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SCHOLARS OF MUSLIM HERITAGE: PROFESSOR AYDIN SAYILI

By Mubahat Turker-Kuyel*

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Professor Sayili was born in Istanbul in 1913. His primary and secondary education took place, for the most part, in Ankara. After completing his secondary education, he took part in competitive state examinations and was sent by the Turkish Ministry of Education to the United States for his higher education. The program of his university education was planned and organized under the guidance of Professor Sarton, one of the foremost pioneers in the field of the history of science and one of the most central figures in securing for it the status of an independent academic discipline. Professor Sayili's training at Harvard was broad in scope with his so-called "horizontal" specialization or concentration in the history of science being in the Muslim civilisation and his "vertical" specialization in the history of physics. He obtained his Ph.D. degree in the history of science in 1942 from Harvard University which was apparently the first such degree to be given in that discipline anywhere (see, *his,* vol. 33, 1942, p. 714; vol. 39, 1948, p. 240).

In 1943, Professor Sayili returned to Turkey and entered the workplace of academia in an auxiliary capacity at the Faculty of Letters (Dil ve Tarih-Cografya Fakultesi) of what became some three years thereafter Ankara University. In 1946, he became assistant professor (docent) at the same faculty. In 1952, he was promoted to associate professorship and in 1958 to full professorship.

In 1952, an independent chair of the history of science was officially established in the Faculty of Letters at Ankara University. This is one of the earliest of the chairs of its kind in the world and the first in Turkey. Professor Sayili was its director ever since its foundation until his retirement in 1983. He also served as chairman of the Department of Philosophy of the same faculty since its official launch in 1974 as an administrative unit. It consisted of six chairs.

In 1947, Professor Sayili was elected to full membership of the Turkish Historical Society. In 1957, he became corresponding member of the International Academy of the History of Science. In 1961 he was made full member of the same academy and in 1962 he was selected for a period of three years to the position of vice president. Professor Sayili is an honorary member of the Society of Turkish Librarians and of "Die Deutschen Morgenländische Gesellshaft" (1989) and has served for several years as the head of the section dealing with the Middle Ages of the Turkish Historical Society. In 1977, he received the "service award" of the Turkish Society for Scientific and Technological Research and in 1981 "the certificate of merit award" of Istanbul Technical University for work in the history of science. In 1992, he received also the "service award" of ILESAM. Professor Sayili was also presented, in 1973, with a Copernicus medal by the Polish ambassador at Ankara for work done on Copernicus, and in 1989, with the Bronze Medal of Nehru, which commemorated the hundredth anniversary of the latter's birth, by the President of UNESCO, Federico Mayor.

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In 1980, Professor Sayili was elected to membership of the International editorial Committee for preparing a six-volume work on the history of Central Asian Civilizations for UNESCO's Paris Centre. Since October 1983, he has been serving as president of the Ataturk Culture Centre of the Ataturk Higher Society for Culture, Language and History. He also continues to give postgraduate courses in the history of science at Ankara University.

Professor Sayili participated in the following international congresses and scientific meetings: The International Orientalists' Congress held in Istanbul in 1951; the international congresses of the history of science of the years 1953, 1956, 1959, 1962 and 1974 held respectively in Israel, Italy, Spain, the United States and Japan; congress of the American History of Science Society held in New York City in 1956; International Colloquium on Sixteenth Century Science hold in Royaumont, Paris in 1957; International Symposium of the History of Science held in Pisa and Vinci in 1958; the International Ibn Sînâ and Nâsiruddîn at-Tûsî congresses held in Tehran in 1954 and 1956; the millennial commemoration of Fârâbî's death held in Istanbul in 1950; Turkish Historical Society congresses held in Ankara in 1956, 1961 and 1970; the Congress of Balkan Mathematicians held in Istanbul in 1971; the International Beyrûnî Congress on the occasion of the one thousandth anniversary of his birth held in Pakistan in 1973; the Third World Conference on Education held in Istanbul by the World Council for Curriculum and Instruction in 1977; the International Symposium on the Observatories in Islam held in Istanbul in 1977 on the occasion of the four hundredth anniversary of the foundation of the Istanbul Observatory of Murad III; International Congress of the History and Philosophy of Science held in Islamabad, Pakistan, 8-13 December 1979; Conference on the Contributions of Islam to the Culture and Civilization on Mankind and its Role in the Future, held in Islamabad, Pakistan, 7-10 March 1981; Science Polity in Islam held in the same year in Pakistan on the occasion of the one thousand and four hundredth lunar year of the Hijra; International Symposium on the occasion of the one thousandth anniversary of Ibn Sînâ's birth held in Kuala Lumpur, Malaysia, June 29 to July 1, 1981; Symposium on Hunting, Food Gathering, and Food Production Types of Economy of the Neolithic Cultures in Central Asia held in Dushanbe, Tajikistan, in April 7-11, 1982; Colloquium on the history of mathematics held by the Centre International de Rencontres Mathématiques in Marseille, 16-21 April 1984.

The Chair of the History of Science in the Faculty of Letters of the Ankara University consists now of three members who have all been trained by Professor Sayili. The senior member mainly represents the history of astronomy. Another, who is also a professor, represents the field of the history of natural sciences and medicine and the remaining member is an assistant being trained in the field of the history of physics and mathematics.

Professor Sayili knows English, French, German, Persian and Arabic.

Professor Sayili's first publications go back to his student days at Harvard University. The main part of his research work at that time was naturally connected with his PhD thesis on the Institutions of Science and Learning in Medieval Islam even though there was also some research work on other subjects which was undertaken independently. But as a consequence of this, one general topic on which he worked considerably, beginning with his doctoral dissertation, has been the astronomical observatory and additionally the madrasa, the hospital and the library in Islam (see list of publication items, 10, 14, 15, 16, 17, 28, 30, 31, 33, 41, 42, 49, 58, 59, 62, 64, 79, 82, 84).

In his book on the observatory in Islam (list, item 41), Professor Sayili has shown that the observatory as an organized and specialized institution for work in astronomy was born in Islam. This was the consequence of certain peculiarities and characteristics of the Muslim lands and its feeling of dependence on astronomy in the conduct of religious and lay affairs. This book also claims to show that the observatories of Eastern Islam served as proto-type and model for the early observatories of Europe.

Professor Sayili has proved in his book that the so-called Muqattam Observatory of Al-Hakim in Cairo, references to which are quite widespread within a period of nearly two hundred years especially in European works, is in reality a non-existent ghost observatory. A preliminary report concerning the non-existence of this observatory was presented in his paper entitled "*Some Facts Concerning the Al-Hakim (or Muqattam) Observatory*" read at the International Congress of Orientalists held in Istanbul in 1951. Professor Sayili has moreover been able to fix the specific location of the Damascus Observatory of Al-Ma'mun (see also list item 42) and of the Malikshah Observatory, which was for the first time discovered to be in Isfahan. His investigations showed the possibility of gleaning fragmentary but clear and detailed information concerning Ma'mun's observatories in the writings of Habash al-Hâsib (see also, list, item 30), Beyrûnî and Ibn Yunus. Thanks to these men it has been possible to clear up the relationship between the Baghdad and the Damascus Observatories of Ma'mun. There is the somewhat strange situation that these two earliest and shortest-lived of Islamic astronomical observatories were seemingly contemporaneous or even simultaneous. It was also possible to ascertain the ties between these two institutions and the geodetical undertakings and field work organized under Ma'mun's patronage as well as the systematic and intense translation activities of the House of Wisdom (Bayt al-Hikma) thanks to Beyrûnî.

Light is shed in the book on the evolution of the observatory in medieval Islam from the standpoint of organization, range of work, richness and efficiency of equipment, length of life, type or nature of financial support, and the connection of the observatory with instruction in astronomy and different branches of mathematics. Professor Sayili has shown for the first time that the astronomers of Ma'mun carried out daily observations of the sun and the moon throughout a year in these institutions (see also, list, item 30). It is of great interest that this methodological aspect of astronomical research work, to the desirability of which later medieval astronomical sources of Islam also refer is reminiscent of Tycho Brahe, whose observatory building activity and astronomical instruments constitute a direct continuation of those of the Turkish-Islamic World of Eastern Islam. (See also, list, item 79).

The Arno Press reprinted The Observatory in Islam in the United States in 1981.

Professor Sayili has other and more specific publications on the Maragha, the Gazan Khan, the Samarqand and the Istanbul Observatories as well as on certain other relatively minor institutions of a similar nature (list, items 10, 14, 13, 17, 31, 33, 42, 43, 51). He has somewhat clarified the contributions of Gazan Khan in this field by showing that what he accomplished was the construction of an observatory building and that the main importance of this institution lay in its officially being supported by waqf revenues and its affiliation with instruction in astronomy and auxiliary disciplines (list, item 10).

The impression prevalent was that the Istanbul Observatory of Murad III was demolished before any work had started to be done in it. Alauddin Mansur's rather elaborate poems (list, item 33) contain clear assertions, however, to the effect that the Istanbul Observatory was the scene of rather important scientific work. Moreover, this document shows that the staff of the Istanbul Observatory was made up of sixteen

astronomers although only the name of one has come down to us and also that there was a "Small Observatory" attached to this institution.

Reviews of *The Observatory in Islam* appeared in *Isis,* (vol. 53, 1962, pp. 237-239), in *Archives Internationales d'Histoire des Sciences,* (vol. 14, 1961, pp. 429-431), in *Revue d'Histoire des Sciences,* (vol. 13, 1960, pp. 359-360), in the Japanese journal for the history of science *Kagakusi Kenyu,* (No. 56, Tokyo 1960, pp. 37-38) and in *Arastirma,* vol. 2, 1964, pp. 337-352).

References to *The Observatory in Islam* are quite numerous. The following may, for example, be mentioned: Shigeru Nakayama, "The Possibility of Scientific Revolution in the East-Specifically in the Case of Astronomy" (in Japanese), *Scientific Revolution* (in Japanese, journal), 1961, pp. 168, 186; C. Doris Hellman in the *British Journal for the History of Science,* (vol. 1, part 4, 1963, pp. 304-305); J. Needham, *Sciences and Civilization in China,* (vol. 4, part 2, 1965, p. 695); E. S. Kennedy, *The Cambridge History of Iran,* vol. 5, 1968, p. 661; Abulqasim-i Qurbânî, *Fâshânînâma,* Tehran 1970, pp. 4, 251; Qurbani, *Hasawînâma,* Tahran 1971, pp. 8, 194; Qurbânî, *Riyâzîdânân-i Irânî ez Khwârazmî td Ibn-i Sînâ,* Tehran 1971, pp. 60, 93,333; David A. King, *journal for the History of Astronomy,* vol. 4,1973, pp. 107, 110; *The Legacy of Islam,* Oxford 1974, p. 488; Y. Dold-Samplonius and S. H. Nasr, *The Dictionary of Scientific Biography,* vol. 11, 1975, p. 24 and vol. 13, 1976, p. 514; Willy Hartner and David A. King in the *Journal for the History of Astronomy,* vol. 9,1978, pp. 202-203, 2U, 213, and 217.

George Saliba, in his article "The First non-Ptolemaic Astronomy at the Maragha School", *(Isis,* vol. 70, 1979, pp. 571-576), refers to *The Observatory in Islam* and quotes from it three passages taken from the *Kitâb al-Hay'a* of Al-Urdî, using them to identify for the first time clearly and correctly a certain Bodleian manuscript of unspecified author. This book had previously been wrongly ascribed to others and especially to Ibn Sînâ. He also fully agrees, after initial hesitations he generously recounts, with the estimate set forth in *The Observatory in Islam* that the *Kitâb al-Hay'a* was written before the foundation of the Maragha Observatory. It may be added here that the statement of a relatively little studied source to the effect that the *Ilkhâni Tables* of the Maragha Observatory were largely based upon the *tables* of Ibn al-A'lam and Ibn Yunus, a point brought to the attention of the historians of science and astronomy in Professor Sayili's *The Observatory in Islam,* has proved to be correct. Needless to say, this is a type of information that could be reached only through a process of trial and error which otherwise, especially in the case of Ibn al-A'lam, would very likely have been a very long if not completely unrewarding one.

Professor Sayili has published only parts of his work on the hospital (see, list, items, 16, 54, 59, 64, and 74). Most of this work was done in connection to his Ph.D. thesis, and Sarton refers to this part in his *Introduction to the History of Science,* (vol. 3, part 1, 1947, p. 293, part 2, 1948, p. 1248-1249). In the same work, he refers also to Professor Sayili's article on Turkish medicine *(ibid,* pp. 1217, 1226). See also, *Isis,* vol. 40, 1949, p. 362).

Professor Sayili's earliest book is of the nature of a popularization of science. Its approach is through the history, methodology and philosophy of science. It bears the title "Science is the Truest Guide in Life" (list, item 19) an aphorism of Ataturk or, rather, a shortened version of such an aphorism. This book propounds the idea that the growth of civilization is highly influenced by technology but that pure technological research and discovery are not sufficient by themselves. It is only technology supported and guided by science that can take up the problems of man and society methodically and prove itself equal to the task of finding answers and solutions for them. It is therefore, in the first place, science and not purely empirical

technology which enables man to ameliorate his life and adapt him to the problems he encounters. (For the third impression of the Book, see, *Erdem,* 6, 18, Sept. 1990, 1992, p. 933-937).

This is not to preclude or disregard the need for virtue, conscience and judgement of value as major components of man's activity of creating a civilization wherein good will and constructive achievements constitute the leitmotivs. On the other hand, however, science is not responsible solely for the material aspects of civilization. It is also a major factor in guiding man in the moral problems and issues he encounters. Thus, science is the main force responsible for constructive change, material and spiritual improvement and development in human life. For man otherwise tends to show inertia towards change. Science achieves its influence upon human life more directly through applied science or technology and more indirectly, through what may be called the intellectual culture sector of our culture or civilization.

This book has been reviewed in the Turkish journal *Ilk Ogretim,* (vol. 14, 1 August 1949, No. 275-277, pp. 3622, 3624) and in *Isis,* (vol. 40, 1949, p. 286). Reference has been made to it by Halil Inalcik in his article "Ataturk ve Turkiye'nin Modernlesmesi", *Belleten,* (vol. 27, 1963, p. 630) and in particular to the idea propounded in it that science oversteps particular social circumstances and brings dynamism to human societies; that science is indifferent to boundaries of language, race or religion.

Professor Sayili has lately returned to the general subject of the fundamental place of science in human life and in man's unremitting activity of forging ahead with the creation of better and mightier civilizations and has treated it in greater detail in connection with the theme of Turkish as a language of science and learning as well as within the context of the Turkish movement of Westernization. (See, list, items, 74, 90, 105, 106 and 109). Professor Sayili's interest in Turkish as a language of science and culture also goes back to his student days. In fact, he had occasion to be of help to Sarton in this respect as can be seen from the latter's acknowledgements *(Introduction to the History of Science,* vol. 3, part 1, 1947, pp. 29, 104, 972, 1014).

It is a well-established fact that the translation of books on science, philosophy and medicine from Arabic into Latin during twelfth century ended the Dark Ages in Western Europe by ushering in the so-called Renaissance of the Twelfth Century. It has been Professor Sayili's contention that infiltration of ideas and scientific knowledge from Islam into Western Europe did not cease after this initial "renaissance" but that it continued in a more subtle manner and restricted measure up to the seventeenth century, so that the Muslim regions exerted appreciable influences in some of the initial phases of the European scientific revolution brought about by men like Copernicus, Galileo and Harvey. Conversely, Ottoman Turkey established cultural and scientific contact with Europe in periods as early as the fifteenth, sixteenth and seventeenth centuries not only in technology and fine art but also in scientific and intellectual matters.

Professor Sayili has taken up these questions more specifically in his articles, "Islam and the Rise of the Seventeenth Century Science" (list item 36), "Murad III's Istanbul Observatory Terrestrial Globe and Cultural Contact with Europe" (list, item 45) and he has touched this question in his book *The Observatory in Islam* (list, item 41), in his Turkish article on the basic causes of the slowing down of the rate of scientific work in Islam (list, item 52) and in his Turkish and English publications on Copernicus (list, items 63, 66). He has also conducted two Ph.D. theses in these subjects, one indicating influence proceeding from the Turkish-Islamic World into Western Europe in the field of astronomical instruments during the sixteenth and earlier centuries and the other on influence received in Turkey in the earlier parts of the seventeenth century from Renaissance Europe in the field of anatomy.

Another view Professor Sayili has held and tried to establish and ascertain is that science is one of the firstborn and most ancient of human activities. It went side by side with magic, technology and religion rather than grow out of them. It was much older than philosophy but at times, it established close ties with the latter and became incorporated in it. Consequently it had to rescue its independence from time to time and cut or reduce its ties with philosophy. This was tantamount, in general or at least at times, to the emergence of a more systematic and theoretical conception of science. This circumstance has given rise to the widely held view that science was born in Greek antiquity and also that science came into being in the true sense of the word and in a somewhat limited range of its meaning only with the Renaissance, i.e. in the sixteenth century. A more empirical and older brand of scientific activity is also held widely to have grown out of religion and especially technology. It would seem pretty clear, however (list, item 54), that what maybe called concrete facts and evidence show an independent existence of science side by side with religion, magic and technology in pre-Greek antiquity. Such a view may find theoretical justification and support in the thesis that evidence is in fact not different in its bare essentials from ordinary everyday thinking, provided secure and systematic measures based partly on well-established exemplary knowledge and partly on formal methodology are taken in order to avoid error and oversight. (See also, list, item 106).

In this general perspective, the pre-Greek sciences of Egypt and Mesopotamia gain in importance historically. This is especially true of Mesopotamia, firstly because Mesopotamians had a much more advanced knowledge of mathematics and astronomy as compared to the Egyptians and secondly because the Greeks seem to have borrowed or learned much more from Mesopotamian science than from that of the Egyptians. The situation changes perhaps considerably from the standpoint of medicine. Another reason why it is necessary to emphasize the importance of the heritage of these older civilizations in the emergence of the Greek stage of scientific achievement is that in general it has so far been somewhat neglected or overlooked. There seems to have been a tendency indeed towards dealing piecemeal with this subject. But isolated examples are apt to escape general notice even when they are momentous. Professor Sayili has therefore attempted to bring together sundry items of this nature and thus to help the creation of cumulative impression in his publication just referred to (list, item 54).

Professor Sayili has also maintained a more or less standing interest in the cause of the decline or stagnation of scientific work and interest in Islam. The Muslim lands exhibited great interest in cultivating the sciences beginning in about the middle of the eighth century. Intense and systematic efforts were made to translate Greek works of science, philosophy and medicine, and, as a result, Islam became the most advanced civilization of medieval times. It is the result of this remarkable activity in science, philosophy and medicine that medieval Islam occupies a place of honour in the intellectual history of the world. Why was it that the Muslim regions that had caused science to emerge from its early medieval slumber did not continue to carry the torch of science still further? Professor Sayili tries to be as clear and concrete as possible in dealing with this very complex question. He therefore emphasizes aspects of this question which can be tied up to intellectual culture to causes which may be characterized as those more directly, or less remotely, connected with the phenomenon of decline. Moreover, in order to secure some degree of check and control over the conclusions reached and inferences made he tries to make comparisons with late medieval Europe on the one hand and with the experiences gone through in the movement of Westernization of the Ottoman Empire on the other.

One central problem here turns out to be the question of the degree of reconciliation that could be brought between philosophy and religion. In a strongly Theocentric society as medieval Islam was it was essential to make some kind of a synthesis between religion and philosophical thought or at least to secure the

conditions needed for a peaceful coexistence. For such a circumstance would help the continued existence and survival of a scientific worldview in the face of mystical and magical rival views. One fundamental fact too is that if scientific and philosophical knowledge were, in addition, transmitted from generation to generation with a intensity higher than a threshold value, then scientific knowledge should be bound not only to continue but it should be able to grow and advance with some degree of impetus however small. Thus, provided the survival of a scientific or rational worldview is somehow guaranteed, the situation boils down - more than anything else - to the problem of setting up and organizing schools of higher education or systems of instruction in the so-called intellectual or secular sciences. Now, Professor Sayili's work in these fields shows that in all these respects Islam achieved important progress but that this was not sufficient to secure scientific progress in a continued and unabated manner. Islam, however, was in these respects helpful to late medieval Western Europe.

As regards the relationship between philosophy, including the secular sciences, and religion, this is taken up in items 20, 22, and 50, item 39, pp. 407-429, item 104, pp. 43-49, item 107, pp. 343-374, and as regards the place of the secular sciences in the schools of higher education in Islam and the transmission of the knowledge of the secular sciences and medicine in general these topics are taken up in items 8, 9, 13, 55, 57, 60, 82, and relevant parts of items 39 and 50.

Another topic to which Professor Sayili has devoted much time and work concerns the part played by the Turks in the scientific and intellectual achievements encountered in the world of medieval Islam. Turks were instrumental in the introduction of the use of a form of rag paper into Islam. They also figured prominently not only in the creation of the madrasa system, i.e. the school for higher education but also among the hospital and observatory builders of Islam. It is of interest that the hospital and the astronomical observatory took an appreciably active part in the dissemination of medical knowledge and astronomy, as well as in the transmission of the secular sciences needed by the physicians and the astronomers, i.e. the natural and mathematical sciences.

Reliance upon astronomy was not only an attitude prevalent in Islam but also one characterizing the Turkish-Mongol sphere of culture that established political hegemony for some time within the Islamic realm. Turks assumed a widely active part in political and administrative affairs in Islam and founded quite a few states not only in Eastern Islam but also even in Africa. They were thereby naturally instrumental to a substantial extent in the promotion and patronage of scientific work. For the cultivation of the secular sciences in Islam rested largely on state support and personal interest shown by individual rulers.

The thesis that the Turks made substantial contributions to the rise and continuation of a scientific and cultural movement of major importance to world intellectual history rests partly at least on the existence of an indigenous Turkish population not only in Central Asia proper but also in the regions immediately to the east and northeast of Persia, already at the time of the conquest of the Arab armies in these districts. Professor Sayili has written on this particular subject in collaboration with Professor Richard N. Frye an article (list, items 5, 6) which has been referred to by various scholars interested in this field. See, e.g., Ahmet Caferoglu, *Turk Dili Tarihi I,* Istanbul 1970, p. 78, George Sarton, *Introduction to the History of Science,* vol. 3, part 1, 1947, p. 379; R. Sesen, *Hilafet Ordusunun Menkibeleri ve Turklerin Faziletleri,* Ankara 1967, p. 28; Gerhard Doerfer, "Woher Stammte Ibn Muhanna", *Archeologische Mitteilungen aus Iran,* Neue Folge, vol. 9, p. 248; H. D. Yildiz, *Islamiyet ve Turkler,* Istanbul 1976, pp. XXI, 14; Mehmet Fuat Bozkurt, *Untersuchungen zum Bojnard-Dialekt des Chorasanturkischen,* Gottingen 1975, p. 2.

It is a well-known fact that these north-eastern regions of Islam were exceptionally productive from the standpoint of intellectual and scientific work in Islam. A galaxy of truly remarkable thinkers and scientists originated from these districts of Central Asia, and, though it is often difficult to determine their nationalities, a considerable number among them must have belonged to the Turkish element of the population of these regions.

Moreover, Turks contributed to not only the continuation and progress of scientific work in Islam but they also took part in the pioneering work of laying the intellectual foundations of the Islamic culture and civilization and in Islam's profound interest in scientific pursuits, in particular in its initial and formative stages. An example of such early Turkish scientists on which I have done some work in particular is Abdulhamid ibn Turk (list, item 46, 51). (See also, list, items 81, 96, and 107).

Such activities by Turks continued throughout the ages. Qadîzâde and Ulug Bey of the first half of the fifteenth century are outstanding examples of this nature. Turks also seem to have played an important part in the transmission of knowledge from Eastern Islam to Europe during the late Middle Ages and early modern times, as mentioned a few pages before. Finally, when Europe made great strides in science and industry, it was Turks that made a clear decision to adopt Western institutions of education and learning and of profiting from European scientific knowledge and methods of objective thinking. In fact, outside of Europe, Ottoman Turkey gave the first example of such Westernization. (See, list, items 90, 96, 105, 106, 109).

In his article "Higher Education in Medieval Islam" (list, item 11) Professor Sayili brought evidence to show that the Islamic madrasa system of higher education, which probably served to some extent as a model for the European medieval university, was not only officially created under the patronage of the Turkish Seljuq rulers such as Alp Arslan and Malikshah but that its earlier and formative stages of development took place in districts to the north and east of Iran which were mostly under Turkish rule and wherein a predominant or at least considerable part of the population was Turkish. G. Sarton refers to this publication in *Isis,* vol. 40, 1949, p. 382, and Shigeru Nakayama in his article "The Possibility of Scientific Revolution into East-Specifically in the Case of Astronomy" (in Japanese) in the Japanese journal *Scientific Revolution,* (1961, p. 168). In the field of the history of mathematics, Professor Sayili's work on Abdulhamid ibn Turk, the early ninth century mathematician (list, item 48, 53), has served to establish definitively that Al-Khwârazmî was not the originator of his well-known geometric methods of solution of second degree equations and that his book was not the first monograph on algebra. Although some prefer to insist on some kind of priority for Khwârazmî. (See, Roshdi Rashed, "L'Idee de l'Algebre Selon Al-Khwârazmî", *Fundamenta Scientiae,* vol. 4, No. 1, 1983, pp. 87-100, and also the reference made to Fuat Sezgin in the next paragraph). I also published for the first time a letter by the ninth century mathematician Thâbit ibn Qurra wherein an elaborate discussion of the generalization of the Pythagorean Theorem is presented.

Both these works of Professor Sayili have attracted clear interest among historians of mathematics. C. B. Boyer (*Isis,* vol. 55, 1964, pp. 68-70) and Christopher J. Scriba *(Isis,* vol. 57, 1966, pp. 56-66) tried to trace the earliest occurrence of references in Western Europe to the theorem brought forth by Thâbit ibn Qurra. B.A. Rosenfeld and A. T. Grigorian site it in the *Dictionary of Scientific Biography,* (vol. 13, 1976, p. 293). C. B. Boyer dwells upon this theorem and refers to Abdulhamid ibn Turk's algebra in his *History of Mathematics,* (1968, pp. 257-259). It may be added that these references of his to these two works occupy about two pages in a chapter of about twenty pages on the whole of mathematics in the World of Islam. A Persian translation of Abdulhamid ibn Turk's Arabic text has been published by Professor Ahmed Aram

("Risâleî der Jabr wa muqâbele, Te'lîf-i Abû'1-Fadl Abdulhamîd ibn Wâsîd ibn Turk al-Jaylî", *Mecelle-i Sukhân-i 'Ilmî,* No. 11 and 12, series (dawra) 3, 1342 SH. (1968). Abûlqâsim-i Qurbânî too in his *Riyâzîdânân-i Irânî ez Khwârazmî tâ Ibn-i Sînâ* refers to Professor Sayili's work on Abdulhamid ibn Turk (Tehran 1971, pp 30-31). Fuat Sezgin too dwells at some length on this work *(Geschichte des arabischen Schrifttums,* vol. 5, 1974, pp. 241-242). Another work by Professor Sayili on pure mathematics concerns a solution found by the tenth century mathematician and astronomer Al-Qûhî for the classical problem of Greek geometry, the trisection of the angle (list, items 47, 48), and a fourth one is on an early proof of the sine theorem of trigonometry as reported by Beyruni (list, item 69).

Professor Sayili's book on Abdulhamid ibn Turk was reviewed in *Revue d'Histoire des Sciences* (vol. 18, 1965, pp. 123-124), while Al-Qûhî's trisection of the angle is cited by Ivonne Dold-Samplonius *(Dictionary of Scientific Biography,* vol. II, 1975, p. 241) and by A. Qurbânî in his book mentioned just a few lines above (pp. 203, 205, 212-213). Professor Sayili had given a preliminary report concerning Thâbit ibn Qurra's generalization of the Pythagorean Theorem first in a talk given at the History of Science Society's annual meeting held in New York City in December 1956 in conjunction with AAAS annual meeting. In an account given concerning this meeting in the *American Historical Review,* (vol. 62, 1957, p. 797), the writer mentions this paper as one of the "highlights" of the meeting.

Al-Qûhî's attempted proof that infinite motion in finite time is possible (list, item 34) represented a venture or an endeavour to set up a purely mathematical approach for the solution and clarification of mechanical and physical problems. Attempts in a similar vein are encountered in the sixteenth and later centuries in Western Europe, an early and typical example being that of Giovanni Battista Benedetti. This Work of Al-Qûhî is mentioned in the article devoted to him in the *Dictionary of Scientific Biography,* (vol. 11, 1975, p. 241).

In the domain of the history of astronomy, Professor Sayili has done also some work outside the field of the history of the astronomical observatory. He has tried his hand, e.g. at the thorny question of the prediction of a solar eclipse (585 B.C.) by Thales. He has, in fact, claimed that contrary to the contention of certain pre-eminent authorities of the field, Thales must actually have made this prediction, as certain other authorities are apt to believe. Thales may have been in a position to make such a prediction, according to Professor Sayili, provided we understand by prediction a forecast or prophecy that may possibly come true, its veracity or cogency not being by any means guaranteed. Professor Sayili took up this question in his Turkish book on pre-Greek science (list, item 56, pp. 393-407) and he did not aim it necessarily to reach non-Turkish readers. It is rather interesting to observe nevertheless that certain articles appeared not much later than this work of Sayili's which represent an attitude not unfavourable to the thesis that Thales actually made this prediction, e.g. Willy Hartner's article in *Centaurus,* (vol. 14, 1969, pp. 60-71) and one by Asgar Aaboe in *Journal for the History of Astronomy,* (vol. 3, 1972, pp. 105-118).

Since about one hundred and fifty years ago historians of astronomy have referred to a work, mentioned by the sources, on astronomical instruments by the eleventh century scientist Al-Khâzinî and as it was not to be found anywhere and was considered lost for good. Professor Sayili discovered the book which turned out to be quite a little one but of considerable interest for some of its unexpected features. It was found in the Sipahsalar Library of Tehran. The book was juxtaposed to two others with which it became artificially merged, a short part of it being bound in one volume and the rest in another (list, item 32). E. S. Kennedy and Robert E. Hall refer to this publication of mine, the former in the *Journal of Near Eastern Studies,* (vol.

20, 1961, p. 107) and the latter in the *Dictionary of Scientific Biography,* (vol. 7, 1973, pp. 336,348,350). See also, A. Qurbânî, *Riyâzidânân-i Irânî ez Khwârazmî tâ Ibn-i Sînâ,* Tehran 1971, pp. 92-93, note.

Professor Sayili has written a book on Copernicus in English and also a somewhat shorter version of it in Turkish filling the greater part of a volume prepared in commemoration of the five hundredth anniversary of Copernicus' birth (list, items 65, 66). In these he advances the view that the attempts, quite frequently met, to explain Copernicus' achievements as merely the results of mathematical manipulations or on the basis of philosophical or ideological reorientations are unduly superficial and that Copernicus in reality hit upon the solution of longstanding questions concerning certain enigmatic relations or ties between solar and planetary motions.

The Babylonians treated different phenomena related to the planets such as retro gradations and heliacal risings and settings as independent phenomena. With the Greeks, such phenomena were integrated into the planetary motions as parts and elements of these motions but the fact that the retro gradation periods of all planets seemed to be geared up with the annual motion of the sun remained mysterious. Copernicus identified all these retrograde motions with the revolution of the earth around the sun and thus solved the enigma of this common feature and facet of these otherwise disparate motions.

Professor Sayili also adds new evidence to support the thesis that Copernicus received substantial influence from the world of Islam and he speculates on the strong likelihood that Istanbul, the Ottoman capital, was instrumental in the passage of this influence. Professor Sayili's English book on Copernicus, *Copernicus and His Monumental Work,* has been reviewed in the *Archives Internationales d'Histoire des Sciences,* (vol. 26, 1976, pp. 182-183).

Professor Sayili was the main speaker in the meeting organized in Ankara in 1973 by the Turkish Commission for the UNESCO for the celebration of the five hundredth anniversary of Copernicus' birth and, as mentioned before, he was presented in that year by the Polish ambassador in Ankara with a Copernicus medal in recognition for his work on the occasion of the five hundredth anniversary of his birth.

Brief references to Professor Sayili's article on Habash al-Hâsib (list, item 30) are found in A. Qurbânî, *Riyâzidânân-i Irânî ez Khwârazmî tâ Ibn-i Sînâ,* (pp. 46-49) and *Isis,* vol. 49, 1958, p. 228. There are short bibliographical references to Professor Sayili's article on Al-Khâzini and Alauddin Mansur's poems (list, items 32, 33) also in the same volume of *Isis,* (pp. 227, 228), while Professor Sayili's book on Ghiyath al-Din al-Kâshî and Ulug Bey's scientific circle (list, items 43, 44) has been referred to by A. P. Youshkevitch and B.A. Rosenfeld in the *Dictionary of Scientific Biography,* (vol. 7, 1973, p. 261).

Professor Sayili has done some work on the status and popularity of astrology in the Middle Ages. The initial stages of this work, which in a more developed form has been incorporated into the first chapter of his book *The Observatory in Islam,* has been referred to by Sarton in his *Introduction to the History of Science,* (vol. 3, part 1, 1947, pp. 263-264). Other references to some of his publications on the history of astronomy may be found in Joseph Needham's *Science and Civilization in China,* (vol. 3, 1959, p. 333, vol. 4, part 3, 1971, p. 814).

Professor Sayili has spent some time also doing research in the field of the history of optics especially on the explanation of the rainbow by Aristotle and also by Al-Qarafî (list, items 2, 12). Carl B. Boyer, in his articles "Aristotelian References to the Law of Reflection" *(Isis,* vol. 36, 1946, pp. 92-95), "The Theory of

the Rainbow: Medieval Triumph and Failure" *(Isis,* vol. 49, 1958, p. 379) and in his book *The Rainbow,* (New York 1959, pp. 324, 325, 327, 328, 335, 356, 358), George Sarton, in his *Introduction to the History of Science,* (vol. 3, part 1,1947, p. 709) and in his book *A History of Science, Ancient Science Through the Golden Age of Greece,* (1952, p. 518), and H. J. J. inter, in "The Optical Researches of Ibn al-Haitham" *(Centaurus,* vol. 3,1954, pp. 205-210), refer to these publications. Sarton also refers to Professor Sayili's work on optical experiments of Theodoricus of Freiberg which, in Sarton's words, are among the most remarkable examples of their kind encountered in medieval times *(Introduction to the History of Science,* vol. 3, part 1, 1947, p. 706).

Ibn al-Haytham was a greater authority than Ibn Sînâ in the field of optics and seemingly, their ideas concerning the explanation of optical phenomena were generally divergent. However Professor Sayili has found an exception to this situation which seems to be indicative of a passage of influence from Ibn Sînâ to Ibn al-Haytham and this was in the field of vision or physiological optics involving Ibn Sînâ's conception of image formation. (See list item 99). It may be noted that these researches of Ibn Sînâ, although in a sense trailblazing, contained a basic lacuna and misunderstanding and that it was this misinterpretation which list at the bottom of Ibn al-Haytham's idea of the image formed on the external surface of the eye-lens, and this idea though erroneous, was quite widely accepted during the late-medieval times and early Renaissance.

Professor Sayili has also drawn attention to an important contribution of Ibn Sînâ in the field of dynamics, an example which is also of great interest from the standpoint of the growth and development or transformation of scientific knowledge. The claim here is that not only Newton's first law of motion but also his second law, which may be said to have existed in a primitive and rudimentary form in Buridan in the fourteenth century, had already been adumbrated in Ibn Sînâ and that it was perhaps these researches of Ibn Sînâ that had influenced Buridan. Now, on the other hand, there are hesitations as to the degree in which Galileo influenced Newton in these respects. To what extents would one prove justified in claiming that Ibn Sînâ actually set on foot a development that through Buridan and Galileo led to ideas that are more definitive in the form of a scientific law? It seems quite clear, it may be said, that here we are confronted with a clear case of a few strategic observations and a piece of good thinking which in the course of a relatively long span of time is seen to have proved viable, or thought-inspiring at least, because it contained the kernel of a significant sector of truth (see, list, item 103).

Sources speak of a work by Al-Fârâbî on vacuum. This work was considered lost. For no copy of it had been found anywhere. Professor Sayili noted that it had come down to us in a volume belonging to the manuscript collection of the Dil ve Tarih-Cografya Faculty of Ankara University. Professor Sayili published the text and translation of this unique manuscript in collaboration with the late Professor Necati Lugal, and he also made an analysis of its contents in a separate article (list, items 23, 27). This tract of Al-Fârâbî has served to bring to light the fact that Al-Fârâbî made a weighty contribution to the formulation of the thirteenth century doctrine of *horror vacui* and thus set in motion a conception which was responsible for the eventual emergence of the idea of atmospheric pressure in the seventeenth century. He also published the text as well as the Turkish and English translations of Al-Fârâbî's short article on alchemy (list, item 25).

The one thousandth anniversary of Al-Fârâbî's death was commemorated by the Istanbul University in a ceremony made up of a series of talks. Professor Sayili participated in that commemoration as the representative of Ankara University with a paper he prepared for the purpose (list, item 22). On the same occasion, the Turkish Historical Society dedicated an issue of its *Belleten (Belleten,* No. 57, vol. 15, 1951) to

Al-Fârâbî. The articles in this issue of the *Belleten,* five in all, are all on Al-Fârâbî, and four out of them bear Professor Sayili's signature, one being the product of collaboration with Professor Necati Lugal.

In the first of these articles, Al-Fârâbî and his place in the History of Thought (list, item 24), Professor Sayili tried to establish a rough and partial chronology of Al-Fârâbî's works and thus to delineate certain general features concerning the development of his thought. Professor Mubahat Turker has referred to this article on different occasions, and A. Adnan Adivar reviewed *Belleten,* 57, dwelling in particular on this article, in the 29 August 1951 issue of the newspaper *Vatan,* (p. 2). His article bore the title "The Work that has come from Ankara".

Professor Sayili prepared an article for the Turkish Historical Society for the nine hundredth anniversary of Al-Beyrûnî's death (list, item 18), and he acted as editor of the volume published by the Turkish Historical Society, *Beyrûnî'ye Armagan,* (Ankara 1974), to celebrate the millennium of Al-Beyrûnî's birth, to which he contributed three articles (list, items 67, 68, 69).

We may finally mention that some of Professor Sayili's publications constitute minor contributions to the history of literature, although they have in all cases been chosen because of their interest to the history of science.

Thus, Professor Sayili has published for the first time and from a unique manuscript Gulshahrî's Persian poem "The Story of the Stork and the Nightingale" (fourteenth century) (list, item 57). This poem contains details on the madrasa curriculum, details which are of great interest from the standpoint of the secular sciences. Alauddin al-Mansur's Persian poems on the Istanbul Observatory, also published for the first time from a unique sixteenth century manuscript, contain a considerable amount of valuable information on that institution (list, item 33). The poem on the early fourteenth century Ghazan Khan's mausoleum of Tabriz which has disappeared quite a long time ago contains certain details on turns of fortune and technical matters pertaining to its construction, as well as information of interest to the history of art (list, item 10 and 60). The Persian poem on the famed Selimiye Mosque of the city of Edirne contains information on the official ceremonies connected with the construction of that mosque (list, item 61). As to the thirteenth century Arabic poem of Nizamuddin al Isfahanî, it contains mostly a praise of Nasiruddin and certain vague hints on other related matters; it too was published for the first time (see, list, item 31).

We may add at this juncture that the late Professor O. Rescher, famed orientalist, put Professor Sayili's picture on the inner front page of his *Beitrdge zur Arabische Poesie, VII, 1, Qutâmî* (ed. Barth, Leiden 1905), 1960-1961, with the accompanying statement "Dedicated to Professor Aydin Sayili as a Small Token of Friendship". This is to be considered as an honour made to Professor Sayili, though this should not be connected with his publications that come closer to literary history.

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2. "The Aristotelian Explanation of the Rainbow", *Isis,* vol. 30, 1939, pp. 65-83.

3. "Was Ibn Sînâ an Iranian or a Turk", *Isis,* vol. 31, 1939, pp. 8-24.

4. Review on: Barnette Miller, "The Palace School of Muhammad the Conqueror", *Isis,* vol. 34, 1942, pp. 168-169.

5. "Turks in the Middle East before the Seljuqs", *Journal of the American Oriental Society,* vol. 64, pp. 194-207, 1943 (in collaboration with R.N. Frye).

6. "The Turks in Khurasan and Transoxania at the Time of the Arab Conquests", *Muslim World,* vol. 35, 1954, pp. 308-315 (in collaboration with R. N. Frye).

7. "Applied Industrial Psychology", *Calisma,* year 1, No. 5, 1946, pp. 34-39 (in Turkish).

8. "The Study of Motion during Work" (in Turkish), *Calisma,* year 1, No. 7, 1946, pp. 12-13.

9. "Turks in the Middle East before the Seljuqs" (in Turkish), *Belleten,* vol. 10, 1946, pp. 97-131 (in collaboration with R.N. Frye).

10. "The Observatory of Gazan Han" (in Turkish), *Belleten,* vol. 10, 1946, pp. 625-640.

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12. "AI-Qarafî and his Explanation of the Rainbow", *Isis,* vol. 32,1947, pp. 16-26.

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