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George Sarton: The Father of the History of Science. Part 1. Sarton's Early Life in Belgium

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Introduction

The year 1984 marked the centennial of the birth of George Alfred Léon Sarton, a pioneer in establishing the history of science as a discipline in its own right. In honor of the Sarton centennial, the journal he founded and edited for 40 years, *Isis*, published a special issue in March 1984 containing a number of articles dedicated to Sarton's contributions to the history of science.[1] The editors of *Isis*, the primary journal in the field of the history of science, also plan a special issue at the end of 1985 to review the events and publications in which Sarton has been memorialized.

This essay was originally planned for presentation at the international conference honoring Sarton that was held in Ghent, Belgium last fall. A slightly condensed version of it was published recently in the *Journal of the History of the Behavioral Sciences*.[2] This first part focuses on Sarton's formative years in his native Belgium, prior to his emigration to the US during World War I. Part 2 will focus on Sarton's struggles to attain his vision of a new discipline uniting the two cultures of art and science.

Sarton's Major Works

Sarton is perhaps best known as the author of what many consider to be one of the most definitive works of the history of science—the mammoth *Introduction to the History of Science*. The three-volume, 4,236-page work consists of five tomes, in which Sarton reviewed and cataloged the scientific and cultural contributions of every civilization from antiquity through the fourteenth century.

Among the other major works by Sarton, author of 15 books and over 300 articles, are *A History of Science*, a two-volume reworking of his lectures covering the acquisition of knowledge from ancient science and the Golden Age of Greece through the Hellenistic period; *A Guide to the History of Science*, a bibliography; *Appreciation of Ancient and Medieval Science During the Renaissance (1450-1600)*; and *The History of Science and the New Humanism*. Table 1 lists the titles of the journals in which Sarton's works were published. Table 2 lists Sarton's most-cited works, according to data accumulated from 1955 to 1984 by ISI®'s *Science Citation Index®* (*SCI®*), *Social Sciences Citation Index®* (*SSCI®*), and *Arts & Humanities Citation Index™* (*A&HCI™*). Keep in mind that most of Sarton's works were published well before 1955, the earliest date for which ISI's data are available. Thus, these works may have passed through their peak citation years before they were included in any of our indexes.

For Sarton, science was "the totality of positive knowledge."[3] According to a 1953 article by William H. Hay, then of the Department of Philosophy, University of Wisconsin, Madison, Sarton's devotion to compiling the history of science was born of his

Table 1: Journals that have published George Sarton's work.

Alumni (Brussels)
American Oriental Society. Journal
Archiv fuer Geschichte der Mathematik, der Naturwissenschaften und der Technik
Archives Internationales d'Histoire des Sciences
Bulletin of the History of Medicine
Bulletin of the New York Academy of Medicine
Cahiers d'Histoire Mondiale (Paris)
Centaurus
Chymia
Ciel et Terre
Cleveland Medical Library. Bulletin
Flamberge; Revue de Littérature et d'Art
Gazette des Beaux-Arts
Harvard Library Bulletin
Isis
Journal of the History of Medicine and Allied Sciences
Journal of Unified Science (Erkenntnis)
Lychnos
Monist
Nation (New York)
Natural History
Open Court, A Quarterly Magazine
Osiris
Proceedings of the American Philosophical Society
Renaissance (Paris)
Revue Bleue, Politique et Littéraire
Revue Générale des Sciences Pures et Appliquées
Revue d'Histoire des Sciences et de Leurs Applications
Science
Scientia (Paris)
Scientific Monthly
Scribner's Magazine
Syrian World
Vie Internationale
Yale Review

conviction that such study is the key to the history of humanity, yielding unique insights concerning the complexity of human nature.[4] The purpose of the *Introduction to the History of Science*, as Sarton puts it, is to "...explain briefly, yet as completely as possible, the development of one essential phase of human civilization...the development of science.... No history of civilization can be tolerably complete which does not give considerable space to the explanation of scientific progress."[5] Indeed, in *The Study of the History of Science*, Sarton states that "...the history of science is the only history which can illustrate the progress of mankind. In fact, 'progress' has no definite and unquestionable meaning in other fields than the field of science."[6]

Despite the importance that Sarton placed on the history of science, however, the discipline was a means, not an end. Sarton's ultimate goal was an integrated philosophy of science that bridged the gap between the sciences and the humanities—an ideal he called "the new humanism,"[7] as F.S. Bodenheimer quotes him in *Archives Internationales d'Histoire des Sciences*. And Hay reports that in the division between scientist and humanist, Sarton saw a "chasm...cutting our culture asunder and threatening to destroy it."[4] As E.J. Dijksterhuis noted, Sarton waged his war on two fronts, admonishing humanists who trivialize science as a mere technical occupation to respect it as one of the most impressive activities of which humanity is capable, while at the same time imploring scientists to immerse themselves in the scholarly traditions of the humanities.[8] Bodenheimer says that Sarton perceived the history of science as the synthesis of science and the humanities that would help to make "...scientists who are not mere scientists, but also men and citizens."[7]

In an essay on the coverage of history and sociology of science journals in *Current Contents*® (*CC*®), which appeared in these pages some years ago,[9] I noted that early in my career as an information scientist, I almost became a historian of science myself. When I was a young, upstart member of the Johns Hopkins University Welch Medical Library Indexing Project in Baltimore, Maryland, I had plenty of exposure to the field. For instance, my boss, Sanford V. Larkey, a physician by training, was fascinated by Elizabethan medicine.[10-12] My friend and mentor Chauncey D. Leake, chairman of the project's advisory group, was one of those rare individuals who combined an interest in the history of science with active laboratory research. His work includes articles on Galileo[13] and Egyptian medical papyri.[14] And during my stay on the project, I often attended Owsei Temkin's and Richard Shryock's lectures on the history of medicine. Incidentally, the *CC* essay just cited contains a list of the history, philosophy, and sociology of science journals covered in *CC* at the time; an updated list of such journals currently covered in ISI's various indexes is shown in Table 3.

Even without the nodding acquaintance with the history of science that I developed at Johns Hopkins, however, the name of

Table 2: Most-cited works by George Sarton arranged in chronologic order. A=bibliographic data. B=number of citations from the *SCI*®, 1955-1984. C=number of citations from the *SSCI*®, 1966-1984. D=number of citations from the *A&HCI*™, 1976-1984. E=total number of citations.

A	B	C	D	E
Sarton, George. *Introduction to the history of science. From Homer to Omar Khayyam.* Baltimore, MD: Williams & Wilkins, 1927. Vol. I.	38	34	25	97
----------. *The history of science and the new humanism.* New York: Henry Holt, 1931. 178 p.	6	6	2	14
----------. *Introduction to the history of science. From Rabbi Ben Ezra to Roger Bacon.* Baltimore, MD: Williams & Wilkins, 1931. Vol. II, part I.	18	7	11	36
----------. *The study of the history of mathematics.* Cambridge, MA: Harvard University Press, 1936. 113 p.	4	4	1	9
----------. *The study of the history of science.* Cambridge, MA: Harvard University Press, 1936. 75 p.	4	4	4	12
----------. *Introduction to the history of science. Science and learning in the fourteenth century.* Baltimore, MD: Williams & Wilkins, 1947. Vol. III, part I.	8	11	7	26
----------. *The life of science. Essays in the history of civilization.* New York: Henry Schuman, 1948. 197 p.	9	5	1	15
----------. *A history of science. Ancient science through the Golden Age of Greece.* Cambridge, MA: Harvard University Press, 1952. 646 p.	29	26	7	62
----------. *A guide to the history of science.* Waltham, MA: Chronica Botanica, 1952. 316 p.	10	8	1	19
----------. *Galen of Pergamon.* Lawrence, KS: University of Kansas Press, 1954. 112 p.	13	5	2	20
----------. *Appreciation of ancient and medieval science during the Renaissance (1450-1600).* Philadelphia, PA: University of Pennsylvania Press, 1955. 233 p.	12	5	8	25
----------. *Six wings: men of science in the Renaissance.** Bloomington, IN: Indiana University Press, 1957. 318 p.	15	6	3	24
----------. *A history of science. Hellenistic science and culture in the last three centuries B.C.* Cambridge, MA: Harvard University Press, 1959. 554 p.	35	8	2	45

*As related by Sarton himself, this book covers "the whole of science during a period of a century and a half (1450-1600)." Its title is a continuation of a tradition traceable to the Old Testament. Sarton was made aware of the tradition through the work of Immanuel Bonfils of Tarascon, a medieval writer who flourished around the years 1340-1377 and who was best known for his astronomical tables, called *Kanfe nesharim*, or "wings of eagles," from the Book of Exodus. Since these tables were divided into six parts, they were more generally called *Shesh kenafayim*, an allusion to the six wings of the seraphim described in the Book of Isaiah: "each one of them had six wings; with twain he covered his face and with twain he covered his feet, and with twain he did fly." Thus, Sarton's title is both a reference to the famous astronomical tables compiled in Tarascon (Bouches-du-Rhône) and to the Bible, which underlay so much of medieval and Renaissance culture. Each wing is devoted to some aspect of Renaissance science: the first is entitled "The frame of the Renaissance: exploration and education"; the second covers "Mathematics and astronomy"; "Physics, chemistry, technology" is the subject matter of the third wing; the fourth wing is devoted to "Natural history"; the fifth wing to "Anatomy and medicine"; and the final wing to "Leonardo da Vinci: art and science."

George Sarton was familiar to me, since my original interest in citation indexing involved its application to the humanities literature. The first paper that I ever presented on the subject of citation indexing, given in Philadelphia in 1955, concerned citation indexes to the Bible.[15] It was fascinating to trace the history of a point Sarton made in his book, *A History of Science. Ancient Science Through the Golden Age of Greece*, concerning a passage in the Book of Joshua, which alludes to the translation of *harbot zurim*. In a note ap-

Table 3: History, philosophy, and sociology of science journals covered in ISI® products.

Annals of Science
Archive for History of Exact Sciences
British Journal for the History of Science
British Journal for the Philosophy of Science
Bulletin of the History of Medicine
Centaurus
Impact of Science on Society
Isis
Journal of the History of Biology
Journal of the History of the Behavioral Sciences
Journal of the History of Medicine and Allied Sciences
Medical History
Philosophy of Science
Philosophy of the Social Sciences
Social Science History
Social Studies of Science
Synthese
Technology and Culture

pending the section on prehistoric medicine, Sarton contends that the phrase has been mistranslated as "sharp knives"; the correct meaning, he claims, is "flint knives."[16] Thus, Joshua 5:2 in the Authorized (King James) Version of the Bible reads, "At that time the Lord said unto Joshua, make thee sharp knives and circumcise again the children of Israel the second time." According to Sarton, however, the passage should read, "And at that time the Lord said unto Joshua, make thee stone knives of the hardest flint, and having again a fixed abode, circumcise the children of Israel."

The Early Years

Who was this giant, George Sarton? What was this polymathic scholar really like? I met his charming daughter, the well-known poet and novelist May Sarton, at the Sarton centennial; she has described him as "...an exceedingly charming man; this charm made itself felt at once, on first meeting, in his beaming smile, the smile of a delighted and sometimes mischievous child, that flashed out below the great domed forehead and sensitive eyes behind thick glasses. He was stout, with beautiful hands and small feet, a stocky man who walked down Brattle Street in Cambridge, Massachusetts, at exactly the same time every morning, with the propulsive energy of a small steam engine, a French beret on his head, a briefcase in one hand, in a coat a little too long for him because he could not be bothered to have his clothes altered and insisted on buying them off the rack to save time."[17]

Sarton was born in Ghent, East Flanders, Belgium, on August 31, 1884. His father, Alfred Sarton, was the director and chief engineer of the Belgian State railways. His mother, Léonie Van Halmé, died when George was less than a year old.

The Victorian household in which Sarton grew up was dominated by the personality of Alfred Sarton. In her book, *I Knew a Phoenix*, May Sarton writes of her impressions of her grandparents. Her grandfather "...was a confirmed bachelor, who had for a brief interlude happened to be married, or so, at least, it appeared to me...."[18] (p. 12) For May, the phrase, "In my father's house," with which George used to begin so many anecdotes about his life in Belgium before World War I, always brought into focus a sharp image of Alfred Sarton—"ultrasensitive, sardonic, with bright, deep-set eyes."[18] (p. 13)

But of Sarton's mother, little is known—even to those in her immediate family. Léonie Sarton died of a hemorrhage a year after George's birth "...because she was too modest to call for help, while her husband, swinging his cane, ready to go out, waited for her in vain."[18] (p. 13) She played Chopin and loved candied violets and *fleur d'oranger*. According to May, she was innocent and extravagant, and shocked her husband's staid family by buying her gloves by the dozen. Yet she is a lonely figure as well: "All around her hangs the perfume of sadness, the silence her husband never broke to tell little George something of that vanished young mother who so soon became younger than her son."[18] (p. 14)

Loneliness also haunted the childhood memories of Sarton himself. An isolated, only child, he was somewhat pampered by the household servants, who, with the best of intentions, took his medicine for him when he was ill—especially if the concoction had a disagreeable taste.

In spite of Sarton's starvation for tenderness as a child, however, he was not without an active imagination and a "streak of Flemish humor."[18] (p. 14) May Sarton writes, "When still eating in a high chair, George was allowed to be present at dinner, but if he so much as babbled a single word, his father, without raising his head from his newspaper, reached forward to touch the bell (a round brass bell on a stand, tapped with one finger)

and when the maid appeared, said simply, '*Enlevez-le*' [remove it]. When George was alone at a meal, formally served him in the dining room in his high chair, and he did not like something he was given to eat, he repeated the lordly gesture and the lordly phrase and was delighted to see that, like 'Open Sesame' in reverse, he could thus have the unhappy cabbage, or whatever is was, removed from sight."[18] (p. 14-15)

Sarton's Studies

Sarton first studied at the Athénée—the equivalent of US primary and secondary schools—in his native town, and then at the one in Chimay for four years. In 1902 he entered the University of Ghent to study at the Faculté de Philosophie. One of his teachers there was the well-known, classical scholar Joseph Bidez, whose influence Sarton remembered with gratitude. Sarton found, however, that the traditional presentation of the humanities did not parallel his interests. So he abandoned the study of philosophy, and in 1904, after a year of private reading and reflection, he reentered the university in the Faculté des Sciences, in which he began work in the natural sciences. As he later wrote in his journal, "I hope thus to become more than a writer of fine phrases, and bring my effective aid to the progress of the sciences."[18] (p. 64)

Sarton's studies included chemistry, crystallography, and mathematics. He received the degree of *docteur des sciences* from the University of Ghent in 1911 for a thesis in celestial mechanics entitled *Les Principes de la Mécanique de Newton*. For his work in chemistry, he was awarded a gold medal offered by the four Belgian universities—Ghent, Louvain, Brussels, and Liège.

Founding of *Isis*

Almost immediately after obtaining his doctorate, on June 22, 1911, Sarton married Eleanor Mabel Elwes, the daughter of a Welsh civil and mining engineer. The young couple established themselves in an old country house in Wondelgem, near Ghent. Sarton, whose small private income was too modest to sustain a family, bought the house with the proceeds of the auction of his deceased father's wine cellar. The sale itself was widely regarded as scandalous, but it was perhaps typical of the iconoclastic Sarton. In the following year, Sarton's only surviving child, Eléanore Marie (later shortened to May) was born, and the journal *Isis*, Sarton's "*Revue consacrée à l'histoire de la science*," was founded.

Sarton liked to refer to his wife, Mabel, as "the mother of those strange twins, May and *Isis*,"[18] (p. 69) and the history of science owes a debt to Mrs. Sarton for the survival of its first journal. When the journal was in its early days, Mabel wrapped and mailed each issue, according to I. Bernard Cohen, Harvard, a member of the board that assumed the duties of editing *Isis* when Sarton stepped down from that position. Even in her last years, she watched over her husband tirelessly, to see that he did not overtax himself.[19] An artist and a distinguished designer of furniture, Mabel Sarton helped George meet the expenses incurred by *Isis* by supplementing his income with her own. She was inspiration, companion, and helpmeet to her husband, and when she died in 1950, he felt that a part of himself had been extinguished.

Isis, a review devoted to the history and philosophy of science, was to be, as Sarton defined it, "...at once the philosophical journal of the scientists and the scientific journal of the philosophers, the historical journal of the scientists and the scientific journal of the historians, the sociological journal of the scientists and the scientific journal of the sociologists."[18] (p. 69) As C.D. Hellman reports, the title of the new journal was meant to evoke "...that period of human civilization which is perhaps the most impressive of all—its beginning."[20]

Like other scholarly journals, *Isis* would publish original research articles, notes, queries, personal items, and book reviews. But a unique feature of the journal was its critical bibliography. During the 40 years he served as the editor of *Isis*, Sarton himself regularly compiled this index of the major publications dealing with the history of science throughout the world. Its purpose was to make scholars aware of resources and growing literature in the field, and to provide a forum for the correction of errors.[19]

By September 1912, Sarton had recruited a distinguished editorial board for the journal that included Henri Poincaré, Svante August Arrhenius, Émile Durkheim, Jacques Loeb, Friedrich Wilhelm Ostwald, and David Eugene Smith. As noted by Robert K. Merton, Columbia, and Arnold Thackray, University of Pennsylvania and present editor of *Isis*, the

wide range of fields represented by the work of these scholars reflected Sarton's conviction that the history of science was by nature an encyclopedic discipline, as well as his orientation toward universal history, and his philosophical belief in the brotherhood of man.[21]

With a discipline to be forged, esoteric theories and rigorous consistency were less important to Sarton than establishing professional techniques, methodologies, and an intellectual orientation of comparison, summation, and synthesis. Thus, Sarton was a combination of propagandist and proselytizer, and *Isis* was the intended organ of the new discipline. It was through *Isis*, according to Thackray and Merton, that he hoped to "systematically and holistically" combine "methodological, sociological, and philosophical perspectives with purely historical inquiry," enabling such inquiry to gain its full significance.[21] (p. 108) The first issue of *Isis* appeared in March 1913. In 1924, when the History of Science Society was founded, *Isis* became its official publication, but the society did not assume full financial responsibility for the journal until 1940. The annual deficit it ran for 28 years was met by Sarton, who had no private or independent income.[19]

As subscriptions to *Isis* trickled in from all over the world, Sarton was hard at work taking voluminous notes for his monumental *Introduction to the History of Science*.[19] At the start, Sarton had intended to bring his *History* up to the present, but the task on the scale he had planned proved beyond even his extraordinary efforts. In fact, according to Cohen, Sarton would explain to students that, had he known as much about the history of science when he began his *Introduction* as he did when he finished the two-volume, 2,155-page work on the fourteenth century, he would never have gotten even that far.[19]

World War I Intervenes

The spring and summer of 1914 was an idyllic time for the Sartons, according to May. "We were beautifully happy and independent, all three."[18] (p. 74) But on June 28, the Archduke Ferdinand was assassinated in Sarajevo. All through July of that year, May wrote, as her father worked quietly in his study, and her mother wondered why the plum tree would not bear fruit, diplomats hurried back and forth across Europe. The war that most people referred to as "a scare" lurked around the corner.

Despite the seemingly far-off nature of the threat, however, the Belgian newspapers were filled with rumors, and preparations of a sort were made. Of that time, May Sarton wrote, "The Civil Guard, to which my father at one time belonged, drilled now and then on the village green, and took uniforms out of mothballs. Sometime in July they were issued ancient muskets. But no one really believed in that impossible war as a reality. In any case...Belgium itself was neutral. Nothing could happen here.

"[But] on August second, the Germans demanded free passage, were refused, and on August third the Wehrmacht marched in in their spiked helmets.... My father, though no longer an official member of the Civil Guard, got out his heavy Civil Guard coat, took down the old musket, and reported for patrol duty. He was set to guard the railway intersection. There, alone, a lantern in one hand, his gun in the other, he paced up and down all night hoping that the German army would not come hurtling down the track. Fortunately, [it] did not."[18] (p. 75-76)

Twenty-six German officers and infantrymen were billeted at the Sartons' house in Wondelgem, and Sarton was responsible for their safety; had any of the enlisted men failed to make curfew, Sarton would have been taken out into his garden and shot. Indeed, it was to prevent just such an occurrence that he buried his Civil Guard coat, since members of the guard were being treated as spies.

Little by little, as the war continued and Sarton realized—after a brief, frustrating stint in the Red Cross in Brussels—that he could be of more use continuing his own work, the Sartons came to the decision that they should leave the country. The quiet, scholarly idyll Sarton had enjoyed during these early, formative years was over; ahead lay years of uncertainty and academic upheaval, but the most fruitful part of Sarton's career was just beginning.

Sarton's emigration to the US and his triumph over numerous obstacles in the realization of his dreams are the subjects of Part 2 of this essay.

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