The Istanbul Museum for the History of Science and Technology in Islam

An Overview
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Istanbul 2010
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The Istanbul Museum for the History of Science and Technology in Islam
The catalogue of the Museum of the Institute for the History of Arabic-Islamic Science at the Johann Wolfgang Goethe University, Frankfurt am Main, which is the mother of the Istanbul Museum for the History of Science and Technology in Islam, was completed and published in five volumes in January 2003 under the title *Wissenschaft und Technik im Islam*. The French translation of the catalogue came out in 2005; it was prepared for an exhibition planned for the year 2006 at the Palais de la Découverte at Paris. The first volume of the Arabic translation was published in 2007 and the second volume will appear in print shortly. The Turkish translation of the catalogue was prepared by the Turkish Academy of Science and was published in collaboration with the Ministry of Culture and Tourism in 2007. A reprint was brought out by the Department of Culture of the Istanbul City Administration in 2008. I hope the English translation of the catalogue, prepared at the Frankfurt Institute, will be ready for the press in a few months.

The present Short Overview, which is printed separately in five editions (Turkish, English, German, French and Arabic), was compiled out of extracts from the large catalogue, as a handy guide for the visitors to the museum. It does not, however, contain the dates of origin of the apparatuses and instruments, their method of function and the bibliographic references; such information is available in the above-mentioned catalogue in five volumes.

The first volume of the large catalogue consists of an “Introduction to the History of the Arabic-Islamic Sciences” and aims to provide an adequate idea of the importance of these sciences in the general history of science.

Frankfurt, 8 July 2009

Fuat Sezgin
 Shortly after the foundation of the Institute of History of Arabic-Islamic Science at the J.W. Goethe-University in Frankfurt in 1982, and in the context of that Institute, the idea emerged to reconstruct the instruments and devices which had been used in the creative period of Arabic-Islamic Science, between the beginning of the ninth and the end of the sixteenth centuries. In the course of the assimilation of science from other cultures, the Muslims adapted a series of instruments and devices, in particular from ancient Greece. Most of these instruments were further developed in the Islamic civilization, and the Muslims invented many new instruments on their own. From this very rich tradition, only a few instruments in astronomy, medicine, chemistry and time measurement have come down to us. But it is very fortunate for the history of science that many of the instruments and devices which were used by the Arabic-Islamic scientists, were described by them in numerous treatises and large works, often accompanied by detailed drawings. Some of these works have been preserved, including the large medical work *Kitāb at-Ṭaṣrīf* of Abu l-Qāsim az-Zahrāwī (10th century CE), the *al-Jāmi‘ bain al-‘ilm wa-l-‘amal* of Ibn ar-Razzāz al-Jazārī (1200 CE) on physics and time measurement, and the astronomical work *Jāmi‘ al-mabādi‘ wa-l-ghāyāt* von Abu l-Ḥasan al-Marrākushī (13th century CE).

Already in the nineteenth century, several orientalists have drawn attention to the importance of these works and of other treatises on instruments. The most important of them is the physicist and historian of science Eilhard Wiedemann from Erlangen, who devoted more than half a century, between 1875 and 1928, to the investigation of the Arabic-Islamic scientific achievements, and who published more than 200 articles on the subject. For me it is a very pleasant duty to mention with recognition and with gratitude that Wiedemann was the first who began, around 1900, with the reconstruction of some of the instruments that had been made by the Arabic-Islamic scientists. Five of these replicas were purchased in 1911 by the Deutsches Museum in Munich.

When I started in 1983 to reconstruct the instruments and devices which were known to me from original sources and modern studies, I was thinking of a goal
which now, in hindsight, appears to have been too modest: a collection of 20 or 30 reconstructions of instruments which have not been preserved, or which were unknown to my orientalist predecessors or had not been described by them. I had to trace them down in manuscripts and then find the persons who could rebuild them: mere patience was not enough.

Already in 2003, the crammed rooms of the Institute in Frankfurt contained a museum with 800 exhibits related to the history of science and technology in Islam. This museum has not yet been officially opened, but every year it receives several thousands of interested visitors by appointment. About 12 years ago it was stimulating and encouraging for me to experience the great interest and surprise of about 1500 persons who visited the museum on the occasion of the Day of the Open Door (Tag der Offenen Tür) of the universities in the German province of Hesse.

This museum had already become known, to some extent, when a comprehensive catalogue in five volumes was published in 2003 under the title “Wissenschaft und Technik im Islam” (Science and Technology in Islam). The French translation appeared one year later, and since two years, a Turkish translation has also been available. The English translation will soon go to the press. The first volume of the Arabic translation has appeared two years ago; the second volume will be printed in two or three months.

I have been asked several times by institutions in other countries if the objects of our museum could be displayed for a certain period, or if a museum could be established with copies of the objects in our museum at Frankfurt. Thus, Mr. Attila Koç, the Turkish minister for culture and museums, who visited the Institute in Frankfurt in 2005, expressed his wish to found a similar museum in Istanbul. For me, this was the fulfillment of a dream, but unfortunately, the building proposed at that time appeared to be inappropriate. Similar wishes to establish a museum were expressed by the Turkish Academy of Sciences (TÜBA) and (the Turkish Association for Technology, Science and Research (TÜBITAK).

It was a great fortune when I heard, during a visit to Istanbul in September 2006, through my friend Mr. Cevdet Akçali about a historic complex of buildings in Gülhane Park, namely the Sultan’s stables, the restauration of which had been nearly finished after six years of work. When I visited the place, I was fascinated by the buildings and their location. Then it was important to obtain the support of the City of Istanbul, which owns the buildings of the Sultan’s stables (Has Ahırlar Binalar), for the museum. The mayor, Dr. Kadir Topbaş, was abroad at that time, but less than a week after he had been informed about the idea, he came to Frankfurt – I mention this with gratitude – in order to visit the Institute and especially the museum. A few days after his return to Istanbul, he informed me of the approval by the City, on the condition that the foundation of the museum and the installation of the instruments would be carried out as soon as possible. In January 2007, the contract for the foundation of the museum was signed. The next day I was able to visit the Turkish president, Mr. Recep Tayyip Erdoğan, who was very interested and
The Istanbul Museum for the History of Science and Technology in Islam gave his full approval. The cabinet decided to approve the foundation of a center for the history of science in the two buildings adjacent to the museum.

By a happy coincidence we had started, 23 years earlier, with the preparations for an exhibition in the USA at the request of a generous Arab friend and with his financial support. With permission of this sponsor we could donate approximately 80 per cent of the instruments to the Istanbul Museum. The remaining part of the exhibition has been financed by the Turkish government, who never hesitated to generously allocate the necessary funds to this project.

The foundation of the museum for the history of science and technology in Islam in Istanbul and previously in Frankfurt was inspired by our conviction that the universal history of science is a united whole. With this we wish to supply a missing link in the historiography of science, namely the gap due to the incorrect notion that the European Renaissance is an immediate continuation of Greek antiquity. We want to present the original contributions of the creative scientists in the Arabic-Islamic civilization, which were made between 900 and 1600, after a period of reception and assimilation. These contributions have created the conditions for creative work in Europe from the second half of the sixteenth century onwards.

In the eighteenth century, the historiographic concept of a scientific “Renaissance” became increasingly widespread in Europe; this concept implied ignoring or rejecting the scientific contributions of the entire Middle Ages, in Europe as well as in the Islamic civilization. But at the same time, the scientific orientation of the scholars of Arabic and Islamic studies, from the seventeenth century onwards, was also beginning to bear fruits. Through the valuable work of these pioneers and their tireless successors, who increased in number in the following centuries, several important corrections were made in a few areas in the history of science. Nevertheless, even the educated people today do not know enough about the real importance of the Arabic-Islamic civilization within the universal history of science. Therefore, the common incorrect view of “Renaissance” has not been challenged.

I hope that this museum which has been founded at such a beautiful location in Istanbul will contribute to a correction of this wrong and outdated historical view.

Frankfurt/Main, 17 April 2009
Fuat Sezgin
Honorable Prime Minister, dear guests,

Ever since the appreciation of history is sufficiently developed, people began to ask themselves when and where certain type of devices and instruments were developed for the first time. For a long time, however, historiography understood its task to be the recording of primarily political, military and up to a certain degree also economic events and changes, and treated the developments in the fields of science and technology in a step-motherly manner.

It is not easy to trace the individual stages of development undergone by science and technology before the Greek period. The Greeks themselves give us hardly any clues about the predecessors of their own important stage of development of the sciences which lasted for roughly eight hundred years. The custom of citing the sources did not develop strongly enough among them.

The attitude of the modern historiography of science of the last three hundred years to regard the important position of the Greeks as the starting point has hardly experienced any significant revision despite the archeological discoveries related to the cultures of the Sumerians, Babylonians, Assyrians, Hittites, Canaanites, Aramaeans and Egyptians, and the insights gained by the decipherment of inscriptions. Little attention was paid even to the thesis postulated during almost half a century by the eminent Austrian historian of science, Otto Neugebauer, that the Greeks did not stand at the starting point of the scientific development but belonged to its middle phase, that is to say, that we should add to the 2500 years which passed since the Greeks assumed the leading role in the history of science, an earlier period of once again 2500 years for forerunners of the Greeks.

In the first half of the seventh century, after the sciences which had reached a
high standard among the Greeks had developed in a weaker form in the Eastern Mediterranean and in Sassanid Persia, Islam entered the arena of history as a force that encompassed these cultural centres. Since the representatives of those cultural centres were integrated, regardless of their belief, with great tolerance and understanding by the Muslims and were accorded the status of teachers, the sciences experienced a new impetus. In the middle of the eighth century Indian sources were added. Thus after a phase of reception and assimilation that lasted for two hundred years, the Muslims entered a period of creativity.

The Islamic world reached the phase of creativity in certain fields already in the second half of the eighth century, in certain others only towards the middle of the ninth century. This period of creativity lasted roughly eight hundred years until the end of the sixteenth century, although there was later on some decline in speed and quantity. Of its total achievements, only relatively few are known today. Instead of enumerating them one by one, we can describe their importance in the following way. The Muslims developed the sciences further which they had taken over from other cultures, particularly from the Greeks; they opened up new areas of knowledge and, during the period of their predominance, they prepared the way for some of the sciences which were to emerge in the succeeding cultural world. In this phase of the history of science which we call “great” and “creative”, a not insignificant role was played by the Christian and Jewish fellow citizens who wrote in Arabic.

We are far from knowing everything or even a large part of all that was achieved in this creative phase of the history of science, and perhaps we shall never learn all of it. But that which we know already now is enough to make us realize that we encounter here one of the most significant phases of the history of science. There is no doubt that the character and nature of these achievements were influenced by factors of time and other prerequisites, and by the achievements of the predecessors and the successors. In general it is also not easy for the historian of science to define the fundamental values that characterize a significant phase of culture. For my own part, I believe to have found out in the course of time the following specific characteristics of the Islamic period of science:

1. The principle of objective criticism.
2. The notion of a clear law of development.
3. A greater readiness than in other cultures to name one’s sources.
4. Historiography of sciences, beginning in the tenth century and developing further.
5. The principle of achieving a balance between the experiment and theory, and to draw upon the experiment as a resource for research, to be employed systematically.
6. The principle of long-term observation of astronomical phenomena; as a con-
sequence of it the creation of observatories.

7. Acquiring knowledge not merely from books, but from books in association with a teacher and, as a consequence of this, the emergence of the first universities.

One of the most important traces of the beginning of the history of science could be seen in the fact that since the second half of the tenth century books, instruments and medicaments from the Islamic cultural sphere reached Western Europe via Spain. Through the conquest of the Iberian peninsula in 711 the Arabs established a connection of the Islamic culture area with Europe, and thus pre-determined the future destiny of the sciences, which had been developed by them to spread out several centuries later in another culture area.

In the course of time, the number of channels connecting the two cultural spheres increased. The most important channels passed through Sicily, Italy and Byzantium. The crusades played a role primarily in the introduction of technology of the Islamic world in Europe.

The phase in which science and technology from the Islamic world reached Europe – and which consisted of the two steps of reception and assimilation – lasted for at least five hundred years. Strictly speaking, the period of creativity in Europe began only in the sixteenth century and in the second half of the same century began the stagnation of sciences in the Islamic world. Only at the beginning of the seventeenth century the Europeans reached their dominant position in sciences.

In this connection I should draw attention to a historical fact, though with some reluctance. The absorption of Arabic-Islamic sources did not take place in the Latin culture area with the same kind of openness that the Muslims had displayed towards their Greek sources. The Muslims called Aristotle the “first teacher”; what they took over from the books by Hippocrates, Galen and others, they cited with the appellation “highly esteemed Hippocrates”, “highly esteemed Galen” and so on. As against this, in the case of quite a few of the Latin translations of Arabic books, even the names of the true authors were not retained. There was also practically no habit of citing the sources correctly.

As a consequence of this, Europeans in the seventeenth century were not aware of how they had reached their dominant position. Both the Europeans and the Muslims believed that this was a heritage stemming from a superior past going back several centuries. Because of this there arose among the Europeans a feeling of superiority towards the Muslims, and among the Muslims gradually a feeling of inferiority. The feeling of superiority of the Europeans found already after a short while in the eighteenth century a fixed notion in the term Renaissance which it has hardly lost until our own days. As a consequence, the new phase of sciences in Europe known since a few centuries was viewed as the new beginning which went back directly to the Greek sciences. With sincere gratitude we may recall that in
the same century a reaction emerged against this attitude which was ridiculed by
the French philosopher Etienne Gilson as the “Renaissance of the Professors”. This
reaction, inspired by the humanistic spirit, came from scholars like the French phi
losopher and historian Voltaire and the Germans Johann Gottfried Herder, Johann
Wolfgang von Goethe and Alexander von Humboldt.

Arising partly from these humanists, growing partly and primarily from being
unaffected by the Eurocentric historiography of science, there emerged a new im-
portant humanist current. Here it was no longer a question exploring the Islamic sci-
ences through Latin translations of Arabic, Persian and Turkish books, but through
the direct study of original sources. This current emerged, though only slowly, al-
ready in the seventeenth century and gained such strength in the nineteenth century
that the conservative historiography of sciences saw itself forced to make revisions
in some fields. In the field of philosophy, the historian of religion and philosophy,
Ernest Renan, in his book *Averroès et l’Averroïsme*, published in 1852, demonstrated
unambiguously how deeply Ibn Rušd from Arabic Spain influenced philosophical
thought in Western Europe and Italy. Renan’s contemporary, the philosopher Hein-
rich Ritter, propounded the thesis that the influence of the Islamic (Arabic) sciences
on Europe had been very great even outside philosophy and that the physical side
of Arabic philosophy had brought about a strong change in the knowledge of the
Christian Middle Ages. The Frenchman Jean-Jacques Sédillot and his son Louis-
Amélie astonished their contemporary colleagues with their research spanning sixty
years during which they could show a large part of the successes achieved by Mus-
lims in the field of astronomy. At the same time Joseph-Toussaint publicized the
achievements of the Islamic culture in the field of geography through his studies,
lasting more than fifty years.

In the field of mathematics the young Franz Woepcke, whom Alexander von
Humboldt had sent to Paris to work for his PhD under the above named schol-
ars, forced the conservative historians of mathematics of his days to make seri-
sous revisions with his forty studies which caused a sensation. In the most popular
contemporary book on the history of mathematics there was to be found, e.g., the
contention that in the field of algebra the Arabs had not gone beyond the quad-
ratic equations. With his edition and French translation of the algebra of ‘Umar
Khayyām of the eleventh century which contains a systematic treatment of cubic
equations, Woepcke furnished a positive proof to show how unfounded the judg-
ments were in his field.

In the second half of the nineteenth century vigorous efforts were undertaken to
publicize Islamic science. Thus, for example, in the field of geography the Dutch-
man Michael Jan de Goeje and the German Ferdinand Wüstenfeld, in the course of
their studies spanning half a century, edited the extant works of almost all important
Arabic geographers and translated certain parts into European languages. Having found a manuscript of the book by the traveller and geographer al-Maqdisi from the tenth century in India in 1864, Alois Sprenger, a contemporary of Goeje and Wüstenfeld, declared al-Maqdisi as „the greatest geographer of all times“. In his subsequent studies Sprenger could easily establish that the standard which had been achieved in the human geography by the Islamic world as early as the tenth century could be reached in Europe only in the nineteenth century. Since 1875 the physicist from Erlangen, Eilhard Wiedemann, took part in the research of the history of natural sciences in Islam. With his more than 200 studies, published until 1928, this indefatigable scholar holds an immortal place in the history of science. The Islamic world cannot be thankful enough to him. We may also recall here that he was the first to reconstruct some instruments from the Islamic world. As far as I know, some of his models are preserved in the stores of the Deutsches Museum in Munich.

In their works spanning several centuries, the orientalists had produced enough convincing results to show that the Muslims hold an important position in the history of science. Even so, we are far from knowing in an adequate manner how important in fact this position was, and perhaps we will never find out. In order to proceed a step forward on the path of gathering information, we founded the Institute for the History of Arabic-Islamic Science at the Johann Wolfgang Goethe University in Frankfurt in 1982. In the course of our work arose the idea of reconstructing devices and instruments improved or newly invented by Muslims. Thus a museum was established at the institute in Frankfurt. Now we hope that many visitors will be able to see the corresponding instruments in the Istanbul Museum for the History of Science and Technology in Islam, which is being inaugurated today, and we believe that this is a unique place to demonstrate our basic idea that the history of science is a common heritage of all mankind.

I thank Dr. Kadir Topbaş, the Mayor of Istanbul, for the very special building which he provided for the museum. The Prime Minister, Reccep Tayyip Erdoğan, took keen interest in the establishment of the museum and assured financial support to it. I should like to express my heartfelt thanks to him. I am especially grateful to the Minister of Culture and Tourism, Mr. Ertuğrul Günay, for having accompanied and supported the realization of the museum project to its final completion with infatigable interest. Finally, I wish to express my sincere thanks to Prof. Dr. Nüket Yetiş, the president of the Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBITAK) and to Prof. Dr. Engin Bermek, the president of the Turkish Academy of Sciences (Türkiye Bilimler Akademisi), for their contribution to the setting up of the museum from its foundation to its inauguration.

Fuat Sezgin
The Istanbul Museum for the History of Science and Technology in Islam

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This museum is established on the basis of the firm belief that the history of science and technology represents a common heritage of mankind. The part played therein by the Islamic Culture Area is highlighted here by means of historical instruments, tools and devices. Yet one should not lose sight of the fact that Muslims did not create these from scratch, but they adopted at first the inheritance of the preceding cultures, above all, that of the Greeks and the early Byzantines, and then developed this inheritance further. To a large extent, the exhibits displayed here are original inventions from the period extending from the ninth to the sixteenth century CE, a period in which Muslims themselves were creatively active.

The exhibits were reconstructed by the Institute for the History of Arabic–Islamic Science at the Johann Wolfgang Goethe University, Frankfurt am Main. Most of the exhibits were prepared on the basis of illustrations and descriptions found in literary sources, and a small number were copied from original specimens that are still extant.
Panels and Objects displayed in
The Istanbul Museum for the
History of Science and Technology in Islam
In the first hundred years of their appearance in history, i.e. the 7th century CE, Muslims began – without reservation or bashfulness, keen on learning and with an insatiable appetite for knowledge – to inherit the scientific legacy of other cultures, notably the Greek. Already by the mid 9th century CE they had progressed beyond reception and assimilation towards a period of genuine creativity. What they had received they perfected to the highest degrees, creating new fields of learning and initiating the development of further disciplines. Yet like all great civilisations they also failed to escape the ultimate fate of decline, of becoming exhausted and feeble and of eventually having to pass the lead to one or several heirs. The order of succession was determined when Muslim culture spread to Spain in the year 711 CE. By the 10th century CE, when large scale translation of Arabic writings into Latin started, the ground for the education of the European heirs was prepared. In the early 16th century CE, when Muslim culture was still unequivocally dominating the sciences, their European successors entered the stage of creativity. Only one century sufficed then to make the old culture yield to the younger.

The historic relation, the actual unity of predecessor and successor, has unfortunately not yet been taken account of on either side. The grand task of disseminating this insight awaits the science–historian. The way for this has already been paved by his orientalist colleagues who tried to dispell the firmly entrenched notions left over from the 18th century CE.
The Istanbul Museum for the History of Science and Technology in Islam

Principal Routes of Science into the Arab-Islamic World.
Muslim Scholars on Science and the scientific Method

Science is not going to yield anything unless you devote yourself completely. But even if you do devote yourself entirely, it remains uncertain whether you will get anything from it.

(an-Nażẓām, d. ca. 840 CE)

However variable its aspects may be, the whole universe obeys a permanent law, and its elements, however variegated they may be, are governed by harmony.

(Ibn al-Haitham, d. ca. 1040 CE)

It appears that with many a problem we do not possess the prerequisites to draw secure conclusions. However, in such cases, it is necessary to conclude as far as possible. It is not inconceivable that things may occur later that will ultimately lead to certainty in matters in which we cannot succeed today.

(Ibn Rušd, d. 1198 CE)

I have done what everybody should do in his profession: accept the achievements of your predecessors gratefully, don’t shrink from correcting eventual blunders and bequeath, what seems worthy, to your successors and future generations.

(al-Bīrūnī, d. 1048 CE)

Although Galen was the first in science to examine and be most careful and exact in what he said and reported, yet the witness of our senses is better than reading Galen.

(‘Abdallaṭīf al-Bağdādī, d. 1231 CE)
**Ibn al-Haitham’s Emphasis on A critical Attitude towards the Use of the Sources**

Whosoever seeks the truth will not proceed by studying the writings of his predecessors and by simply accepting his own good opinion of them. Rather, the truth-seeker will mistrust his established opinion. He will rely solely on his understanding of the texts by following the criteria of logic rather than the statements of authors who are, after all, human, with the errors and faults which this naturally involves. Whosoever studies works of science must, if he wants to find the truth, transform himself into a critic of everything he reads. He must examine texts and explanations with the greatest precision and question them from all angles and aspects. But he must also observe himself with a critical eye in this process, so that his judgement is neither too strict nor too lax. If he follows this path, the truths will reveal themselves to him and the possible inadequacies and uncertainties in the works of his predecessors will come to the fore.

*(Ibn al-Haitham, d. ca. 1040 CE)*

**On Errors with Measuring Instruments**

Since in the manufacture of measuring instruments one cannot achieve the precision one has in mind, be it with the evenness of the surfaces or with the marking of the divisions or holes at the right place, it is but natural that errors occur, as with the adjustment of the instruments. In almost every construction inaccuracies exist, whether visible ones or hidden. If the instrument is made of wood, then it will warp, particularly when it stands at a place exposed to sun and humidity. The errors are larger or smaller, according to the theoretical knowledge, craftsmanship and experience. Added to this, there is the expertise of the observer in setting up and measuring, the precision of the adjusting apparatus and much more. Whosoever believes that everybody can execute measurements on order and without previous practice, and that each measuring instrument delivers correct results, is in error. Whosoever wishes to achieve this must, first of all, spend a long time in the study of the instruments and in the practice in measuring, until finally his measurement rests on the knowledge of the precision of his instrument and on his experience in measuring.

*(Ibn Yûnus, d. 1009 CE)*
In the field of historiography we shall mention al-Bīrūnī’s (d. 1048) book on India, which bears witness to its author’s exemplary veracity, critical mind, keen observation and a remarkable cosmopolitan openness and objectivity. Al-Bīrūnī deals with the culture, religions and sciences of the Indians on the basis of his own research and observations made over many years while living in India. In the introduction, he states: “This is not a polemical book but a plain factual report. I shall describe the theories of the Hindus as they are and in that connection mention similar theories of the Greeks in order to demonstrate the relationship between the two.” Al-Bīrūnī’s book appears to stand in the tradition of the spirit we already encounter in the early Abbasid period, the spirit which aims at getting to know foreign cultures and religions, the spirit that found expression in many travelogues, in the masterworks of al-Masʿūdī, and in al-Bīrūnī’s “Chronology of Eastern People”. Al-Bīrūnī’s book on India marks an apex that – perhaps not only in Islamic culture – could never be surpassed.

Among the most significant achievements of the 10th century was also a fundamental work on the history of science. It is the “Catalogue” (Fihrist) by Muḥammad b. Abī Ya’qūb Ishāq Ibn an-Nadīm (d. ca. 1010) which, under its modest title, aims to list the scientific literature of all known culture areas. Such a work on the history of science – which astonishes us with its capacity to survey the material on a broad basis and which deals with foreign cultures objectively – would be inconceivable without an older tradition that made its appearance possible. We are reasonably familiar with this tradition today. We might also think, for instance, of the works by the widely travelled encyclopaedist ‘Alī b. al-Ḥusain Masʿūdī (d. ca. 956), which can be seen as an attempt to describe all known cultures and civilizations past and present. Ibn an-Nadīm himself quite frequently offers interesting clues that help us understand how his book came about. In the second part of his 9th treatise on the cultures of India and China, he cites a passage about the religions and sects of India and their sacred places from a book written by an envoy whom the statesman Yahyā b. Ḥālid al-Barmakī (d. 805) had sent to India to report on its religions and to bring back medical drugs. (Catalogue I, p. 23)∗

“Even if our own age is inferior to that of our predecessors among the writers and is far from them, yet we do hope that we are not inferior to them in the tasks we undertake and in the goals we follow. If they have the advantage of the beginning, we have the luck of being able to use their work. Thus we have in common the ideas and the contents. A younger writer will be able to write more agreeably and more thoroughly, because he has become more experienced, more discerning and more cautious against pitfalls. This explains the growth in the sciences, (which progresses) without hindrance and limitation, because a later generation discovers things which the previous generation did not find. This is expressed in the words of God when it is said: ‘Above every knower there is one who knows more’ (Quran XII, 76). The habit of praising the old, of extolling their books (excessively), and of decrying the present, even when there is much that is more useful and instructive in the books of the contemporaries, is but human nature.”

(al-Mas’udi, Tanbih, p. 76)
If Muslims have become aware over the last hundred and, particularly, the last fifty years of the great, nay, paramount importance of their culture in the history of sciences, they owe this to a number of orientalists who devoted their lives to the study of the natural sciences in Islam.

While great humanists like J.G. Herder (1744–1803), J.W. von Goethe (1749–1832) and Alexander von Humboldt (1769–1859) defended the view that the artificial term “renais-
sance”—which failed or refused to recognize the crucial contribution the Islamic culture made over a period of almost 800 years—absolutely contradicted the facts of history, a group of orientalists who will always be remembered with gratitude by Muslims made themselves heard with their investigation of Arabic sciences.

Jean-Jacques Sédillot (1777–1826) and his son Louis-Amélie Sédillot (1808–1876), Paris, who were mainly concerned with Muslim contributions to astronomy.

Joseph Reinaud (1795–1867), Paris, who worked on geography, military technology and archaeology.

Ernst Renan (1823–1892), Paris, who was an eminent contributor to the study of philosophy.

Franz Woepcke (1826–1864), a German scholar, who worked mainly in Paris and died prematurely, succeeded even in those days in establishing the vast contribution made by Muslims to the history of mathematics in his some 40 published treatises.

Eilhard Wiedemann (1852–1928), Erlangen (Germany), bequeathed a monumental body of publications—numbering almost 200—on practically all subjects of natural sciences, which Muslims will remember forever. He also gained merit as the first scientist to build models of reconstructed Islamic instruments.

Carl Schoy (1877–1925), Frankfurt, Islamic mathematics and astronomy.

Julius Ruska (1867–1949), Heidelberg, dealt with several areas of Islamic natural sciences.

Paul Kraus (1907–1946), Cairo – Paris, Islamic chemistry and alchemy.

Julius Hirschberg (1843–1925), Berlin, ophthalmology in Islam.

Alfred von Kremer (1828–1889), Vienna, cultural history of Islam.

Heinrich Suter (1848–1922), Zurich, Islamic mathematics.

Michael Jan de Goeje (1836–1909), Leyden, Islamic geography.


Ignatius J. Kratchkovsky (1883–1951), Petersburg, Islamic geography.

After these, some other scholars made substantial contributions in the second half of the 20th century.
Johann Wolfgang von Goethe (1749—1832) expressed his admiration for the Arabic-Islamic sources known to him in the following manner:

“If we should wish to partake in those productions of the most exalted minds we would have to orientalise ourselves, as the Orient is not going to approach us. And even though translations are utterly commendable, yet it becomes clear from the aforesaid that in this particular literary tradition language as such is pivotal. Who wouldn’t desire to make himself acquainted with such treasures in the original!”

In 1965 Franz Rosenthal explained the motivation for the urge to acquire foreign knowledge in the following words:

“Probably neither the practical utilitarianism which made the acquaintance with medicine, alchemy and the exact sciences desirable for the Muslims, nor the theoretical utilitarianism that induced them to occupy themselves with philosophical theological questions, would have been adequate to motivate the extensive activity of translation, had not Muhammad’s religion, from the very beginning, emphasized the role of knowledge (‘ilm) as the main force in religious life and thus for human life in general… Without this pivotal position of knowledge, which is characteristic of Islam and which indeed almost borders on religious reverence, the translation activity would presumably have been less scientific, less comprehensive and have been limited rather to what was absolutely necessary than was actually the case.” (Catalogue, vol. I, p. 5)

(J.W. von Goethe, East-West Divan)
The Art of Experimenting among Muslim Scholars

The fact that experiments come strongly to the forefront has also to do with the entirely different mental attitude of Muslim scholars. Quite likely Archimedes, while examining Hiero’s crown, conducted experiments and other Greeks must have done the same. But Antiquity cannot offer such carefully conducted experimental work as that of Biruni on specific weights …, or that of ibn al-Haitham on different types of shadows, or that of Kamāl al-Dīn on the movement of light rays in globes, where theory and experiment go hand in hand in an exemplary manner, especially in the case of ibn al-Haitham and Kamāl al-Dīn. Roger Bacon took them as role models, but did not attain their level, when he expounded his general ideas on experiments as the basis of research in the natural sciences. However, he did not substantiate this method; he merely described it systematically, although in a manner somewhat different from that of the Arabs. He certainly did not invent the experimental method just as Francis Bacon of Verulam did not invent the inductive method, even though the English would like to attribute both these methods to their compatriots.

(Eilhard Wiedemann, 1917)
Ahmad b. Muhammad al-Farghani, author of a handbook on astronomy, which was probably the first such work in Arabic. He was active in the first half of the 9th century CE. His book was one of the earliest astronomical treatises translated into Latin. Through repeated translations, it enjoyed a great popularity in the Occident and he became famous under the Latinised name Alfraganus. Woodcut from the translation by Johannes Hispalensis, Ferrara 1493.

Idealized picture of Jābir ibn Hayyān (8th century CE) who established chemistry as a branch of science of its own in the Islamic world. His name was Latinized as Geber. Picture from the Codex lat. Ashburnham 1166 of the Biblioteca Laurenziana in Florence.
After the work accomplished by the Greek predecessors, fixed star astronomy reached a new climax in the second half of the 10th century in the work of ‘Abdarrāḥmān aṣ-Ṣūfī, in particular through his Šuwar al-kawākib at-ṭābi‘a. This eminent astronomer verified the data in the catalogue of Hipparchus-Ptolemy on the basis of his own observations and measurements, and compiled a new catalogue with largely revised scales of brightness, coordinates and magnitudes of stars. A further revision of the star catalogue was made on the basis of fresh observations at the observatory of Uluğ Beg (d. 1449) in Samarqand. This new catalogue distinguished itself from its predecessor primarily through more precise coordinates. ‘Abdarrāḥmān aṣ-

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The Planetarium of as-Siğzi

To the Arabic-Islamic astronomers who believed that the Earth turns around itself belonged Abū Sa‘īd Ahmad b. Muḥammad as-Siğzi (2nd half 10th c.). As al-Bīrūnī reports, as-Siğzi constructed also an astrolabe in the form of a boat (al-usturlâb az-zauraqi) according to the principle of the Earth’s rotation. Whether as-Siğzi himself built a planetarium is not known; our model serves to illustrate his ideas of the Earth’s rotation.

(Catalogue II, p. 16)

Reconstructed model of the Planetarium of as-Siğzi (A 1.05)

Ibn Sinā (Avicenna), together with Hippocrates (d. 377 BCE), Galen (2nd c. CE) and Aetius (6th c. CE), on the title page of the Latin translation of his Qānūn in the edition Venice 1608.
During his reign the Abbasid caliph al-Ma’mūn (r. 813–833 CE), who was resident in Baghdad and was fascinated by the sciences, commissioned a large group of geographers and astronomers with the task of creating a comprehensive geographical work and a new world map. The work was carried out by the scholars involved on the basis of contemporary geographical knowledge and with the help of data collected from geodesic measurements and astronomical and mathematical information, taking as its starting point the well-known world map of Marinos (1st half of 2nd c. CE) and Ptolemy’s (2nd half of 2nd c. CE) geography. The map of the Ma’mūnian geographers was rediscovered in 1984 in a copy dating back to the year 740 of the Hijra (1340 CE). Together with several surviving regional maps from the Ma’mūnian geographical work and contemporary tables of co-ordinates based on its world map which have also survived, it opens up a completely new horizon in cartographic history. The progress made thanks to the work commissioned by the Caliph can be ascertained when it is compared with the world map bearing Ptolemy’s name. The scholars commissioned by al-Ma’mūn had the advantage of covering South and Central Asia, East and North Africa as far as possible by means of their own observations and measurements from Baghdad, which practically lay in the centre of the then known world. Thus the Ma’mūn map, for manifold reasons, is of epoch-making significance.
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The map illustrated here was reconstructed on the basis of the data given in the original book of co-ordinates. Both maps together—even when we take into account that the later copy no longer reflects the quality of the original—can clearly convey a sense of humanity’s achievements in the cartographic representation of the surface of the Earth in the first quarter of the 3rd/9th century. The Ma’mūn map thereby provides us with a solid basis for assessing the further development of cartography, while at the same time itself becoming of great importance for this development, both in the Arab world and the West. Apart from its fairly advanced shape of the Earth’s surface, its cartographic aids, such as its globular projection and its cartographic scale, and the representation of mountains in perspective, help us to bring forward appreciably our previous dating estimate for the time when these aids were developed. In addition, the axis of the Mediterranean is reduced to 52° compared with that in Ptolemy of 62° or 63°; moreover, it shows Africa in the south, Europe and Asia in the north as being circumnavigable and the Indian and Atlantic oceans are no longer portrayed as inland seas as was the case in Ptolemy.

Reconstruction of the World Map of Caliph al-Ma’mūn

Model of a terrestrial globe with the reconstructed world map

Terrestrial Globe

with the world map which Caliph al-Ma’mūn (reigned 813–833 CE) had commissioned a large group of astronomers and geographers to make. (A t. 05)
Elephant Clepsydra

Model reconstructed after the description in al-Jazari’s book (ca. 1200 CE). Hidden inside the elephant is a water-powered mechanism which causes the figurine of the driver to move its whip and strike the drum every half an hour. Moreover it makes a bird on top turn and two other birds drop metal balls from their beaks into the gaping mouths of two snakes. The weight causes the latter to decline slowly and ultimately drop the balls in sonorous bowls and from there further down. A clerk figurine on the back of the elephant points out the elapsed time with his pen on a dial by ticking a bit to the right every half hour.

(Catalogue III, p. 101; Nr. B 106)
Nasiraddin at-Tusi (d. 1274) and his team of astronomers. Miniature from the Tansüqnâma-Ilyâni, MS. British Library, Or. 3222, fol. 105a.
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