AN OVERVIEW OF OTTOMAN SCIENTIFIC ACTIVITIES

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"Ottoman Science" is a term encompassing the scientific activities that occurred throughout the Ottoman epoch in the lands where the empire extended. The Ottoman Empire which was established as a small principality at the turn of the fourteenth century gradually expanded in the lands of the Byzantine Empire both in Anatolia and the Balkans. Its sovereignty reached the Arab world after 1517. Hence, it became the most powerful state of the Islamic world in a vast area extending from Central Europe to the Indian Ocean and persisted by keeping the balances of power with Europe. Following the defeat in the First World War, the Ottoman Empire disintegrated in 1923.

Ottoman science emerged and developed on the basis of the old scientific legacy and institutions of the pre-Ottoman Seljukid period in Anatolian cities, and benefited from the activities of scholars who came from Egypt, Syria, Iran, and Turkestan which were the most important scientific and cultural centers of the time. The Ottomans brought a new dynamism to cultural and scientific life in the Islamic world and enriched it. Thus, the Islamic scientific tradition reached its climax in the sixteenth century. Besides the old centers of the Islamic civilization, new cultural and scientific centers flourished, such as Bursa, Edirne, Istanbul, Skopje, and Sarajevo. The cultural and scientific heritage which developed in this period constitutes the cultural identity and scientific legacy of present-day Turkey as well as several Middle Eastern, North African, and Balkan countries (İhsanoğlu, 1993/1). This article aims to give an overview of the formation and development of Ottoman science in Anatolia and the scientific activities which expanded later from Istanbul, the capital of the empire, to Ottoman lands.

The Ottomans always sought solutions to the intellectual and practical problems they encountered in Islamic culture and science. But when the scientific and industrial revolutions occurred in Europe, a gap emerged between them and the Western world. Thus, Ottomans began to make some transfers from Western science selectively and gradually the scientific tradition began to change from "Islamic" into "Western". Therefore, Ottoman science should be studied under two headings; firstly, the Islamic scientific tradition (classical period) and secondly, Western scientific tradition (modernization period). Although it is difficult to demarcate the two traditions in a clear-cut way in the transition period, as the contacts became more frequent, the two periods were separated more clearly.

In the classical period, the madrasa (college) was the essential source of science and education and the most important institution of learning in the Ottoman empire. The Ottoman madrasa continued their activities from the establishment of the state approximately until the turn of the twentieth century. The basic structure of the madrasa remained the same within the framework of the Islamic tradition, but in terms of organization they underwent several changes in the Ottoman period. Starting with the first madrasa established in 1331 in Iznik (Nicara) by Orhan Bey (1326-1362) (the second Ottoman sultan), all madrasas had külfis supporting their activities. The külfis (the
The scholars who graduated from the madrasa served as teachers, kada, karamchis (military judges) and chief nisiffs. Several physicians were trained and many patients were treated in the dârûqasâfî (hospital) of Fârîd Complex which was active until mid-nineteenth century. The Fârîd Complex provided services for the society in various areas such as religion, education and science, health and nourishment. From the second half of the nineteenth century, as the activities of the Fârîd Complex became gradually ineffective, its various units, namely its hospital, its tahtâbîn (hospice), its mawâkkihânâ (timekeeper’s office), caravanserai and school fell out of service. Finally, when all madrasas were closed in the Republican Period, its college, too, became inactive in 1924. The mosque of the Complex, however, has preserved its principal function to a considerable extent from its establishment until the present day (Unsal, 1995).

The establishment of the Sâlyûmînîyâ Kulliyât by Suleyman the Magnificent (1520-1566) in the sixteenth century marked the final stage in the development of the madrasa system when, besides the conventional madrasa, a specialized madrasa named Dârûqasâm (Medical College) was founded. Thus, for the first time in Ottoman history, in addition to the jîlîâhîs (hospitals), an independent institution was established to give medical education. The other specialized madrasas established by the Ottomans were the Dârûqasâm and the Dârûkatîbî. The Dârûkatîbî had the highest rank in the madrasa hierarchy.

In addition to the madrasas which gave basic education, there were the institutions where medical sciences and astronomy were practiced and taught by the master-apprentice method. These were the jîlîâhîs, the office of mawâkkihânâ and the mawâkkihânâs.

The institutions which provided health services and medical education were called dârûqasâm, jîlîâhîs or bâmirtuç. The Selçukids had built dârûqasâm in the cities of Konya, Sivas, and Kayseri. Similarly, the Ottomans built several dârûqasâm in cities such as Bursa, Edirne, and Istanbul. Some Western sources mention that there were a great number of dârûqasâm in Istanbul in the sixteenth and seventeenth centuries. This indicates the importance that Ottomans attributed to building dârûqasâm. The Ottoman dârûqasâm were not constructed as independent buildings, but as part of a hâkıîf. The most important Ottoman dârûqasâm were the following: Fârîd’s dârûqasâm built by the Conqueror in 1470, Bâyázit II’s dârûqasâm (1481) built upon his order in Edirne, the Sâlyûmînîyâ dârûqasâm (1530) built by Süleyman the Magnificent, Haseki dârûqasâm (1530), Hafiz Sultan’s dârûqasâm (1522-23) built in Manisa by Selim Is’s wife Hafiz Sultan. These dârûqasâm also had medical colleges. (Terzoglu, 1992). In the Ottoman palace administration, the person in charge of directing the astronomers was called mînumaçî, i.e. chief astronomer. The institution of chief astronomers was established sometime between the late fifteenth and early sixteenth centuries. The chief astronomers were selected from among the ulama who were graduates of madrasa. From the sixteenth century, they started to prepare calendars, fasting timetables, and horoscopes for the palace and prominent statesmen. Until 1800 the calendars were made according to the Zij of Ulugh Bey, from that date onwards the Zij of Jacques Cassini was used. The chief astronomer and sometimes a senior astronomer fixed the lucky hour for important or trivial events such as imperial accessions, wars, imperial births, wedding ceremonies, the launching of ships, etc. Moreover, the chief astronomers followed the extraordinary events related to astronomy such as the passage of comets, earthquakes, fires as well as solar and lunar eclipses and passed the notice to the palace with the related interpretations. The administration of the mawâkkihânâs was also a duty of the chief astronomer. Besides these, the observatory founded in Istanbul was administered by the chief astronomer Tiki al-Din Râşîid. (d. 1585). The overall number of persons who held the post of the chief astronomer was thirty-seven. Chief astronomership continued until the end of the empire and was abolished in 1924. The office of mawâkkihâbî (chief of timekeepers) was established in 1927 (Ayluğ, 1993).

The timekeeper’s offices (mawâkkihânâs) were public buildings located in the courtyards of mosques or mausoleums in almost every town. They were widely built by the Ottomans especially after the conquest of Istanbul. These institutions were administered by the foundation (naqi) of the complex (hâkıîf) and the persons who worked in the mawâkkihânâs were named mawâkkih, meaning the person who kept the time especially for the prayer hours. The major instruments which were used in the mawâkkihânâs for timekeeping were the following: ruhs tabâqas (equadrants), astrolabes (astrolabia), sextant, octant, hourglass, sundial, mechanical clock, and chronometer. Depending on the level of knowledge of the timekeepers, the mawâkkihânâs functioned in various locations where astronomy was taught, and also as simple observatories. Thus, some of the mawâkkihânâs were important for the education of chief astronomers. Indeed, quite a number of successful timekeepers rose to the rank of chief astronomer. The timekeepers were appointed by the chief astronomers. The son of the deceased would have the priority, and if he had no son, one of the candidates would be selected by examination. After the proclamation of the Republic, the mawâkkihânâs were administratively attached to the kâmil-âhsâ’î (minister of science and technology), and were totally abolished in 1952 (Aively, 1975).

The Ottoman scientific literature in the classical period was produced mainly within the milieu of the madrasa. Scholars compiled several original works and translations in the fields of religious sciences as well as mathematics, astronomy, and medicine, besides a great number of textbooks. These works were written in Arabic, Turkish, and Persian, i.e. the three languages called elmi-i sulâm which Ottoman scholars knew. At the beginning, the literature was mostly written in Arabic, but from the fifteenth century onwards, Turkish was used more and more. From the eighteenth century, the majority of the scientific works were written in Turkish and upon the establishment of the first printing house in Istanbul in 1727, Ottoman Turkish became the most frequently used language in the transfer of modern sciences.
flourished in Anatolia and settled in Samarkand after he compiled his first work. Kazaziode wrote Shahr al-Mulakhabba fi'l-Hay'a (Commentary on 'Compendium on Astronomy') and Shahr Asbhal al-Tuzii (Commentary on 'The Fundamental Theorems') in Arabic in the fields of astronomy and mathematics and became the chief instructor at the Samarkand medrese and the director of the observatory founded by Ulug Beg (d. 831/1430) in Samarkand. He was also the co-author of Ziyi-i Gunesi (Ziyi-i Ulug Beg) (The Astronomical Tables of Ulug Beg) written in Persian. He simplified the calculation of the sine of one degree arc in his work Risala fi Iskhakha'ay Yariye Dariya'ih Wirda (Treatise on the Calculation of the Sine of a One Degree Arc). In addition to the works of Kazaziode-i Rumi, Ali Kuçu (d. 879/1474) and Fathullah al-Shirwani (d. 891/1486), his two students from Tabrizz, influenced the Ottoman science by disseminating mathematics and astronomy in the Ottoman Empire. In the preface of his work Shahr Asbhal al-Tuzii, Kazaziode-i Rumi indicated that the philosophers who ponder on the creation and the secrets of the universe, the parana (sages) in religious matters, the officials who run the affairs of the state, and the hadisi who deal with juridical matters should know geometry. Thus, he emphasized the necessity of science in philosophical, religious, and worldly matters. This understanding reflects a general characteristic of Ottoman science in the classical period. In the period of modernization, however, the Western concept of man's domination of nature through science and technology was foreign to Ottoman scholars due to their beliefs based on Islam.

Among other astronomy books of this period there was also Orvija fi Manazii al-Kamar wa Tadilih (Poem on the Moon of the Moon and their Rising) and Marmaza fi Suluk al-Najam (Poem on the Orbits of the Stars) written by Abd al-Wahhab b. Jawal al-Din b. Yunus al-Mardunia in Arabic. The founder of the Maragha school Nasir al-Din al-Tusi's two books entitled Risala fi'l-Tabiwin (Treatise on the Calendar) and Si Fiis fi'l-Tabiwin (Thirty Sections on the Calendar) were translated from Persian into Turkish. Ahmet-i Df (d. ca. 825/1421) is the translator of the second work.

During this period, besides Samarkand, Egypt was another source for Ottoman science. Hao Paga (Celledidin Hodi) (d. 1413 or 1417), a well-known physician of the time educated in Egypt, wrote two books in Arabic entitled Shifa' al-Ashab wa Da'aw al-A’lan (Treatment of Illnesses and the Remedy for Pain) and Risalat al-Tuzim fi'l-Tibb (Book on the Teaching of Medicine) which played an important part in the development of Ottoman medicine. He had many other works in Turkish and Arabic.

In medicine, the works of Subuncuoglu Serefeddin (d. ca. 1460) are particularly important in the development of Ottoman medical literature and their influence on Safavid medicine. The first book on surgery that he wrote in Turkish entitled Jamaliyyat al-Khatir (Treatise on Surgery of the Sultan) comprised the translation of Abu'l-Kassem Zahrwani al-Tarif, a self-contained handbook of the medical art in all its branches, and the three sections that he himself wrote. This work is much renowned in history of Islamic medicine in that it illustrates surgical operations with miniatures for the first time. Besides the classical Islamic medical information, this work contains Turco-Mongolian and Far Eastern influences as well as the author's own experiences (Uzel, 1979, 1992).

Ottoman science developed further owing to the personal interest of Mehmed II and the educational institutions which he established after the conquest of Istanbul. Consequently, some brilliant scholars emerged in the sixteenth century and made original contributions to science in this most vivid period of Ottoman history of science. Mehmed the Conqueror patronized the Islamic scholars and at the same time he ordered the Greek scholar from Trabzon Georgios Amirotus and his son to translate the Geography book of Ptolomy into Arabic and to draw a world map. Mehmed II's interest in European culture had started while he was the crown prince settled in the Manisa Palace. In 1445, Italian humanist Ciriaco d'Ancona and other Italians who were in the Palace taught him Roman and European history. While Patriarch Germondus prepared his work on the Christian belief Fikih-nami (The Book on Belief) for the sultan, Francesco Berlinghieri and Roberto Valtorio wished to present their works Geographia and De re militar (On the other hand, Mehmed II encouraged the scholars of his time to produce works in their special fields; e.g. for the comparison of the Giuzatti's criticisms of peripatetic philosophers regarding metaphysical matters, expressed in his work Tafsifat al-Fada’i (The Incoherence of the Philosophers), and Ibn Rushd's answer to these criticisms in his work Tafsifat al-Takhsifat (The Incoherence of Incoherence), he ordered two scholars of his time, Hocazade and 'Ala al-Din al-Tusi, each to write a work on this subject (Avdar, 1983; Ihsanoğlu, 1992/1). No doubt the most notable scientist of the Conqueror's period is Ali Kuçu, a representative of the Samarkand tradition. The total number of his works on mathematics and astronomy is twelve. One of them is his commentary on the Ziyi-i Ulug Beg in Persian. His two works in Persian, namely, Risala fi'l-Hay'a (Treatise on Astronomy) and Risala fi'l-Hisab (Treatise on Arithmetic) were taught in the Ottoman madrasas. He has preserved these two works in Arabic with some additions under new titles, al-Fakhiyya (Commemoration of Conquest) and al-Muhammediyya (The Book Dedicated to Sultan Muhammad), respectively. Another noteworthy scholar of the Bayezid II period (1481-1512) was Molla Lâti. He wrote a treatise about the classification of sciences titled Mawdu’al-al-Ulam (Subjects of the Sciences) in Arabic and compiled a book on geometry titled Tadwil al-Madhhab (Duplication of Cube) which was partly translated from Greek. Mîrin Çelebi (d. 1525) who was a well-known astronomer and mathematician of this period and the grandnephil of Ali Kuçu and Kazaziode-i Rumi, contributed to the establishment of the scientific tradition of mathematics and astronomy and was renowned for the commentary he wrote on the Ziyi of Ulug Beg.

Some scholars who came from Andalusia also contributed to the Ottoman scientific literature. The Arabic medical and astronomical works of the Andalusian scholar 'Abd al-Salam al-Muhtadi al-Muhammedi (alive in 1512), who settled in Istanbul during the reign of Bayezid II and gave up his Jewish name Ilya b. Abram al-Yahudi after emigrating Islam, are examples of such contributions. In a treatise which he wrote first in Hebrew and translated into Arabic in 1503, he introduced the instrument called Al-Dahid, which was his own invention, and stated that it was superior to Dhar al-halat (armillary sphere) invented by Ptolemy. This treatise illuminates on aspect of Ottoman scientific literature which is not much known.

Scientific literature developed considerably in the period of Sultan Süleyman the Magnificent. We find two major mathematical books in Turkish entitled Jamal al-Kustah wa Kamal al-Hisab (Beauty of Scribes and Perfection of Accountants) and Umud al-Hisab (Treatise on arithmetic) by Nasuh al-Sihhi al-Muradi (d. 971/1564). His book in Turkish entitled Bezgah-i Mendzil-i Sefer-i Ibrani (Description of the Stopping Places of the Campaign to the Two Iraqs), related to geography, should also be mentioned. Muṣa b. Hamun (d. 1554), one of the famous Jewish physicians from Andalusian descent, was appointed as Sultan Süleyman’s physician and wrote the first Turkish and one of the earliest independent works on dentistry which is based on Greek, Islamic, and Ugur Turkish medical sources and in particular Subuncuoglu Serefeddin's works (Terzioglu, 1977). In the sixteenth century, important works on astronomy were written by the representatives of the Egyptians-Damas- cus tradition of astronomy-mathematics. The greatest astronomer of this period was Taki al-Din al-Rasid (d. 1585) who combined the Egyptian-Damascus and Samarkand traditions of astronomy and mathematics in his studies. He wrote more than thirty books in Arabic on the subjects of mathematics, astronomy, mechanics, and medicine.

Taki al-Din came from Egypt to Istanbul in 1570. In 1571, he was appointed imam attached (chief astronomer) by Sultan Selim II (1565-1574). Shortly after Sultan Murad III's (1574-1595) accession to the throne, he started the construction of the observatory of Istanbul. In this observatory, he was assisted by fifteen persons. It is understood from his Ziyi titled Şih
rat Montahal-Alfiqar that he made observations in the year 1573. On the other hand, it is generally agreed that the observatory was demolished on 4 Dhilhija 987 corresponding to 22 January 1580 (Sayili, 1960; Maraghi, 1973). Therefore, it can be estimated that he carried out observations from 1573 until 1580.

In addition to the instruments of observation, which were used until his time, Taki al-Din invented new instruments such as Muta'ahab or 'zi-namisik (sextant) and Dhat al-utitar in order to determine the equinoxes. Moreover, he also benefited from mechanical clocks in his observations. When one compares the instruments of observation used by Tycho Brahe (1546-1601), a famous astronomer of this period, and those used by Taki al-Din, one sees that they are very similar.

Taki al-Din developed a different method of calculation to determine the latitudes and longitudes of stars by using Venus and the two stars near the ecliptic, i.e. Aldeberan and Spica Virginis. Taki al-Din had found the magnitude of the annual movement of the Sun's apogee at 63°. Considering that the value known today is 61°, the method he used appears to be more precise than the methods of Copernicus (24°) and Tycho Brahe (45°) (Tekeli, 1953, 1986, 1994).

The Western world used chords for measuring the angles starting with Ptolemy in the second century A.D. until Copernicus in the sixteenth century. For this reason, the calculation of the value of 1° chord has been an important matter for astronomers. Thus, while Copernicus used the method based on the calculation of a 3° chord that yielded an approximate value, Taki al-Din used the trigonometric functions such as the sine, cosine, tangent, and cotangent to measure the values of angles in line with the tradition of Islamic astronomy, instead of the chords. Inspired by Ulugh Beg, Taki al-Din developed a different method to calculate the size of 1°. Furthermore, Taki al-Din applied the decimal fractions, which had been previously developed by Islamic mathematicians such as Al-Kindi and al-Kashi, to astronomy and trigonometry, prepared sinus and tangent tables accordingly and used them in his work titled Jarirat al-Durar wa Khiriat al-Fikar (Demir, 1993).

The first contact with Copernican astronomy in the Islamic world occurred around mid-seventeenth century when the Ottoman astronomer Tekerekçi Köse ıbrahim Efendi of Seizevar translated a work by the French astronomer Noël Dutert (d. ca. 1650). The introduction and spread of the new heliocentric concept of Copernicus into the Ottoman world did not cause a conflict between religion and science, contrary to the case in Europe. This concept, which was first seen as a technical detail, was later preferred to Ptolemy's geocentric system and considered more suitable with respect to religion. However, the conflict between religion and science entered into Ottoman Turkish intellectual life around the end of the nineteenth century together with Western trends of thought such as positivism and biological materialism (Ibarsoglu, 1992/93). The Ottomans needed the knowledge of geography in order to determine the borders of their continuously expanding territory and to establish control over the military and commercial activities in the Mediterranean, the Black Sea, the Red Sea, and the Indian Ocean where they extended. They benefited both from the geographical works of classical Islam and from works of European origin. On the other hand, by supplementing their own observations, the Ottoman geographers produced original works as well. The first source of the Ottoman knowledge about geography is the Samarkand tradition of astronomy and geography.

From the sixteenth century onwards, noteworthy geographical works were produced by Piri Reis. In 1511, Piri Reis drew his first map. This map is part of the world map prepared on a large scale. It was drawn on the basis of his rich and detailed drafts and in addition, European maps including Columbus' map of America. This first Ottoman map which included preliminary information about the New World represents south western Europe, north western Africa, south eastern and Central America. It is a portolan, without latitude and longitude lines but with lines delineating coasts and islands. Piri Reis drew his second map and presented it to Süleyman the Magnificent in 1528. Only the part which contains the
ALİ KUŞCU, PRESENTING HIS BOOK ON
MATHEMATICS ‘RİSALE DER İLM-İ HİSAB’ TO
MEHMED THE CONQUEROR IN THE YEAR 1474

MINIATURE BY NAKŞİ BEY

WORLD MAP PRESENTED TO SÜLTAN SELİM I
BY PİRİ REİS IN 1517
ASTRONOMERS AT OBSERVATORY OF TAKİYÜDDİN
AT TOPHANE

FROM ŞEHİNSAHNAME BY SEYİD LOKMAN
1581

FRONT AND BACK OF AN ASTROLABE USED
BY THE OTTOMANS
HOROSCOPES

MINIATURE RELATED WITH HOROSCOPES TAKEN FROM ‘ZUBDET-OT TEVARIH’ ATTRIBUTED AS GENERAL WORLD HISTORY, WHICH WAS PRESENTED TO MURAD III BY SEYYED LokMAN IN 1583

A DRAWING FROM “KITAB FL MA'RIFET'IL HİYELİL-HENDESİYE” BY EBU'L'IZ ER-REZZAZ EL-CEZERİ WHO HAS AN IMPORTANT PLACE IN THE OTTOMAN SCIENCE
North Atlantic Ocean and the then newly discovered areas of Northern and Central America is exact. Piri Reis also wrote a book entitled Kitâb-ı Bahriye (Book of the Sea) (1521). In this work, Piri Reis presents drawings and maps of the cities on the Mediterranean and Aegean coasts, and gives extensive information about navigation and nautical astronomy. Admiral Seyyid Ali Reis (d. 1562), who wrote the work in Turkish titled al-Mabârî (The Ocean), was a notable figure of the period in maritime geography. This work contains astronomical and geographical information necessary for long sea voyages and his own observations about the Indian Ocean.

Another work of the sixteenth century which contains information about the geographical discoveries and the New World is the book entitled Tarih-i Hind-i Garbi (History of Western India). This work, whose author is unknown, was presented to Sultan Murad III in 1583. It was based on Spanish and Italian geographical sources. It is important in showing that the geographical discoveries of the West were known to the Ottomans. The work has three parts: the first part which is the most important and which comprises two thirds of the whole book, relates the adventures of Columbus, Balboa, Magellan, Crees, and Pizarro during the thirty years from the discovery of America in 1492 until 1532 (Goodrich, 1950). Apparently, cartography was organized as a profession in the Ottoman Empire; for example, in the seventeenth century, fifteen individuals were occupied with the art of surveying, in eight locations in Istanbul and nearby areas.

From the seventeenth century onwards, the new medical doctrines which were put forward by Paracelsus and his followers in the sixteenth century began to be observed in the Ottoman medical literature under the names of Tofik-i sadîd (new medicine) and Tofik-i kimyâî (chemical medicine), in the works of Salih b. Nazullah (d. 1669), Omar b. Sinan al-ızâkî (eighteenth century), and Ömer ezârî (d. 1742). Şemseddin İtâkî's book on anatomy (1632) reflects the first influences of European anatomists. Ottoman medical literature carried both classical Islamic and European medical information side by side until the beginning of the nineteenth century when Şâzîlxâde Azâlullah (d. 1826) wrote his work entitled Hımsâ-ı Şâzîlxâde (Five Works of Şâzîlxâde) composed of five parts (physiology, pathology, surgery, and pharmacology) based totally on European sources without any reference to traditional medicine (Sari & Zülfikar, 1992; Russell, 1992). From the seventeenth century onwards, gradually the conditions were no longer conducive to the development of science due to the social and economic disruptions resulting from the weakening of central authority, dissolution of political stability, decreasing conquests, perpetual loss of land, the influx of American silver into Europe in abundant quantity, and the diminishing revenues of the empire. All these conditions had a negative influence on cultural and scientific activity. In time, the factors that encouraged scholars to conduct scientific work disappeared and were replaced by the struggle to make a living. Disputes arose in the seventeenth century between the supporters of sadîc Islam and mysticism among Ottoman intellectuals. The upholders of salafiyya, who started the movement known as the Kadîzâdemi, had a negative attitude to philosophy and science which led to the regression of Ottoman science (Çavuşoğlu, 1990).

The famous Ottoman scholar and bibliographer Kâtip Çelebi (d. 1658), who is also known under the name of Haci Halife, was one of the first Muslim intellectuals to notice the evident gap between the levels of scientific development of Europe and the Ottoman world. Kâtip Çelebi was able to approach analytically both classical Islamic culture and modern Western culture. He wrote works in Arabic and Turkish on a variety of subjects. In the field of history, he translated from Latin the Chronik of Johann Carion that he entitled Târîkh-i Fersi: Torunmâsi (The Translation of European History) and compiled his Rânekah al-Saltana (Splendour of the Sultanate) on the basis of works by authors such as Johannes Zouara, Nicetas Acomintire, Nicopora Gregorios and the Athenian Laonikas Claudondylie. In the field of geography, he translated the Atlas Minor of Mercator and Hondius.
under the title Lawami al-Nas fi Zulmat Atlas Minor (Flashes of light on the darkness of Atlas Minor). Furthermore, in his work titled Muzan al-Hakk fi Hakayat al-Askab (The Balance of Truth and the Choice of the Truth), Kâtip Çelebi criticized the intellectual life of his period.

The Ottoman world was the first environment with which Western science came into contact outside its own milieu, due to the close interactions and geographical proximity of the Ottomans with European countries. This made them aware of novelties and discoveries. In the early periods when the Ottomans had contact with and transferred Western sciences (especially firearms, cartography, and mining) they also had some early contacts with Renaissance science (astronomy, medicine) through the emigrant Jewish scholars. Particularly in the early centuries, this interest of Ottomans developed in a selective manner because of their feeling of superiority and their autocratic system. But functional transfers from European science developed gradually due to increasing needs as the military, political, and economic balances turned against them. In these periods, the Ottomans required immediate transfers of science and technology to strengthen their military power. Thus, they established the imperial engineering schools (end of the eighteenth century) and the imperial medical school (beginning of the nineteenth century). Major reforms known as the Tanzâhî (1839) led to a shift in the process of selective transfer to include public and civilian objectives. In addition to the measures taken by the state regarding matters of education and science, in the second half of the nineteenth century individuals started to establish professional and learned associations similar to the examples in the West. These new corporate bodies with their legal status and work procedures, which did not exist in the classical period, added a new dimension to Ottoman cultural and scientific life. (Ihsanoglu, 1991, 1992/3).

Ihsan Efendi (d. 1836), who was chief instructor in the Imperial School of Engineering, had a leading role in the transfer of modern science. Among his works of 13 volumes, which he wrote using Western and particularly French sources, his work Muzanu'l-Ôlm-i Rüyââz (Compendium of Mathematical Sciences) of four volumes, totalling 2224 pages is of special importance since it is the first attempt in any language of the Muslim world to present a comprehensive textbook on different sciences such as mathematics, physics, chemistry, astronomy, biology, botany, and mineralogy in one comprehensive. Ihsan Efendi’s efforts for finding the equivalents of the new scientific terminology and his influence on the transfer of modern science spread over other Islamic countries beyond Ottoman Turkey (Ihsanoglu, 1989; 1993).

The Ottomans’ principal interest was oriented towards practical ends and the application of scientific discoveries, while the three main aspects of science, namely theory, experiment, and research were not taken into consideration as a whole. This understanding was reflected in the educational and “scientific” policy of the Ottoman State before and during the Tanzâhî period. The Ottomans made several attempts to establish an institute for higher education under the name of Dârul-fünûn (House of sciences), apart from the medrese, in line with the model of the European universities. However, they disregarded the importance of scientific research in the program of this institution and those of the previously established ones. For this reason, these institutions were not as successful as their counterparts in Russia and Japan. The dimension of research was introduced to Ottoman scholars circles upon the establishment of the Faculty of Sciences (1900) which started to function as a part of Istanbul University (Ihsanoglu, 1992/3). Ottoman contacts with European science and technology started with the purpose of fulfilling their needs, in a selective way. However, after this long process, they abandoned their own scientific traditions and began to think that development and progress could only be accomplished through Western science and technology.

THE EVOLUTION OF THE GEOCULTURAL SPACE OF OTTOMAN SCIENCE (ITS EXTENSION, DIFFERENTIATION, AND COLONISATION)

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OTTOMAN EMPIRE AND ISLAMIC SCIENCE

The Ottomans took the role of the Islamic world in their hands, as a young nation. They have inherited the Muslim institutions, among them the scientific institutions, such as colleges, mosques, and madrasas. Neither the state of the scientific knowledge was in a fortunate level, as claimed recently by the historians of Islamic Turkish science. It was the responsibility, it is proposed, of its scholars to catch the essential elements in the development of science. But, as the sciences were not necessarily related to prosperity, the arts, in the other side, which may affect the socio-economic level of the society, were not linked with the purely scientific knowledge. So, there were some confusion set into the Islamic world, under the Ottomans. The Muslim world has had a sound economy, a powerful military forces, and a dynamic scientific community. Considering these positive factors, the Muslim world was still a powerful state. As the historian of science Ekmeleddin İnanlıoğlu has remarked the above mentioned factors, and the Islamic faith, all have given the Muslim Ottoman world a feeling of superiority. They felt, he added, a real need of the contemporary European sciences.

By discussing the state of the sciences under the Ottoman rule, one may be in position to show the evolution of the sciences in the Islamic world after Ibn Khaldun’s work. The Ottomans have inherited the Islamic civilization. The historian of science Fuat Sezgin has noted that, “It was true that the Ottomans have inherited the Islamic sciences and the universities from their predecessors, and they have not been neither careless, nor neglectful inheritors. But, as history can inform us, emphasis Sezgin, those inherited sciences have reached the decline stage, and unfortunately, the Ottomans have been unaware of that phenomenon. At the same time, their European counterparts have known the importance of the sciences, and they were aware of their reality situation, and this feeling has encouraged them to challenge the Arabs, since the end of the 13th century.”

OTTOMAN SCIENCE IN THE MAKING

The century of Ibn Khaldun did not witness the total decline of the sciences in the Islamic world, but only in some parts, mainly located in its Western parts. As Ibn Khaldun showed in his Muqaddima, since he related the cultivation of science to the sedentary culture, which must be well rooted in the country. The Ottomans were at their heyday, when they discovered the Arab world in the beginning of the 16th century. It was a natural extension of the Seljuqid Empire, both in the Anatolian places as a conqueror, and in the Arab world as rescuer.

This Empire saw the lands opened to him, so the triumphant powerful nation, has to play a role, as the civilizational background of the Islamic civilization can afford them, and the capability of the local and in-
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The incredible fact that the Ottoman frontier beylik became an Empire over such a short period of time has attracted many Western researchers and scholars to delve into the history of the Ottoman State. It could be argued that there are miscellaneous determinants and dimensions that actually created the possibility for such an incredible feat to be accomplished. This volume has been edited with the aim of focussing on the main factors that gave rise to such a great civilisation. In the first place, the institutional character of the Ottoman State is of utmost importance. In order to understand the basis of Ottoman civilisation, the different patterns of its institutions should be studied, as the comprehensive analysis of the institutional structure of the Ottoman Empire might enable us to conceive how a small beylik was able to turn into one of the greatest Empires in the world. In this volume, the administrative, judiciary and military institutions of the Empire are set out as the main subject titles. In addition, there are various subjects which have been analysed, under such subrubles as bureaucracy, religion and law, shedding light on the main characteristics of Ottoman institutions.

In appreciation of the highly developed institutional structure of the Ottoman Empire, the ideational and philosophical sources cannot be underrated. Unless these sources are taken into consideration, it is impossible to grasp the various dynamics of Ottoman institutions. Therefore, this volume is entitled “Philosophy, Science and Institutions”, due to the close correlation and importance of these subjects to one another.

Contrary to conventional Euro-centric and Orientalist assumptions, which hold ‘science’ as the peculiar praxis of the Renaissance and Enlightenment in
the West, in this volume it is generally argued that the Ottomans had a number of successes in scientific activities (ılm ı fen). The Ottoman State not only promoted the development of science within the borders of the Empire, but also facilitated several interactions with scientific activities outside of its territories. During this interaction, it both benefited from and contributed to the scientific improvements made in Europe.

Additionally, this volume dedicates an important place to the development of philosophy and thought in the Ottoman Empire; although in the Ottoman Empire such major philosophical écoles as developed in Europe were not formed, rather the Ottomans focused mainly on Islamic philosophy. Yet this situation does not arise from the fact that the Ottomans lagged behind in speculative matters. On the contrary, they were not interested in philosophical issues that were outside the realm of Islamic tradition. From their point of view, Islam encompassed all ontological and epistemological matters, making any other philosophical concern dysfunctional.

Yeni Türkiye

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