



GEORGE SARTON: HISTORIAN OF MEDIEVAL ISLAMIC SCIENCE

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Before the publication in 1927 of the first volume of George Sarton's *Introduction to the History of Science*, the field of the history of medieval Islamic science consisted of partial studies of one or another branch of scientific knowledge. In spite of their authority, these studies did not provide the historian of science with a general picture which could enable him not only to grasp the realizations in every scientific discipline, but also the relationships between these disciplines in themselves, and between them and other elements of culture.

On the other hand, at the same time as Sarton's *Introduction*, existed in the field of the history of science some works, which in their general survey of the subject, devoted some space to Islamic medieval science. Among these works are Pierre Duhem's *Le système du monde* (1913-1959), Lynne Thorndike's *A History of Magic and Experimental Science* (1923-1958) and Charles Homer Haskins' *Studies in the History of Mediaeval Science* (1924). Duhem treated essentially cosmological concepts, while Thorndike investigated magic in its broadest sense. Haskins' work is centred on the history of culture during the European Middle Ages. Great importance has been given by Haskins to manuscript sources, as well as to the diffusion of scientific knowledge. Amid this short bibliography, Sarton's *Introduction* appeared as the first attempt to provide a general history of science from Greek antiquity to the fourteenth century. Egyptian and Babylonian antiquities were excluded for chronological reasons. Sarton's ambition was to integrate into one coherent and unique historiography the Eastern and Western scientific contributions. Regarding the specific domain of Muslim medieval science, the *Introduction* represented the first attempt to evaluate the different scientific activities in Islamic culture and their influences.

Concerning the chronological cuts such as Antiquity, Middle Ages, Renaissance and Modern Times, Sarton considers them arbitrary, conventional and approximative. For him there are no real breaches between the Antiquity and the Middle Ages, no more than between the Middle Ages and the Modern Times. There is instead a disintegration or dissolution of one period into another. The history of science is thus an uninterrupted chain of scientific contributions which, in spite of their sometimes irregular flow, was never really broken off. In this long process, a particular period is dominated by Islamic science. It stretches from the beginning of the eighth until the twelfth century. However, it should be taken into consideration that from the thirteenth to the fifteenth centuries, although some men of science manifested real originality, the vigor and the intellectual energy of Islamic culture was declining. Nevertheless, the influence of this scientific movement was felt in the West until the sixteenth century and even later.

The important place which Sarton gives to medieval science in his writings was far from being acknowledged by historians prior to him. As a matter of fact the period of the Middle Ages, and particularly the field of its scientific thought, was generally regarded as a period of obscurity, a sterile and unproductive one, in short *the dark ages*.

This standpoint was the consequence of two widely spread mistaken attitudes among historians in general. The first was to centre historical investigations on the political and economical questions, without taking into consideration scientific realizations and achievements. Here the historian would limit the role of the Middle Ages to the mere transmission of scientific knowledge, deprived from all creativity.

The second mistake was that, in the rare cases when the scientific realizations of the Middle Ages were studied, it were the Latin Middle Ages that were investigated while the Eastern contribution was ignored. For Sarton, this attitude was a necessary consequence of the underrating of medieval science by the Renaissance, the seventeenth and eighteenth centuries. In the introductory chapter to Vol. I of the *Introduction to the History of Science*, Sarton points out that : "There were perhaps as many men of genius in the Middle Ages as now; at least, my survey gives that impression, which would be confirmed, I am sure, by statistical inquiry" (1).

However, the Renaissance rejected all sources of knowledge other than the classical Antiquity, and manifested a real hostility towards all thoughts of Oriental origin, while during the Middle Ages the bulk of the scientific writings was Arabic. Thus any attempt to restrict the study of medieval scientific achievements to the Latin writings will necessarily give a false and distorted image of this period. In Sarton's view, should we someday rewrite the history of the Middle Ages in general, and reevaluate its intellectual legacy in particular, we must deliberately take into consideration the Arabic scientific literature.

On the other hand, Sarton believed that the rejection of the Oriental scientific contribution was in reality not only restricted to the Middle Ages. For, in his opinion, the study of the Eastern influence on the development of science in Antiquity does not have the place it ought to occupy in the historiography of this period.

Sarton soon arrived to the conclusion that : "If a history of ancient science is written without giving the reader a sufficient knowledge of these two groups of facts - Oriental science on the one hand and Greek occultism on the other - the history is not only incomplete but falsified" (2). This approach between East and West during Antiquity laid the foundation for a long and fertile exchange which took place during the eighth and ninth centuries, when Greek science was transmitted to Islamic culture, and from the eleventh to the thirteenth century when Islamic science passed to Latin Europe.

The movement of the translation of Greek scientific works into Arabic will include practically the totality of the scientific writings, and in less than a century this literature was not only available in Arabic, but also assimilated by Islamic men of science who, in their turn, were beginning to write original works based on this new scientific foundation. Sarton evaluates this scientific movement : "There is nothing like it in the whole history of the world, except the Japanese assimilation of modern science and technology during the Meiji era" (3).

He goes further in his judgement of the Islamic medieval scientific contribution : "The creation of a new civilization of international and encyclopedic magnitude within less than two centuries is something that we can describe, but not completely explain. This movement ... was creative; it was the most creative movement of the Middle Ages down to the thirteenth century" (4).

The translation of Greek scientific works into Arabic began systematically at the end of the eighth century, that is, nearly four centuries after the last spark of Greek science had died out. This translation from Greek into Arabic was so exhaustive that certain Greek texts lost in their original version were recovered only through Arabic translations. Moreover, our only hope of finding further Greek scientific works is to recover them in Arabic manuscripts.

Sarton underlines the importance of studying and editing Arabic scientific manuscripts in these words : "... if I were certain that a MS. available to me in one form or another, were extremely important, I would probably stop any other activities and devote my whole time to its study; if I could not do that myself, I would intrust the MS to a special friend of mine or to a favorite student, to whom I would thus give a unique chance of distinguishing himself among other scholars; I could not make him a greater gift" (5).

On the other hand there were Far Eastern elements that made their impression on Western science by way of Arabic scientific texts translated into Latin. Consequently, any study of an eventual infiltration of Indian or Chinese scientific and technological ideas into European scientific thought, must begin by analyzing medieval Arabic scientific writings. For Sarton the Arabic culture "constituted the main link between the Near East and the West, as well as between the Near East and Buddhist Asia" (6).

Progressively, George Sarton realized the importance of the medieval period within the general history of science, and in the formation of Western science in particular. It was in 1916, when Sarton undertook the study of Leonardo da Vinci's scientific manuscripts, that he noticed a historical fact which he never suspected before.

After giving six lectures on the subject at the Lowell Institute of Boston, Sarton realized the gaps that remained in his formation. He soon arrived at the conclusion that understanding Leonardo's scientific thought required an intimate knowledge of its sources, that is medieval science. Sarton therefore resolved to write a general, systematic and comprehensive history of science from classical Antiquity to 1900. This project was realized by the writing of the *Introduction to the History of Science* covering the period from classical Antiquity to the fourteenth century, that is, five centuries before the terminal point Sarton has fixed.

As a matter of fact, the more the composition of the *Introduction* advanced, the more Sarton realized the importance of the Islamic period. He also realized that acquiring only Greek and Latin languages limited the historian of science, in denying him the direct access to the basic writings of the Middle Ages he needed in order to study the sources of this period, and to better evaluate and appreciate it.

For Sarton, it is the historians of medieval science lack of knowledge of the Arabic language that prevented them defining the exact place of the Islamic medieval scientific contribution. Sarton thus resolved to study Arabic, and this was the principal reason which obliged him to limit the *Introduction* to the fourteenth century. In 1953 Sarton recalled his study of Arabic : "I must have spent some thirty years in Arabic studies, off and on, and days when I do not do no Arabic reading at all are very few. Did I master the language ? The question is indeterminate to the point of meaninglessness. I read Arabic print very easily; I write it slowly and with difficulty; I can hardly speak it" (7). He spent the 1931-1932 sabbatical year in the Middle East in order to improve his Arabic and to become better acquainted with the culture.

The necessity of acquiring a knowledge of Arabic for the historian of medieval science is evident from the fact that from the second half of the eighth until the end of the eleventh century Arabic was the universal language of science. Also during the twelfth and thirteenth centuries Arabic remained the fastest vehicle to update scientific ideas.

On the other hand, for Sarton it was not before the constant and systematic application of inductive method in experimental sciences, i.e., from the second half of the sixteenth century onward, that one might speak of two distinct scientific streams of thought : Eastern and Western. The scientific tradition of which modern science forms the last chapter has passed successively by the following phases : Greek, Arabic and Latin. The interrelationships among these three phases are so closely knit that excluding, or ignoring, one of them gives *ipso facto* a false image of the intellectual background of our today's science. Sarton writes in this context : "... as I have explained repeatedly. Our own tradition is Greek-Arabic-Latin; we cannot have the Arabic links out without breaking it" (8).

In his historiography of medieval Islamic science, Sarton answers the criticism directed by certain historians against the Middle Ages in general and the Islamic period in particular. It has been repeated often that the Middle Ages was a period exclusively devoted to the transmission of knowledge. Sarton rejects this claim which suppresses all creativity from medieval scientific achievements. He considers that, even if a great part of the intellectual efforts during the Middle Ages were directed toward the transmission of knowledge, nevertheless new scientific doctrines were developed during this period. He dismisses all attempts to diminish the originality and creativity of the Middle Ages in general.

Another criticism, this time directed toward science during the Islamic Middle Ages in particular, was based on the assumption that Islamic science is nothing but a synthesis of different elements borrowed from a variety of sources : Greco-Roman, Mid-Eastern, Indian and Far-Eastern. Sarton pushes aside this viewpoint too. He writes : "This manner of argument is certainly very misleading, especially in mathematics... Indeed, a scientific invention is simply the weaving together of separate threads and the trying of new knots. There are no inventions *ex nihilo*" (9).

Sarton devotes an important place in his historiography to the study of the decline of Islamic medieval science. For him the intellectual decadence of a culture is a phenomenon, the real causes of which are often difficult to assess, and sometimes even impossible to grasp, because of their complexity.

The decline of Islamic science in the Middle Ages began in the twelfth century. Although certain distinguished men of science appeared in the fourteenth and even the fifteenth centuries, the enthusiasm, the intellectual energy and the creativity, which characterized the first period, have been changed into submission to the authority of the old masters and the dogmatization of their doctrines.

Meanwhile, another movement of transmission of scientific knowledge took place during the twelfth and thirteenth centuries. This time it proceeded from East to West, that is, from Islamic to Latin culture. The meeting between East and West during the twelfth century helped further to establish the foundation of our scientific tradition of today. By the thirteenth century this scientific tradition was to be defined as Greco-Arabic-Latin. Sarton remarks in this context that : "One may say that there were in the thirteenth century three independent civilizations : the Greco-Arabic-Latin, the Hindu and the Sino-Japanese" (10).

Furthermore, the twelfth century saw a strong development of the experimental spirit in science, which carried over to the application of the inductive method. As a matter of fact the inductive method, which was known to Aristotle as a mean of investigation into the natural sciences, has never occupied an important place in Greek science in general, with the possible exception of medicine. Medieval Islamic men of science applied the inductive method in various disciplines, such as physics, pharmacy, medicine, botany and optics. They, however, never derived from it all its potentialities, nor exploited all its resources.

Sarton writes in this context : "Perhaps the main, as well as the least obvious, achievement of the Middle Ages, was the creation of the experimental spirit ... This was primarily due to Muslims down to the end of the twelfth century, then to Christians. Thus in this essential respect, East and West cooperated like brothers" (11). Further Sarton goes on : "Thus, in a large sense, experimental science is a child not only of the West, but also of the East; the East was its mother, the West was its father" (12).

In the eighteenth century the experimental spirit found a new vigour, this time only in the West, represented in the scientific ideas of Leonardo da Vinci. The East did not participate in the efforts made in the second half of the sixteenth century and the first half of the seventeenth to establish definitively and on firm grounds the inductive method. Particularly during the period after the publication of Francis Bacon's *Novum Organum*.

However, I might mention here the little known attempt made during the seventeenth century by certain Egyptian, Syrian and Turkish physicians to introduce in the East of what was known in Europe as the "New Medicine", i.e., Paracelsus' medical doctrine. This attempt was doomed to fail, for the decline of science in the East was deeply rooted.

Sarton will attach a particular importance to the role and place of the inductive method in the history of science in general. For him : "The great intellectual division of mankind is not along geographical or racial lines, but between those who understand and practise the experimental method and those who do not understand and who do not practise it" (13).

In his historiography of Islamic medieval science as well as in all his writings, George Sarton the historian, and George Sarton the humanist, are intermixed. Sarton wrote : "The unity of mankind includes East and West. They are like two moods of the same man; they represent two fundamental and complementary phases of human experience. Scientific truth is the same East and West, and so are beauty and charity. Man is the same everywhere with a little more emphasis on this or that. East and West, who said the twain shall never meet ? They meet in the soul of every great artist ... they meet also in the soul of every great scientist" (14).

NOTES

- (1) George Sarton, *Introduction to the History of Science*, Vol. I, Baltimore, Maryland, 1927, p. 20.
- (2) George Sarton, *A History of Science*, Vol. I, Cambridge, Mass., 1959,

p. ix.

- (3) George Sarton, Arabic Scientific Literature, in *Ignace Goldziher Memorial Volume*, Part 1, Budapest, 1948, pp. 59-60.
- (4) George Sarton, East and West in the History of Science, in *The Life of Science*, New York: Schuman, 1948, p. 151.
- (5) George Sarton, op. cit. in Note (3), p. 67.
- (6) George Sarton, op. cit. in Note (3), p. 63.
- (7) George Sarton, Why Isis ? in *Isis*, XLIV, 1953, p. 237.
- (8) George Sarton, Qualifications of Teachers of the History of Science (Second article) in *Isis*, XL, 1949, p. 311.
- (9) George Sarton, op. cit. In Note (3), pp. 62-63.
- (10) George Sarton, *Introduction to the History of Science*, Vol. II, Part 1, 1931, p. 3.
- (11) George Sarton, op. cit. in Note (4), p. 159.
- (12) George Sarton, op. cit. in Note (4).
- (13) George Sarton, *Introduction to the History of Science*, Vol. I, Baltimore, Maryland, 1927, p. 29.
- (14) George Sarton, op. cit. in Note (4), p. 165.

