cd	وانادیوم	V

Fig. 12 The table of elements and symbols in *Usûl-i kimya* (Elements of chemistry, 1848) (left) and formulas of iron compounds according to Berzelius (right).

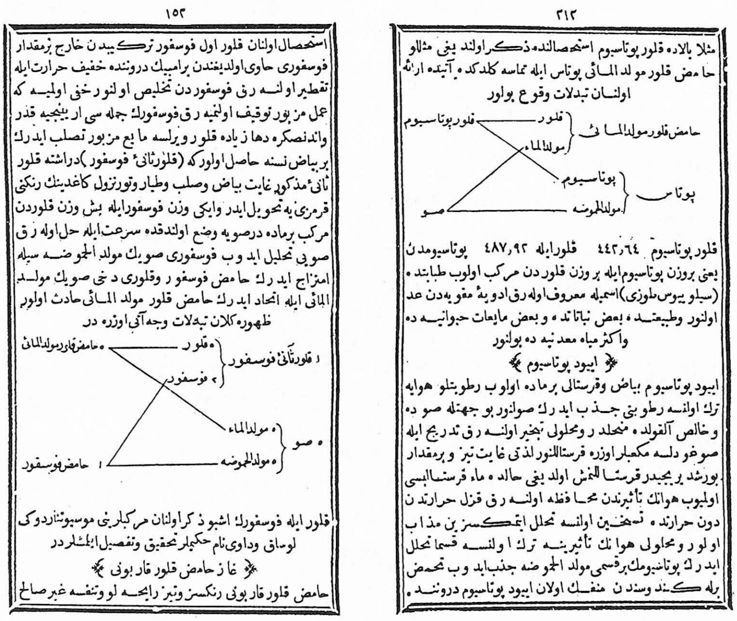
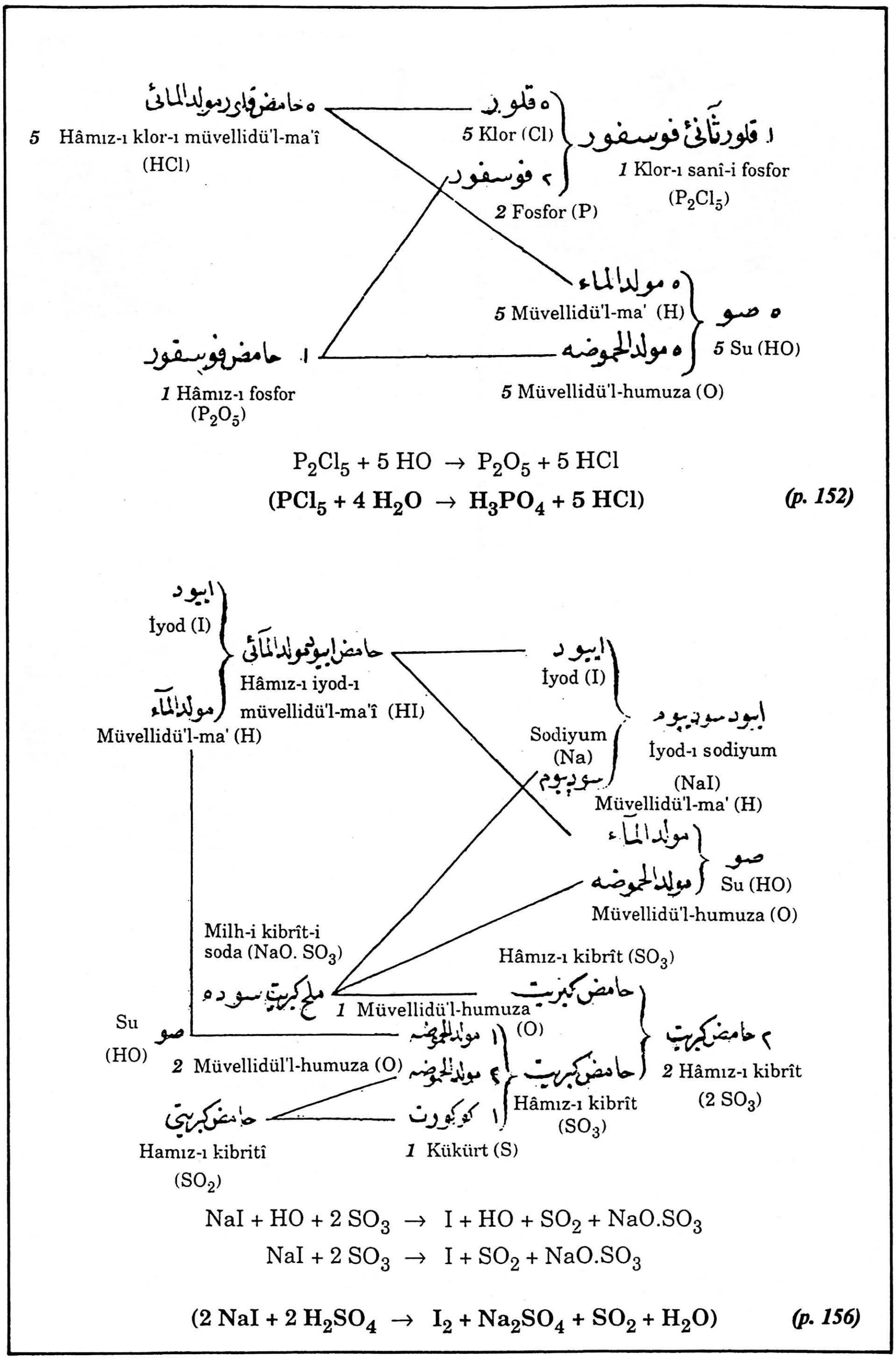


Fig. 13 Two pages showing chemical equations from *Usûl-i kimya* (Elements of chemistry, 1848) (Left p. 152, right p. 212).



$$P_2Cl_5 + 5\,HO \rightarrow P_2O_5 + 5\,HCl$$

$$\mathbf{(PCl_5 + 4\,H_2O \rightarrow H_3PO_4 + 5\,HCl)}$$

(p. 152)

$$NaI + HO + 2\,SO_3 \rightarrow I + HO + SO_2 + NaO.SO_3$$

$$NaI + 2\,SO_3 \rightarrow I + SO_2 + NaO.SO_3$$

$$\mathbf{(2\,NaI + 2\,H_2SO_4 \rightarrow I_2 + Na_2SO_4 + SO_2 + H_2O)}$$

(p. 156)

Fig. 14 Chemical equations from *Usûl-i kimya* (Elements of chemistry, 1848). The hydrolysis of phosphorous pentachloride (above) and the oxidation of sodium iodide by sulfuric acid (below). The equations written in bold characters show the contemporary way of writing.

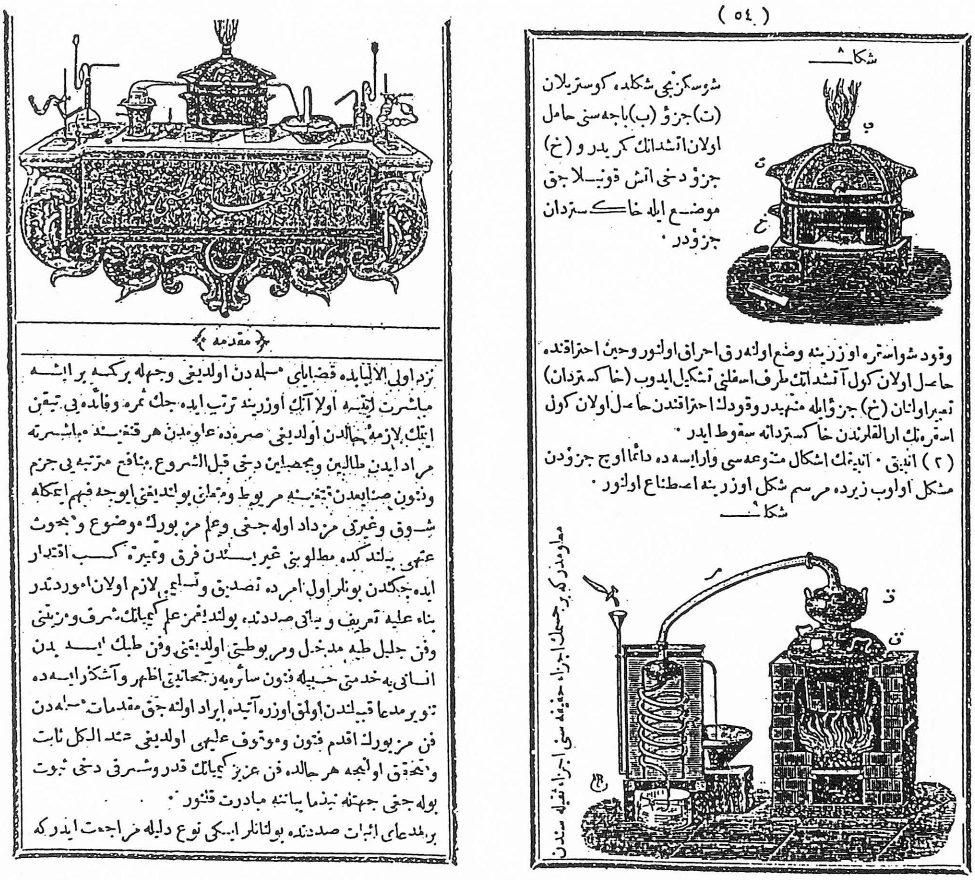


Fig. 15 The first page of the first volume of *Kimya-yi tibbî* (Medical chemistry, 1868) (left) and a page showing laboratory equipment (right p. 54).

which mirrored the chemical knowledge of the time. Ample space was given to the spectroscope and to spectral analysis, and a colored plate of the emission spectra of alkali metals was also inserted (Fig. 16). The chemical terminology proposed by Dervis Pasha was further developed and systematized. On the other hand, as one expression of the emotional rejection of medical teaching in French, the Latin characters symbolizing chemical elements were replaced with Arabic characters (Fig. 17). All the formulas and the equations were written with these symbols following Berzelius' method (Fig. 18). The followers of Aziz Bey subsequently continued to use symbols derived from Arabic characters.

Another essential work was the *İlm-i kimya-yi gayr-i uzvî-i tıbbî* (Inorganic medical chemistry, vol. 1, 1892 ; vol. 2, 1894) written by Dr. Vasil Naum Bey (1855–1915), professor of chemistry at the Imperial School of Medicine. This work presented the tables of elements with French names and the symbols in Latin characters, and all formulas and equations in Arabic characters. For the

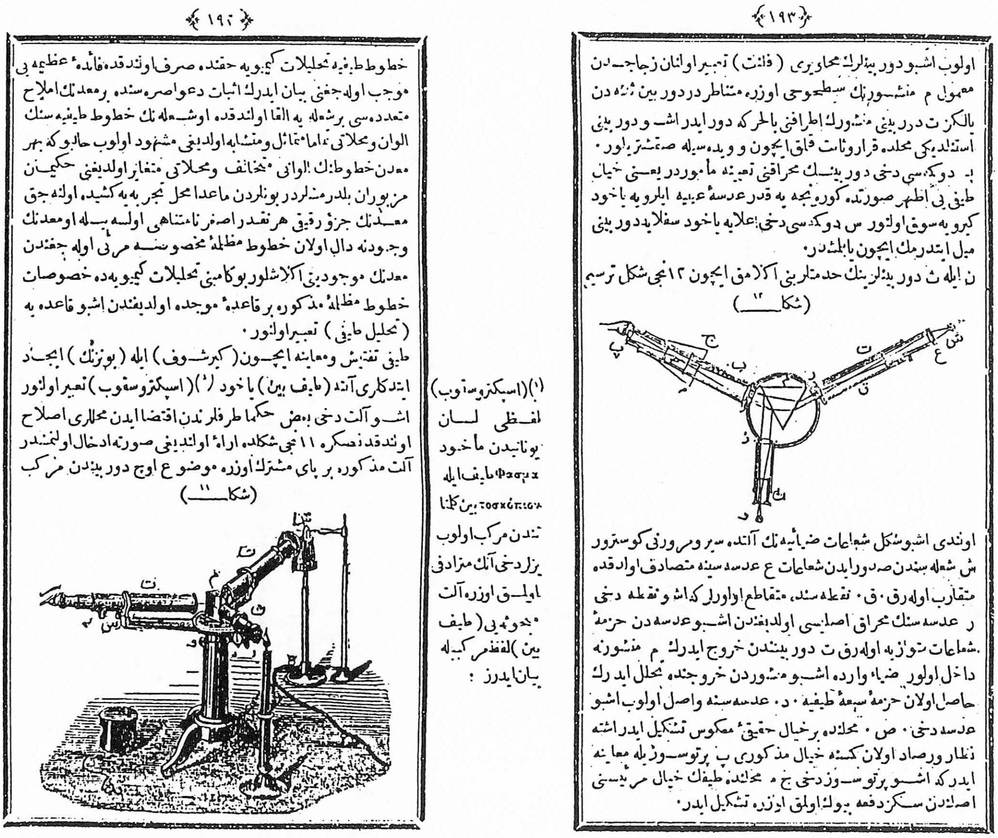
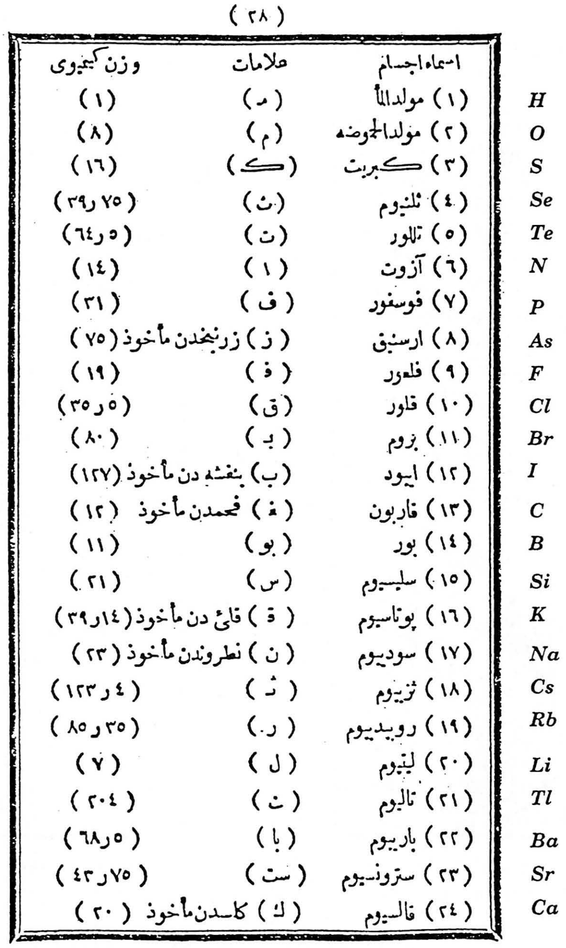


Fig. 16 Two pages on spectroscope and spectral analysis from the second volume of *Kimya-yi tibbî* (Medical chemistry, 1871) (Left p. 192, right p. 193).

first time in Turkish chemical history, stoichiometric calculations, solubility curves and a periodic table were given (Fig. 19). However, the periodic table was not followed in the study of chemical elements.

In 1901, Ali Riza Bey published a major book on organic chemistry under the title *Kimya-yi uzvî* (Organic chemistry) (Fig. 20). Its formulas and equations were written with symbols in Arabic characters. The work discussed *cis-trans* isomerism and stereoisomer compounds, and introduced the corresponding formulas.

From the end of the 19th century, symbols in Latin characters began to appear in books compiled or translated outside the medical schools. Later on, a third way emerged, in which symbols and equations in both Arabic and Latin characters were used concurrently (Fig. 21). From the end of the 19th century, German academic influence accelerated the use of Latin symbols in chemistry. However, it was only after the adoption of the Latin alphabet in 1928 that the simultaneous use of Arabic and Latin symbols was finally eliminated.



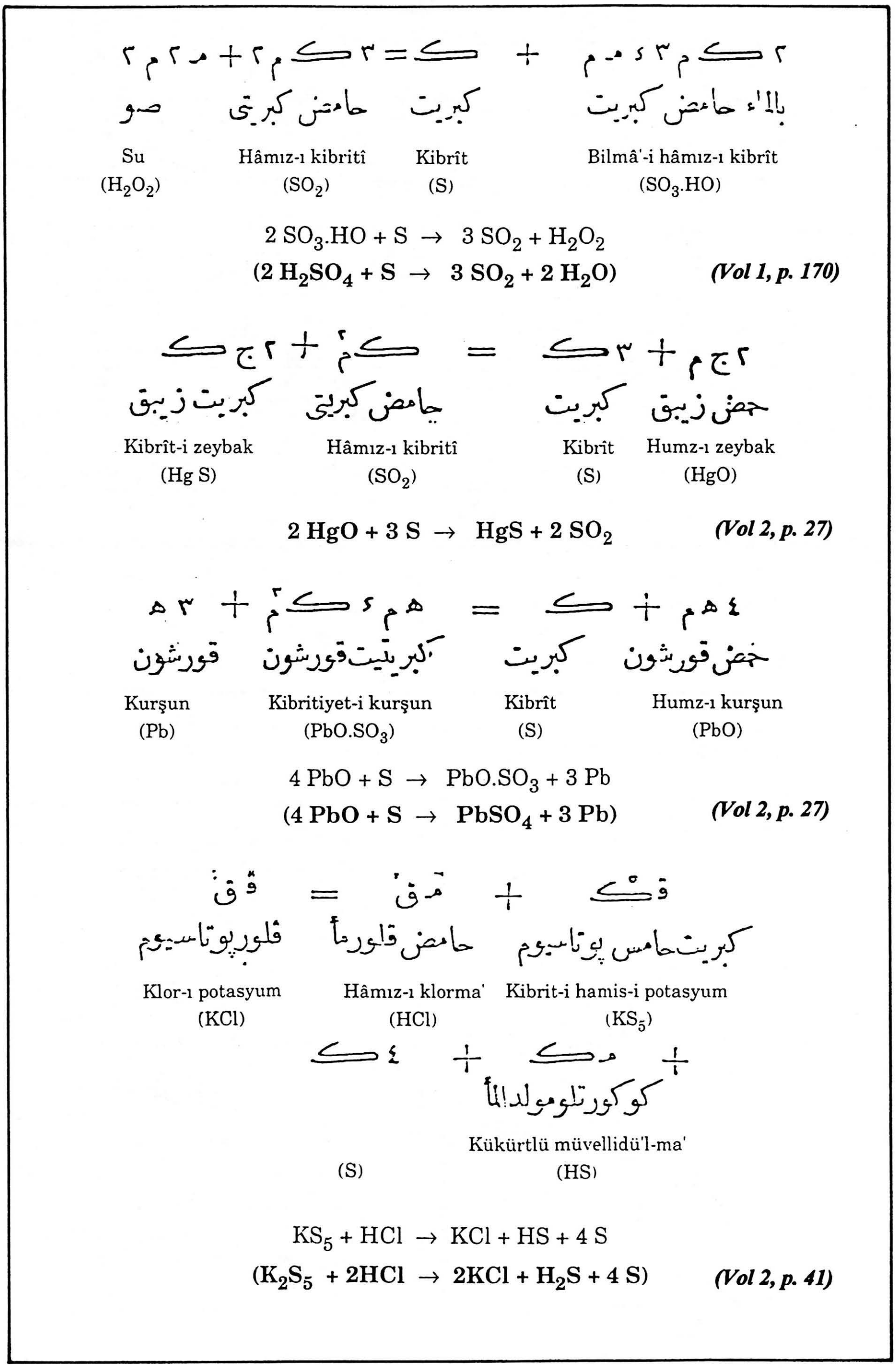
(٢٨)

	اسماء اجسام	علامات	وزن کیمیوی
H	(١) مولدالما	(مـ)	(١)
O	(٢) مولدالحموضه	(م)	(٨)
S	(٣) کبریت	(ک)	(١٦)
Se	(٤) ثلنیوم	(ث)	(٣٩ر٧٥)
Te	(٥) تللور	(ت)	(٦٤ر٥)
N	(٦) آزوت	(ا)	(١٤)
P	(٧) فوسفور	(ف)	(٣١)
As	(٨) ارسنیق	(ز) زرنیخدن مأخوذ	(٧٥)
F	(٩) فلوور	(ف)	(١٩)
Cl	(١٠) قلور	(ق)	(٣٥ر٥)
Br	(١١) بروم	(بـ)	(٨٠)
I	(١٢) ایود	(ب) بنفشه دن مأخوذ	(١٢٧)
C	(١٣) قاربون	(ف) فحمدن مأخوذ	(١٢)
B	(١٤) بور	(بو)	(١١)
Si	(١٥) سلیسیوم	(س)	(٢١)
K	(١٦) پوتاسیوم	(ق) قلی دن مأخوذ	(٣٩ر١٤)
Na	(١٧) سودیوم	(ن) نطروندن مأخوذ	(٢٣)
Cs	(١٨) ثزیوم	(ثـ)	(١٣٣ر٤)
Rb	(١٩) روبیدیوم	(ر)	(٨٥ر٣٥)
Li	(٢٠) لیتیوم	(ل)	(٧)
Tl	(٢١) تالیوم	(ت)	(٢٠٤)
Ba	(٢٢) باریوم	(با)	(٦٨ر٥)
Sr	(٢٣) سترونسیوم	(ست)	(٤٣ر٧٥)
Ca	(٢٤) قالسیوم	(ك) كلسدن مأخوذ	(٢٠)

Fig. 17 Table of elements and symbols in Arabic characters in the first volume of *Kimya-yi tibbî* (Medical chemistry, 1868). The symbols in Latin characters placed in the right column are added by the author.

Most nations using scripts other then Latin adopted Berzelius' symbols without any change. The Ottomans, however, followed a different course, and derived chemical symbols from the Arabic alphabet as well. Today, among the nations using the Arabic script, it is only in Libya that this Ottoman tradition survives (Fig. 22).

Even when coverage began to spread across such different fields such as astronomy, zoology, botany, geology, and physics, the greatest number of books published in the 19th century remained focused on chemistry. Most of these books were either directly translated or compiled from French works. From the end of the 19th century, however German influence made itself felt, as the number of Ottomans studying chemistry in Germany gradually increased, and in



$$2\,SO_3.HO + S \rightarrow 3\,SO_2 + H_2O_2$$

$$\mathbf{(2\,H_2SO_4 + S \rightarrow 3\,SO_2 + 2\,H_2O)}$$

(Vol 1, p. 170)

$$\mathbf{2\,HgO + 3\,S \rightarrow HgS + 2\,SO_2}$$

(Vol 2, p. 27)

$$4\,PbO + S \rightarrow PbO.SO_3 + 3\,Pb$$

$$\mathbf{(4\,PbO + S \rightarrow PbSO_4 + 3\,Pb)}$$

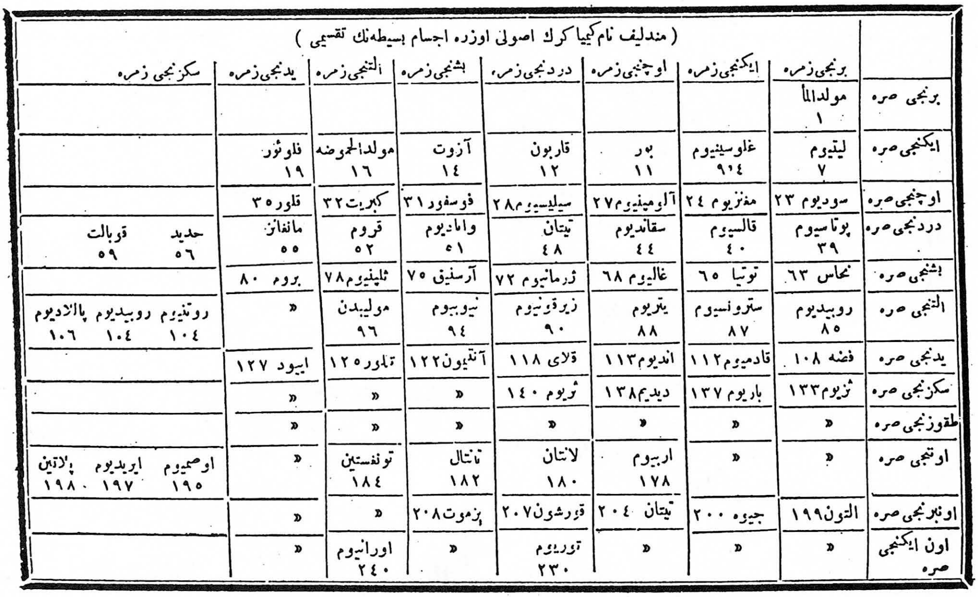
(Vol 2, p. 27)

$$KS_5 + HCl \rightarrow KCl + HS + 4\,S$$

$$\mathbf{(K_2S_5 + 2HCl \rightarrow 2KCl + H_2S + 4\,S)}$$

(Vol 2, p. 41)

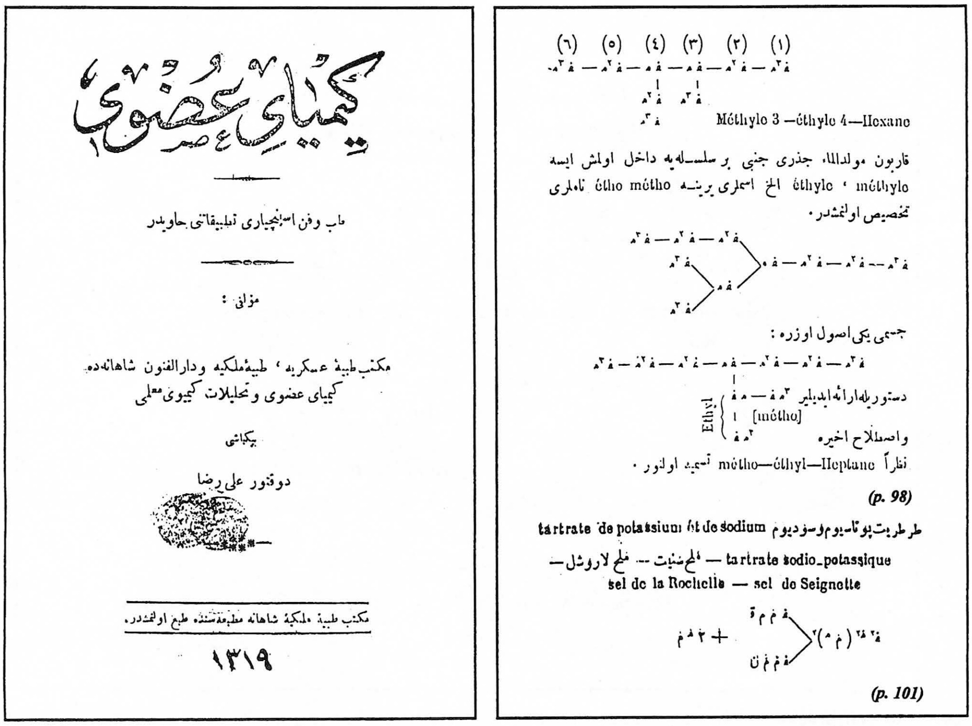
Fig. 18 Symbols and the chemical equations in Arabic characters in *Kimya-yi tibbî* (Medical chemistry). The equations written in bold characters show the contemporary way of writing.



(مندلیف نام کیمیاکرك اصولی اوزره اجسام بسیطه‌نك تقسیمی)

	برنجی زمره	ایکنجی زمره	اوچنجی زمره	دردنجی زمره	بشنجی زمره	آلتنجی زمره	یدنجی زمره	سکزنجی زمره
برنجی صره	مولدالما ۱							
ایکنجی صره	لیتیوم ۷	غلوسینیوم ۹٬٤	بور ۱۱	قاربون ۱۲	آزوت ۱٤	مولدالحموضه ۱٦	فلوئور ۱۹	
اوچنجی صره	سودیوم ۲۳	مغنزیوم ۲٤	آلومینیوم ۲۷	سیلیسیوم ۲۸	فوسفور ۳۱	کبریت ۳۲	قلور ۳٥	
دردنجی صره	پوتاسیوم ۳۹	قالسیوم ٤۰	سقاندیوم ٤٤	تیتان ٤۸	واناديوم ٥۱	قروم ٥۲	مانغانز ٥٥	حدید ٥٦ قوبالت ٥۹
بشنجی صره	نحاس ٦۳	توتیا ٦٥	غالیوم ٦۸	ژرمانیوم ۷۲	آرسنیق ۷٥	ثلینیوم ۷۸	بروم ۸۰	
آلتنجی صره	روبیدیوم ۸٥	سترونسیوم ۸۷	یتریوم ۸۸	زیرقونیوم ۹۰	نیوبیوم ۹٤	مولیبدن ۹٦	»	روتنیوم ۱۰٤ روبیدیوم ۱۰٤ پالادیوم ۱۰٦
یدنجی صره	فضه ۱۰۸	قادمیوم ۱۱۲	اندیوم ۱۱۳	قلای ۱۱۸	آنتیمون ۱۲۲	تلور ۱۲٥	ایود ۱۲۷	
سکزنجی صره	ثزیوم ۱۳۳	باریوم ۱۳۷	دیدیم ۱۳۸	ثریوم ۱٤۰	»	»	»	
طقوزنجی صره	»	»	»	»	»	»	»	
اوننجی صره	»	»	اربیوم ۱۷۸	لانتان ۱۸۰	تانتال ۱۸۲	تونغستین ۱۸٤	»	اوصمیوم ۱۹٥ ایریدیوم ۱۹۷ پلاتین ۱۹۸
اون برنجی صره	آلتون ۱۹۹	جیوه ۲۰۰	تیتان ۲۰٤	قورشون ۲۰۷	بزموت ۲۰۸	»	»	
اون ایکنجی صره	»	»	»	توریوم ۲۳۰	»	اورانیوم ۲٤۰	»	

Fig. 19 The periodic table in the second volume of *Ilm-i kimya-yi gayr-i uzvî-i tibbî* (Inorganic medical chemistry, 1894) (p. 21).



کیمیای عضوی

طب وفن اسپنچیاری تطبیقاتنی حاویدر

مؤلفی :

مکتب طبیهٔ عسکریه ، طبیهٔ ملکیه ودارالفنون شاهانه‌ده
کیمیای عضوی وتحلیلات کیمیوی معلمی

بکباشی

دوقتور علی رضا

مکتب طبیهٔ ملکیهٔ شاهانه مطبعه‌سنده طبع اولنمشدر.

۱۳۱۹

(٦) (٥) (٤) (٣) (٢) (١)

Méthylo 3 —éthylo 4—Hexane

قاربون مولدالماء جذری جنبی بر سلسله‌یه داخل اولمش ایسه
méthylo ، éthylo الخ اسملری یرینه mètho étho نامری
تخصیص اولنمشدر.

جسمی یکی اصول اوزره :

دستوریله ارائه ایدیلیر

Ethyl

[mètho]

واصطلاح اخیره

نظراً mètho—éthyl—Heptane تسمیه اولنور.

(p. 98)

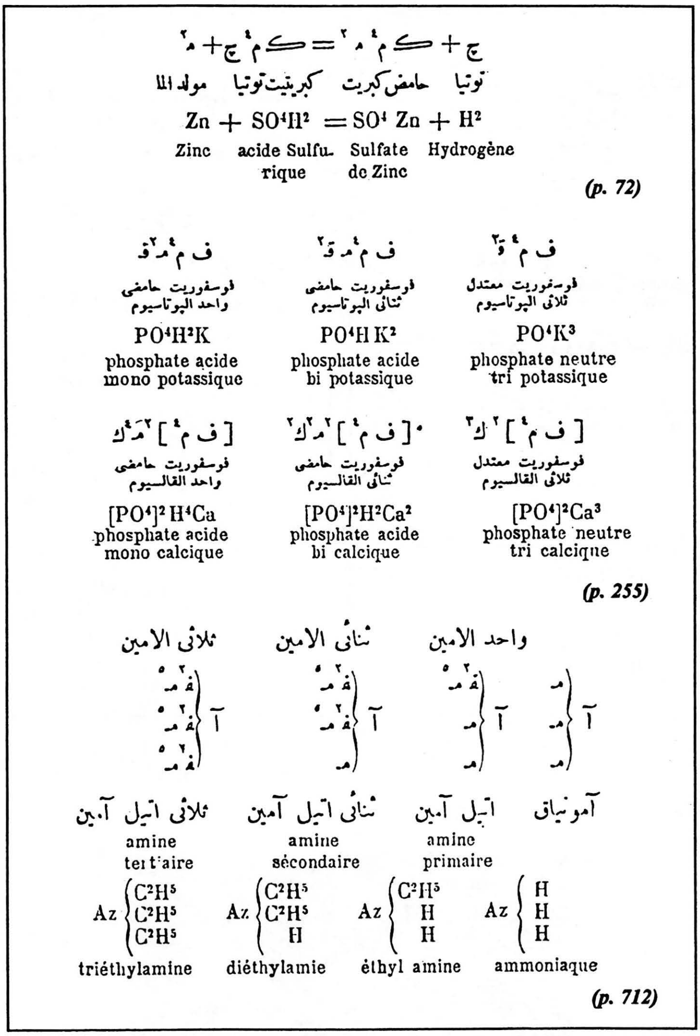
طرطریت پوتاسیوم وسودیوم tartrate de potassium et de sodium

— ملح لاروشل -- الملح ضنیات — tartrate sodio_potassique

sel de la Rochelle — sel de Seignette

(p. 101)

Fig. 20 The title page (left) and some formulas (right) in *Kimya-yi uzvî* (Organic chemistry, 1901).



ج + كم٤م٢ = كم٤ج + م٢

توتيا حامض كبريت كبريتيت توتيا مولد الما

$Zn + SO^4H^2 = SO^4 Zn + H^2$

Zinc acide Sulfurique Sulfate de Zinc Hydrogène

(p. 72)

ف م٤ م٢ ق	ف م٤ م ق٢	ف م٤ ق٣
فوسفوريت حامضى واحد البوتاسيوم	فوسفوريت حامضى ثنائى البوتاسيوم	فوسفوريت معتدل ثلاثى البوتاسيوم
PO^4H^2K	$PO^4H K^2$	PO^4K^3
phosphate acide mono potassique	phosphate acide bi potassique	phosphate neutre tri potassique
[ف م٤]٢ م٤ ك	[ف م٤]٢ م٢ ك٢	[ف م٤]٢ ك٣
فوسفوريت حامضى واحد القالسيوم	فوسفوريت حامضى ثنائى القالسيوم	فوسفوريت معتدل ثلاثى القالسيوم
$[PO^4]^2 H^4Ca$	$[PO^4]^2H^2Ca^2$	$[PO^4]^2Ca^3$
phosphate acide mono calcique	phosphate acide bi calcique	phosphate neutre tri calcique

(p. 255)

ثلاثى الامين	ثنائى الامين	واحد الامين	
ثلاثى اتيل آمين	ثنائى اتيل آمين	اتيل آمين	آمونياق
amine tertiaire	amine sécondaire	amine primaire	
$Az \begin{cases} C^2H^5 \\ C^2H^5 \\ C^2H^5 \end{cases}$	$Az \begin{cases} C^2H^5 \\ C^2H^5 \\ H \end{cases}$	$Az \begin{cases} C^2H^5 \\ H \\ H \end{cases}$	$Az \begin{cases} H \\ H \\ H \end{cases}$
triéthylamine	diéthylamie	éthyl amine	ammoniaque

(p. 712)

Fig. 21 The formulas and equations in Arabic and Latin characters written in parallel from *Ilm–i kimyadan kimya–yi ma'denî ve kimya–yi uzvî* (Inorganic and organic chemistry, 1901).

1915, German instructors began to teach at the *Darülfünûn.*

Three Turkish students graduated in Europe with doctoral degrees in chemistry. Joseph Zanni (1854–1934) studied with Robert Bunsen, and submitted his doctoral thesis in 1876 (Fig. 23). He opened the first private chemistry laboratory in Turkey in 1891. Halil Edhem (Eldem; 1861–1938) obtained his doctorate from Bern University in 1885; and Mehmet Arif (1865–?) who worked with Jacob Volhard (1834–1910) obtained his degree from Halle University in 1891 (Figs. 24 & 25). Mehmet Arif published his thesis in *Annalen der Chemie.**

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* Über α–β–Dibromisovaleriansäure, *Ann.*, 280, 259–262 (1894).

الجماهيرية العربية الليبية الشعبية الاشتراكية العظمى

اللجنة الشعبية العامة للتعليم

الكيمياء

التحليلية والنووية وغير العضوية

للصف الثالث الثانوي

تأليف

د. الصديق الشكشوكى　　د. سليم مصطفى

عاطف امين المنيرى

1401 و.ر

1992-1991 م

استخداماته :

أ – يستخدم كلوريد الالومونيوم اللامائي في تنقية الزيوت المعدنية ويعتبر من أهم العوامل المساعدة والمختزلة لمركبات الكيمياء العضوية

ب – يستخدم كلوريد الالومنيوم غير النقي في الصناعات البترولية وذلك في تحضير زيوت التشحيم .

4 - كبريتات الالومنيوم　　لو$_2$ (كب أ$_4$)$_3$　$Al_2(SO_4)_3$

تحضيرها :

تحضر بتفاعل حمض الكبريتيك الساخن مع اكسيد أو هيدروكسيد الالومنيوم

لو$_2$ أ$_3$ + 3 يد$_2$ كب أ$_4$ $\xleftarrow{\Delta}$ لو$_2$ (كب أ$_4$)$_3$ + 3 يد$_2$ أ

2 لو (أيد)$_3$ + 3 يد$_2$ كب أ$_4$ $\xleftarrow{\Delta}$ لو$_2$ (كب أ$_4$)$_3$ + 6 يد$_2$ أ

كما يمكن تحضيرها في المعمل بتفاعل قطعة من الالومنيوم النقي مع حمض الكبريتيك المركز الساخن .

2 لو + 6 يد$_2$ كب أ$_4$ $\xleftarrow{\Delta}$ لو$_2$ (كب أ$_4$)$_3$ + 6 يد$_2$ أ + 3 كب أ$_2$ ↑

وللحصول على البللورات يركز المحلول ثم يضاف بعض الكحول فيترسب على هيئة بللورات بيضاء

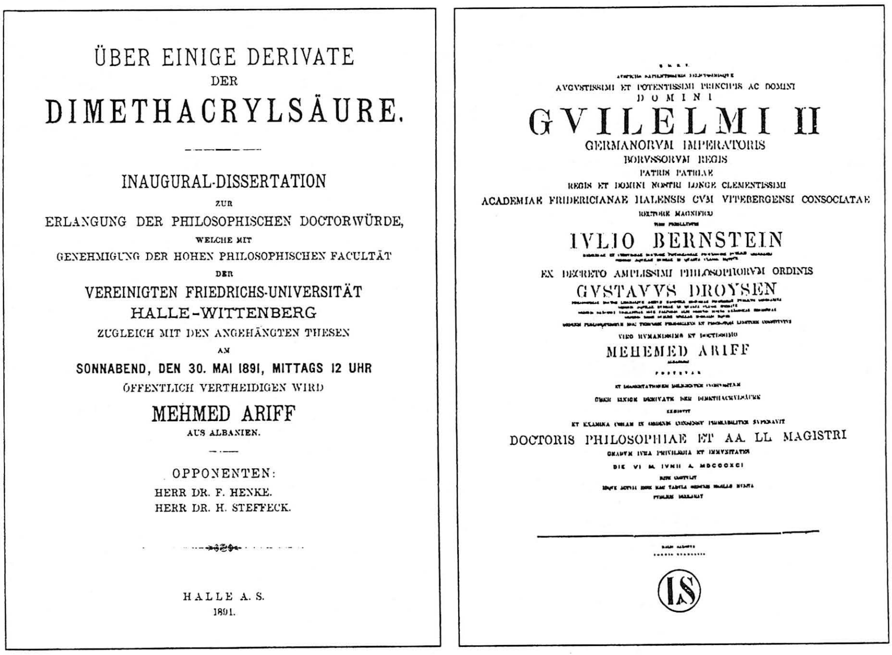
لو$_2$ (كب أ$_4$)$_3$ – 18 يد$_2$ أ

334

Fig. 22 The title page (left) and the chemical equations written with symbols in Arabic characters in a chemistry textbook published in Libya in 1991.

Fig. 23 Joseph Zanni (1854–1934).

Fig. 24 Mehmed Arif in a dissertation in Halle University (Germany, 15 March 1889). Left to right Dr. F. Henke, Mehmed Arif and Dr. H. Steffeck.



ÜBER EINIGE DERIVATE
DER
DIMETHACRYLSÄURE.

INAUGURAL-DISSERTATION
ZUR
ERLANGUNG DER PHILOSOPHISCHEN DOCTORWÜRDE,
WELCHE MIT
GENEHMIGUNG DER HOHEN PHILOSOPHISCHEN FACULTÄT
DER
VEREINIGTEN FRIEDRICHS-UNIVERSITÄT
HALLE-WITTENBERG
ZUGLEICH MIT DEN ANGEHÄNGTEN THESEN
AM
SONNABEND, DEN 30. MAI 1891, MITTAGS 12 UHR
ÖFFENTLICH VERTHEIDIGEN WIRD
MEHMED ARIFF
AUS ALBANIEN.

OPPONENTEN:
HERR DR. F. HENKE.
HERR DR. H. STEFFECK.

HALLE A. S.
1891.

AVGVSTISSIMI ET POTENTISSIMI PRINCIPIS AC DOMINI
DOMINI
GVILELMI II
GERMANORVM IMPERATORIS
BORVSSORVM REGIS
PATRIS PATRIAE
REGIS ET DOMINI NOSTRI LONGE CLEMENTISSIMI
ACADEMIAE FRIDERICIANAE HALENSIS CVM VITEBERGENSI CONSOCIATAE
RECTORE MAGNIFICO
IVLIO BERNSTEIN
EX DECRETO AMPLISSIMI PHILOSOPHORVM ORDINIS
GVSTAVVS DROYSEN
VIRO HVMANISSIMO ET DOCTISSIMO
MEHEMED ARIFF
DOCTORIS PHILOSOPHIAE ET AA. LL. MAGISTRI
GRADVM IVRA PRIVILEGIA ET IMMVNITATES
DIE VI M. IVNII A. MDCCCXCI

Fig. 25 The cover page of Mehmed Arif's Ph D. thesis (left) and his Ph D. diploma.

Geology

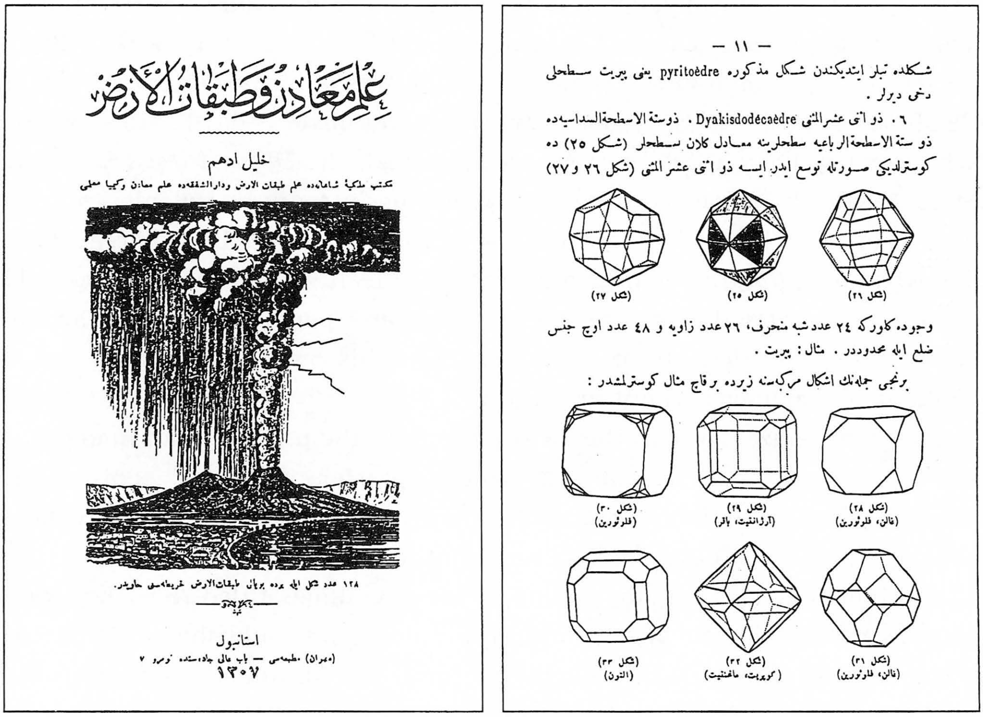
The fourth volume of Hodja İshak Efendi's *Mecmua* included a short chapter on geology which, reflecting contemporary thinking, presented volcanic phenomena as the cause of earthquakes.

Ali Fethi Efendi (d. 1857–58) compiled the *İlm-i tabakatü'l-arz* (Geology, 1852–53), the first book fully devoted to geology. The work was a Turkish rendering of an Arabic translation of a French work. A colored plate of geological time periods was appended. A few years later, İbrahim Edhem Paşa (1818–1893), the first Turkish mining engineer, published a series of articles under the title of "Medhal-i ilm-i jeoloji ve ilm-i maadin" (Introduction to geology and mineralogy) in the *Mecmua-i fünûn* (Journal of sciences, 1862). In these articles the author introduced modern geology into Turkey.

Abdullah Bey (1799–1874), a native Hungarian, taught geology in the Imperial School of Medicine. The textbook that he wrote in French was later translated into Turkish by his assistant İbrahim Lütfi (Pasha) under the title of *İlmü'l-arz ve'l-maadin* (Geology and mineralogy, 1875). This 584-page book was made up of four sections: 1. mineralogy and petrography, 2. lithogenesis, 3. stratigraphy and paleontology, 4. dynamic geology. The book reflected the influence of Elie de Beaumont (1798–1874), a representative figure in French geology, and summarized the contemporary state of the field. The treatise of the French geologist A. de Lapparent was also translated by İbrahim Lütfi Bey under the title of *İlm-i arz* (Geology, 1889–90).

Halil Edhem Bey (1861–1938), the son of İbrahim Edhem Paşa, was educated in Vienna and Bern, and received his doctorate in chemistry. Upon returning to Turkey, he taught geology in various schools, and published a book called *İlm-i maadin ve tabakatü'l-arz* (Mineralogy and geology, 1889–90) (Fig. 26). This work was important in that it reflected the views of the Austrian school of geology, based as it was on the books of his teachers Hochstetter and F. Toula. A colored geological map of Europe was also added. Halil Edhem's book differed from previously publications in that it also included information about Turkey. With its clear style, beautiful figures, and lucid organization, this work could be used as a textbook even today. Halil Edhem Bey translated Hochstetter and Bisching's geology book under the title of *Muhtasar ilm-i tabakatü'l-arz* (Concise book on geology). This book first appeared in 1901, and the revised second edition was published in 1905–6.

Foreign research on Turkey's geological features greatly increased in the 19th century. Original research on this topic was conducted by Abdullah Bey, who published his results in various European scientific journals. A fossil which he found, the *Cryphaeus (Trilobites) Abdullahi* Vern, was named in his honor by



علم معادن وطبقات الارض

خليل ادهم

مكتب ملكيهٔ شاهانه‌ده علم طبقات الارض ودارالشفقه‌ده علم معادن وكيميا معلمى

١٢٨ عدد شكل ايله برده برياك طبقات الارض خريطه‌سى حاويدر.

استانبول
(عمران) مطبعه‌سى — باب عالى جاده‌سنده نومرو ٧
١٣٠٧

— ١١ —

شكلده تبلر ايتديكندن شكل مذكوره pyritoèdre يعنى پيريت سطحلى دخى ديرلر .

٦ . ذو اثنى عشرالمثنى Dyakisdodécaèdre . ذوستة الاسطحة السداسيه‌ده ذو ستة الاسطحة الرباعيه سطحلرينه معادل كلان سطحلر (شكل ٢٥) ده كوسترلديكى صورتله توسع ايدر ايسه ذو اثنى عشر المثنى (شكل ٢٦ و ٢٧)

(شكل ٢٦) (شكل ٢٥) (شكل ٢٧)

وجوده كلور كه ٢٤ عدد شبه منحرف، ٢٦ عدد زاويه و ٤٨ عدد اوچ جنس ضلع ايله محدوددر . مثال : پيريت .

برنجى جمله‌نك اشكال مركبه‌سنه زيرده برقاچ مثال كوسترلمشدر :

(شكل ٢٨) (غالن، فلوئورين) (شكل ٢٩) (آرژانتيت، بالر) (شكل ٣٠) (فلوئورين)

(شكل ٣١) (غالن، فلوئورين) (شكل ٣٢) (كوپريت، ماغنتيت) (شكل ٣٣) (التون)

Fig. 26 The title page of the *Ilm–i Maadin ve tabakatu'l–arz* (Mineralogy and geology, 1889–90) (left) and a sample page (right p. 11).

the French paleontologist E. de Verneuil.

Zoology

Modern zoology was an auxiliary branch of medical, veterinarian and pharmaceutical education. Special emphasis was thus given in zoology texts to medical zoology. Zoology became an independent field at the Faculty of Science of Istanbul University during the Republican period, that is, in the 1920s.

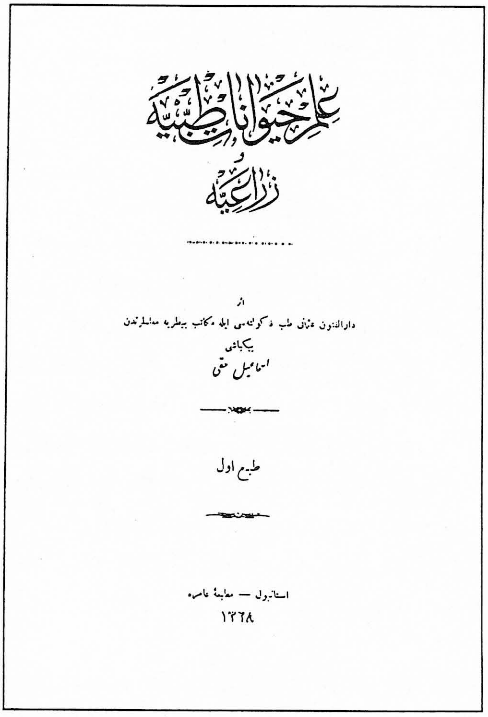
The first zoology book in Turkey was written in French by Abdullah Bey (1779–1875), an instructor at the Imperial School of Medicine. This work was translated into Turkish by his assistant Ali Raşit Bey, when medical instruction switched to Turkish, and it appeared in 1876 in Istanbul under the title *Fenn–i hayvanat–i tıbbiye* (Medical zoology). This 500–page book explained animal systematics, and also described the microscope and its use; 354 pages were devoted to invertebrates. This book was based on French and German writings, and presented up–to–date scientific research.

The *İlm–i hayvanat* (Zoology) by Hüseyin Remzi Bey (1839–1896), instructor at the Imperial School of Medicine, was based on the theories of George Cuvier. Published in 1873, it was the first extensive zoological treatise translated into

Turkish from a European language. Later on, Remzi Bey translated Bouguillon's book, thus presenting Lamarck's ideas for the first time in Turkish. He also inserted some personal views. This translation was published in 1876 under the title of *Tarih–i tabii–i tıbbî. Kısm–ı evvel : ilm–i hayvanat* (Medical natural history. Part I : zoology). In 1889, he went on to publish the *Dürûs–i ilm–i hayvanat–ı tıbbiye* (Medical zoology lectures) in order to introduce students to recent discoveries in zoology. The first volume of Hüseyin Remzi Bey's three–volume *İlm–i hayvanat–ı tıbbiye* (Medical zoology, 1893) dealt with general zoology. The second volume was devoted to invertebrates and parasitology, and the third volume to vertebrates. Here too, he included his own observations and the results of research carried out in Turkey.

Hüseyin Remzi Bey was thus a key figure in the promotion of modern and medical zoology in Turkey during the last quarter of the 19th century. His student Hulusi Raşit Bey (1862–1936) published a variety of zoology books based on French works in the beginning of the 20th century.

Another important zoology book in three volumes titled *İlm–i hayvanat–ı tıbbiye ve zıraiye* (Medical and agricultural zoology) was published in 1912–1913 by İsmail Hakkı Bey (1873–1939), instructor at the Military Veterinary School



علم حیوانات طبیه
و
زراعیه

اثر
دارالفنون عثمانی طب فاکولته‌سی ایله مکتب بیطریه معلملرندن
بیکباشی
اسماعیل حقی

طبع اول

استانبول — مطبعهٔ عامره
۱۳۲۸

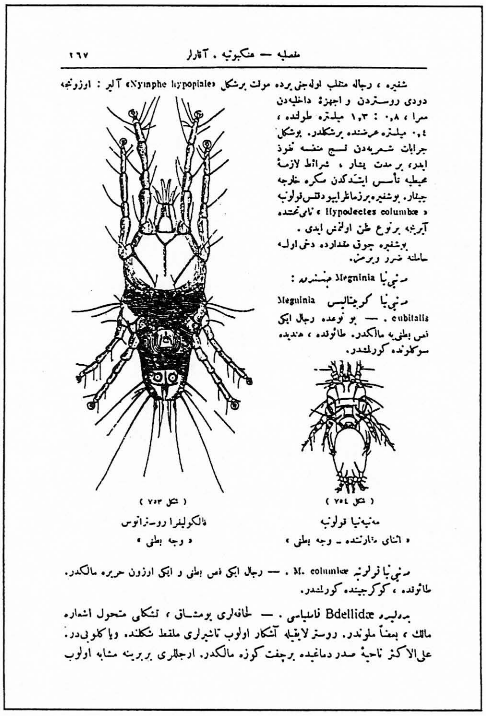


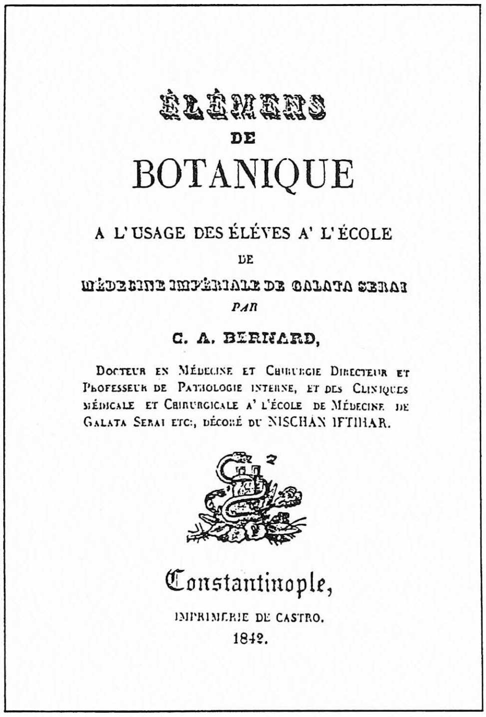
Fig. 27 The title page of the first volume of *Ilm–i hayvanat–i tıbbiye ve ziraiye* (Medical and agricultural zoology, 1912) (left) and a sample page from the same volume (right p. 267).

(Askerî Baytar Mektebi) (Fig. 27). He used several French sources, among them the *Traité de zoologie médicale et agricole* by A. Railliet, his teacher in France.

Botany

Although there were six pages on botany in the fourth volume of Ishak Efendi's *Mecmua*, the first Ottoman botany book was the *Élémens de botanique* (1842) by Karl Ambros Bernard (1808–1844), director at the Imperial School of Medicine (Fig. 28). This book was based on A. Richard's (1794–1852) two French treatises published in 1838 and 1839. *Élémens de botanique* dealt with general botanical subjects, and pharmaceutical botany as well. Bernard chose to publish it in French, since this was the language of instruction at the Imperial School of Medicine.

The first botany book in Turkish, the *İlm–i nebatat–i tıbbiye* (Medical botany) appeared only in 1885, after the language of medical teaching was changed to Turkish (Fig. 29). It was a translation by Mehmed Ali Pasha (1834–1914), a botany teacher at the civil and military medical schools of a work by the French botanist D. Cauvet. Mehmed Ali Pasha also translated another book by Cauvet and published it in 1900 under the title *Kitabü'l–nebatat* (The book of plants).



ÉLÉMENS
DE
BOTANIQUE
A L'USAGE DES ÉLÉVES A' L'ÉCOLE
DE
MÉDECINE IMPÉRIALE DE GALATA SERAI
PAR
C. A. BERNARD,
DOCTEUR EN MÉDECINE ET CHIRURGIE DIRECTEUR ET PROFESSEUR DE PATHOLOGIE INTERNE, ET DES CLINIQUES MÉDICALE ET CHIRURGICALE A' L'ÉCOLE DE MÉDECINE DE GALATA SERAI ETC:, DÉCORÉ DU NISCHAN IFTIHAR.

Constantinople,
IMPRIMERIE DE CASTRO.
1842.

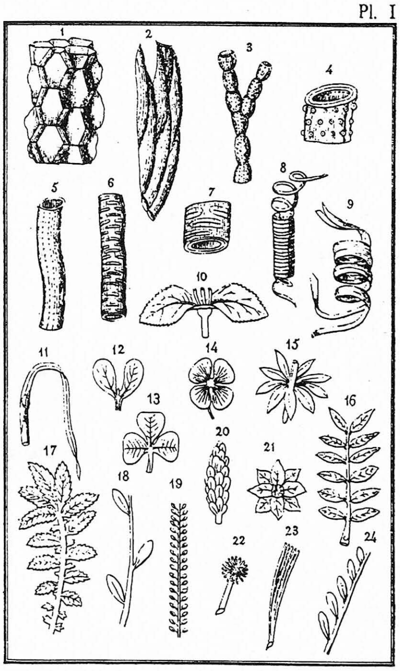
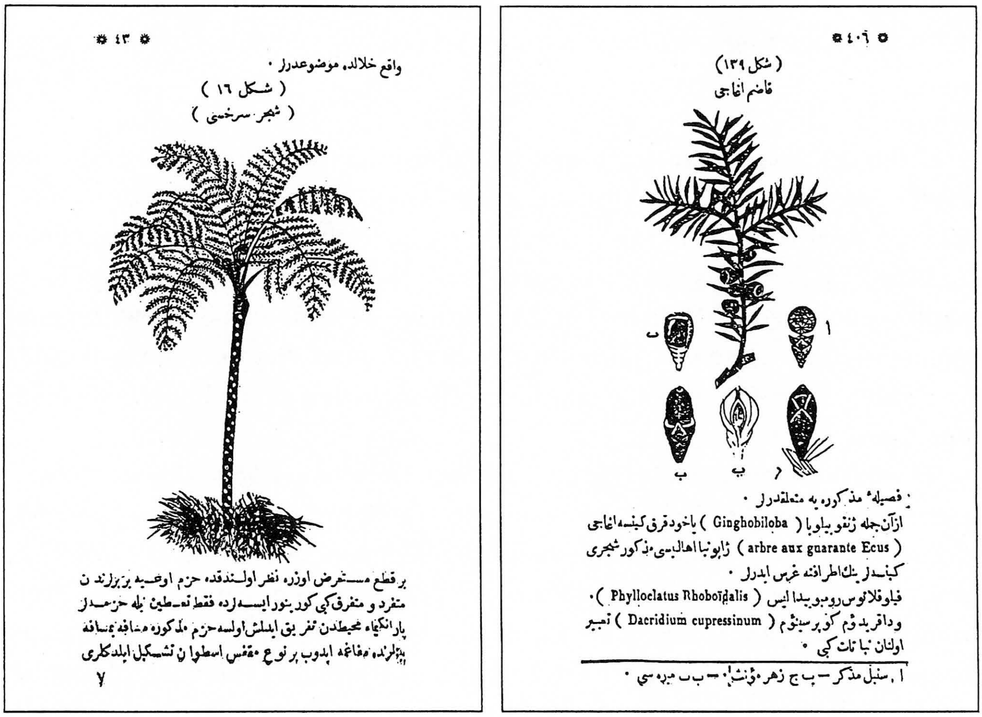


Fig. 28 The title page of *Élémens de botanique* (Elements of botany, 1842) (left) and Plate I.



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واقع خلالده موضوعدرلر ٠

(شكل ١٦)

(شجر سرخسی)

بر قطع مستعرض اوزره نظر اولندقده حزم اوعيه بر برلرندن
متفرد و متفرق كبی كورينور ايسه لرده فقط نه طين بله حزمه لر
پارانكيماء محيطدن تفريق ايدلش اولسه حزم مذكوره مسافه مسافه
پيهلرنده مفاغمه ايدوب بر نوع مقفس اسطوانه تشكيل ايلدكلری

٧

٤٠٦

(شكل ١٣٩)

قاضم اغاجی

فصيلهٔ مذكوره يه متعلقدرلر ٠
ازآنجمله ژنغو بيلوبا (Ginghobiloba) ياخود قرق كيسه اغاجی
(arbre aux guarante Ecus) ژاپونيا اهاليسی مذكور شجری
كبندلرينك اطرافنه غرس ايدرلر ٠
فيلوقلاتوس روموبيدا ليس (Phylloclatus Rhoboïdalis) ٠
و داقريديوم كوپرسينوم (Dacridium cupressinum) تعبير
اولنان نباتات كبی ٠

١ . سنبل مذكر — ب ج زهر مؤنث — ب ب ميوه سی ٠

Fig. 29 Two sample pages from *Ilm–i nebatat–i tibbiye* (Medical botany, 1875) (Left Vol. 1, p. 43 ; Vol. 2, p. 406).

The few botany books that circulated in the 19th century generally dealt with pharmaceutical botany, since they were used to teach medicine and pharmacy. An early example is the *Nebatat–i saydelaniye* (Pharmaceutical botany, 1910) written by Esad Şerefeddin Köprülü (1866–1943), a botany teacher in the faculties of medicine and science of İstanbul University. This book was based on French sources. He also published *İlm–i nebatat* (Botany, 1912), a textbook of general botany (Fig. 30).

* * *

From the beginning of the 18th century onwards, then, the Ottomans followed technological and scientific progress in Europe through translations mainly from the French. Knowledge thus passed to them with about a 10–15 year delay, although sometimes this interval was as short as five years. The military and technical schools were generally the most important channels of transfer, and until the 1870s the focus remained fixed on military technology and engineering. Notable exceptions were Şanizade Ataullah Efendi's work on medicine (1820), Ali Fethi Efendi's treatise on geology (1852–3), Dervis Pasha's texts on chemistry (1848) and physics (1864), and Hodja İshak Efendi's broad compendium (1830–34).

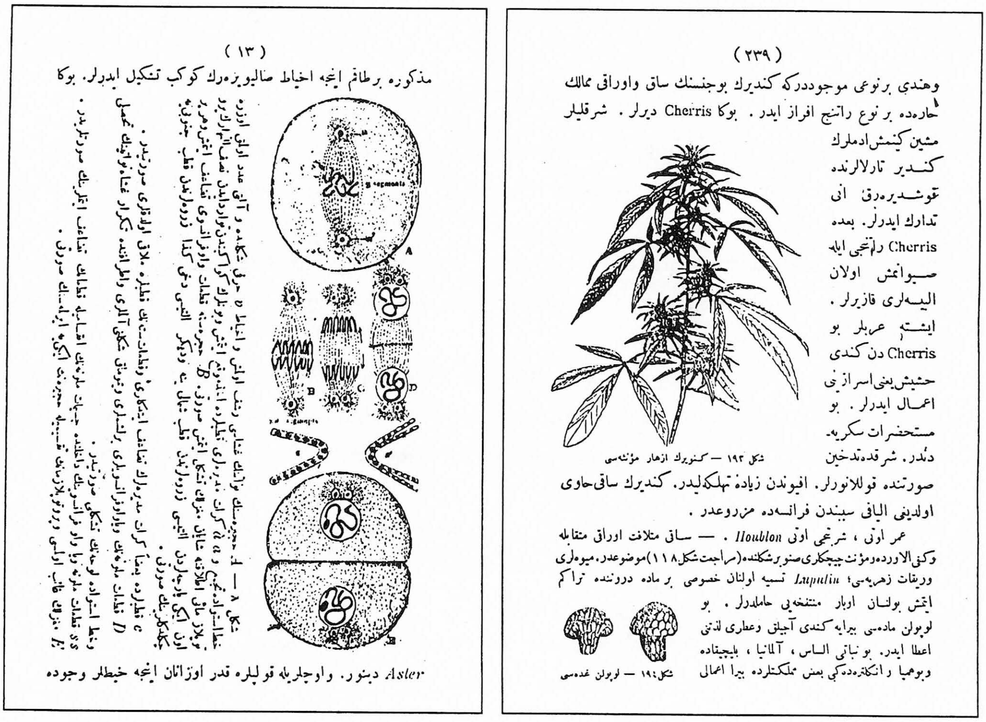

Fig. 30 Two sample pages from *Ilm-i nebatat* (Botany, 1912) (Left p. 13 ; right p. 239).

Beginning in 1870s, when the teaching of medicine switched to Turkish, the number of books on geology, botany, zoology and chemistry grew significantly. Secondary education, which became widespread during the last quarter of the 19th century, contributed to this growth. However, most of these works approached the basic sciences with an eye toward practical applications. For example, except for the books by Dervis Pasha and Aziz Bey, general chemistry figured only briefly, if at all, in chemistry texts. Publications on organic and analytical chemistry, on the other hand, increased since these were useful for medicine.

Undergraduate education in mathematics and the basic sciences began in the Darülfünun (University of İstanbul), founded in 1900. It started as a science program, and later spread into different branches. The chemistry program began in 1917, and programs for other branches were born in the 1920s.

We find little original scientific research on basic sciences in the 19th century. The exceptions are three Ph. D. theses in chemistry completed in Europe, Abdullah Bey's researches on geology and paleontology, and Tevfik Pasha's contributions in mathematics. In the second half of the 19th century, journals of medicine and pharmacy began to appear, and these included articles on chemistry, zoology and botany. 1911 saw the publication of *Genç kimyager* (Young chemist), the first journal dedicated to chemistry as a basic science.

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