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PIERRE SPEZIALI

TANNERY, PAUL (*b.* Mantes-la-Jolie, Yvelines, France, 20 December 1843; *d.* Pantin, Seine–St. Denis, France, 27 November 1904), *history of science, history of mathematics*.

An engineer and administrator by profession, Tannery could devote only his leisure hours to scholarship. Despite this limitation, however, he accomplished a vast amount of penetrating and wide-ranging research and became one of the most influential figures in the rapidly developing study of the history of science at the beginning of the twentieth century. Like his younger brother, Jules, who later became a mathematician, Tannery early received a deeply Christian education from his parents, S. Delphin Tannery, an engineer who worked for railroad companies, and the former E. Opportune Perrier. After proving to be a brilliant pupil at a private school in Mantes, Tannery attended the *lycées* of Le Mans and Caen, where he showed great enthusiasm for the classics, although he had enrolled as a science student. His philosophy teacher, Jules Lachelier, communicated to Tannery a passion for the subject and strengthened his interest in classical antiquity. In 1860 Tannery fulfilled his father's hopes by obtaining one of the highest scores on the competitive entrance examination for the École Polytechnique, where he acquired a solid education in science and technology but devoted much time to other subjects as well. In particular he began to learn Hebrew and developed a strong interest in the teaching of mathematics.

Upon graduating from the *École Polytechnique* in 1863, Tannery entered the *École d'Application des Tabacs* as an apprentice engineer. At this time he read Auguste Comte's *Cours de philosophie positive*, an initiation into positivist philosophy that so profoundly influenced him that years later he approached the study of the history of science as a spiritual disciple of Comte.

After working for two years as an assistant engineer at the state tobacco factory in Lille, Tannery was transferred in 1867 to an administrative post at the headquarters of the state tobacco administration in Paris, where he enjoyed a more active intellectual and artistic life. He served in the Franco-Prussian War as an artillery captain and was present during the siege of Paris. An ardent patriot, he was deeply affected by the defeat and never consented to acknowledge the terms of the peace treaty as definitive. Upon demobilization Tannery resumed his former duties. At the same time he eagerly studied philosophy and mathematics, subjects that he discussed with his brother, Jules, who taught at Caen and later at the *École Normale Supérieure* of Paris, and with such young philosophers as É. Boutroux. In 1872 the tobacco administration sent Tannery to supervise the construction of several buildings in the Périgord region. While there he became seriously ill and was obliged to convalesce for a long period. He used this time to further his knowledge of ancient languages, acquiring a mastery of this field that was evident in his very first publications.

In March 1874 Tannery began to direct an extensive construction project at the state tobacco factory of Bordeaux. This university city had a very active intellectual life, and he soon decided to spend his leisure time investigating various topics in the history of the exact sciences in antiquity, as well as a number of philosophical and philological questions. From 1876 Tannery participated in the work of the *Société des Sciences Physiques et Naturelles de Bordeaux* and published many studies in its *Mémoires* and in the *Revue philosophique de la France et de l'étranger*, which had recently been founded at Paris. He gradually began to send material to other journals, eventually becoming a fairly regular contributor to about fifteen French and foreign periodicals. He published hundreds of memoirs, articles, notes, and reviews while pursuing a brilliant career in the state tobacco administration. Although many other historians of science have been obliged to conduct their research concurrently with their professional activities, none of them seems to have produced a body

of work comparable to Tannery's in scope and importance.

Although his stay at Bordeaux had proved enriching and fruitful, Tannery soon ended it. In 1877, at his own request, he was appointed engineer at the tobacco factory of Le Havre, a city with intellectual resources far inferior to those of Bordeaux but near the region of Caen, where Tannery's parents lived. He continued, however, to take a lively interest in Greek science; and his survey of mathematics at the time of Plato ("L'éducation platonicienne"), published in the *Revue philosophique de la France et de l'étranger*, was enthusiastically received and was translated into English and German. Meanwhile, his professional obligations, already considerable, become still greater in 1880, when he became acting director of the tobacco factory.

In June 1881 Tannery married Marie-Alexandrine Prisset (1856–1945), daughter of a well-to-do notary in Poitiers. Although she had received only a modest education, his young wife encouraged Tannery to pursue his scholarly research. Several trips abroad during this period enabled Tannery to meet leading scholars, notably J. L. Heiberg, H.-G. Zeuthen, G. Eneström, and M. Cantor, with whom he maintained close and fruitful relationships. Since his situation at Le Havre provided little encouragement for his research, however, Tannery soon sought a transfer to Paris.

His request was granted, and in July 1883 he was named appraiser-engineer in a Paris tobacco factory. Once again he was able to devote all his leisure time to scholarship. Although relatively brief, this Paris period was extremely productive. Tannery's principal area of interest was the history of mathematics; he gave a private course on the subject at the Faculty of Sciences in 1884–1885 and published an important series of articles on Greek geometry in the *Bulletin des sciences mathématiques*. He also pursued studies already under way on the origins of Greek science and on various philological questions. In addition he printed previously unpublished Greek texts, as well as original studies on a wide range of topics. Research at the Bibliothèque Nationale and a scholarly visit to Italy enabled him to begin work on two important editorial projects: an edition of the manuscripts of Diophantus, which was entrusted to him in 1883, and one of Fermat's works, for which he received a joint commission with Charles Henry in 1885.

At the end of 1886 Tannery had to leave Paris, in order to direct the tobacco factory at Tonneins

(Lot-et-Garonne). Deprived of the resources of the Bibliothèque Nationale, he was limited to editorial work and to perfecting his manuscripts. He revised and completed a series of articles that had been appearing in the *Revue philosophique de la France et de l'étranger* since 1880 and presented them in book form as *Pour l'histoire de la science hellène. De Thalès à Empédocle*, his first separately printed publication. Tannery also regrouped and completed another series of articles, which had been appearing since 1884 in *Bulletin des sciences mathématiques*, into a second, shorter book, *La géométrie grecque, comment son histoire nous est parvenue et ce que nous en savons*, I. *Histoire générale de la géométrie élémentaire* (the only part to be published). In addition, he continued to prepare the edition of Fermat's works.

Promoted to director of the Bordeaux tobacco factory in January 1888, Tannery spent two years in the city in which he had first become aware of his vocation for history. Renewing contact with intellectual circles there, he became friendly with an amateur scholar, Polydore Hochart, who assisted him in collecting material on the Bordeaux correspondents of Mersenne—the first step in a great project that Tannery was not able to complete. He also worked on a study of Greek astronomy, in which he sought, through a very detailed analysis of the *Almagest*, to gain insight into the different theories outlined by Ptolemy. (The study was published in the *Mémoires de la Société des sciences physiques et naturelles de Bordeaux* in 1893.)

At the beginning of 1890 Tannery returned to the Paris headquarters of the state tobacco authority in order to organize the manufacture of matches and to give instruction in the relevant techniques to the apprentice engineers at the École d'Application des Tabacs. In 1893 he was appointed director of the factory at Pantin, near Paris, a post that he held until his death in 1904. Although this appointment entailed heavy administrative and social responsibilities, Tannery did a remarkable amount of research during this final period of his life. He regularly contributed articles, memoirs, notes, and book reviews to about fifteen journals and completed his editions of the works of Diophantus and of Fermat. Tannery also undertook vast new projects, such as collaborating on the *Histoire générale du IV^e siècle à nos jours* of Ernest Lavisse and A. N. Rambaud, teaching at the Collège de France for several years, and preparing a new critical edition of the works and correspondence of Descartes. Through his regular corre-

spondence with French and foreign colleagues and through his activities at several congresses, he laid the foundations for international collaboration in the history of science.

A rapid survey of the various aspects of Tannery's work provides some idea of the scope and importance of his accomplishments during these final years. He wrote some 250 articles, notes, and other communications on the most varied issues in the history of the exact sciences, the history of philosophy, and philology, most of them concerning antiquity, Byzantine civilization, and Western civilization from the Middle Ages to the seventeenth century; they occupy five volumes of his collected *Mémoires scientifiques*.

In the years immediately after 1893, however, Tannery concentrated most of his effort on completing his two major editorial projects. The two volumes of Diophantus' *Opera omnia* appeared in 1893 and 1895. (Tannery also began work on a French translation, but he did not complete it.) The three volumes of the *Oeuvres de Fermat*, which Tannery edited with Charles Henry, were published between 1891 and 1896. The first volume contains mathematical works and "Observations sur Diophante"; the second (1894) contains Fermat's correspondence; and the third consists of French translations of the writings and of Latin fragments by Fermat as well as of several texts by J. de Billy and J. Wallis. Tannery, who played the principal role in editing these volumes, also assembled material for a fourth (*Compléments . . .*), which was completed by Henry and published in 1912. A fifth volume, containing further supplementary material, was published by C. de Waard in 1922.

In 1892 Tannery agreed to substitute for Charles Lévêque in the chair of Greek and Latin philosophy at the Collège de France. Without fundamentally altering the character of the chair, Tannery sought to place greater emphasis on the history of ancient scientific thought and to illustrate its influence on the formation of modern science. Unfortunately, he did not publish any of his courses, and we have a record only of the main subjects he treated. These included Aristotle's *Physics* and *De caelo*, an interpretation of Plato, ancient theories of matter, the commentaries of Simplicius, and atomistic doctrines, as well as various currents of ancient philosophy and even fragments of Orphic poetry. At the end of the academic year 1896–1897, however, a new project began to occupy almost all Tannery's time: an edition of the works of Descartes. Accordingly, he gave up

teaching and thereby renounced the possibility of succeeding Lévêque.

Tannery was interested in Descartes during his first stay in Bordeaux, though only in principle, since all his research during that period pertained to ancient thought. But from 1890 on the preparation of his edition of Fermat's work led him to make a thorough study of Descartes's correspondence and to publish a number of items that had remained in manuscript. The rigor of his editorial work and his deep knowledge of seventeenth-century science brought him, in 1894, the co-editorship (with the historian of modern philosophy Charles Adam) of a new critical edition of the works and correspondence of Descartes that was destined to replace the very dated, eleven-volume edition by Victor Cousin (1824–1826). In the last ten years of Tannery's life this undertaking, the scope and importance of which are obvious, absorbed a growing portion of his leisure. His first—and most difficult—task was the preparation of volumes I–V, devoted to Descartes's correspondence (published 1897–1903). He also participated in editing volumes VI (*Discours de la méthode* and *Essais* [1902]), VII (*Meditationes de prima philosophia* [1904]), and IX (*Méditations* and *Principes* [1904]), and left valuable notes for the other volumes published by Henry. This edition, called the “Adam-Tannery” Descartes, is too well-known to require detailed description here. A major contribution to the history of ideas, and especially to the history of science in the seventeenth century, it sparked a renewal of interest in Cartesian philosophy. By its rigor and precision, and the wealth of its documentation, it far surpassed the earlier editions and marked an important step in the elaboration of modern methods of producing critical editions. Only recently has it been necessary to publish a revised and enlarged edition that takes into account the documentary discoveries made since the beginning of the twentieth century.

Although during the final decade of his career Tannery devoted an ever increasing amount of time to this editorial effort, he still managed to publish a large number of studies, chiefly on ancient science and medieval and Byzantine mathematics. Moreover, his vast erudition enabled him to reply to numerous questions posed in the *Intermédiaire des mathématiciens* and to contribute valuable notes to several fascicles of the *Encyclopédie des sciences mathématiques*. Along with his highly specialized works, he wished to produce a more general account of the history of science, the initial outlines of which he had sketched in his chapters

of Lavissee and Rambaud's *Histoire générale*. At the beginning of 1903 it appeared that Tannery would have an especially favorable opportunity to carry out this project. The death of Pierre Laffitte had left vacant the chair of the history of science at the Collège de France, which had been created for him in 1892, and the Assembly of professors at the Collège had voted to maintain the chair. The two consultative bodies, the Assembly and the Académie des Sciences, informed the minister of education that Tannery was their first choice among several candidates. His nomination seemed so certain that he began to write the inaugural lecture of his course. But, for obscure political and philosophical reasons the minister chose the candidate who was second on the list submitted to him: the crystallographer Grégoire Wyruboff, a positivist philosopher with little competence in the history of science. Strictly speaking the minister was within his rights. Tannery was deeply disappointed by this unjust decision, however, which was vainly opposed by the many French and foreign scholars who considered Tannery one of the leaders in the field. Although the case is not clear, Sarton and Louis have revealed some of Chaumié's motives. First of all it is certain that a militant positivist and freethinker like Wyruboff fitted more easily into the anticlericalism of Émile Combes's government than a fervid Catholic like Tannery. But it appears also that the minister preferred a course of studies that was oriented toward contemporary science, as Wyruboff proposed, to the program of general scientific history proposed by Tannery. But there is no doubt that the “scandal of 1903” did great damage to the development of the history of science in France.

Tannery was convinced of the necessity of an international effort to catalog documentary sources and to eliminate the nationalistic interpretations of the history of science that were all too common at that time. The four volumes of his *Mélanges scientifiques* that are devoted to correspondence reveal the extent of his relations with the leading historians of science in France, Germany, Scandinavia, Italy, and elsewhere. Tannery also was active at the international congresses of historical studies (Paris, 1900; Rome, 1903), philosophy (Paris, 1900; Geneva, 1904), and mathematicians (Heidelberg, 1904). Conscious of the interdisciplinary role of the history of science, Tannery wanted the subject to be recognized as a field in its own right by historians and philosophers, as well as by scientists. He also hoped that students of the field would become aware of the distinctive contribution it could

make and that close contacts would be established between historians of science in all countries.

This effort was suddenly interrupted a few weeks after Tannery returned from the Geneva congress of 1904. Suffering from cancer of the pancreas, he died at the end of November in that year. A considerable portion of his work was dispersed in various specialized—and sometimes hard-to-find—journals. His widow soon undertook to collect the publications and regroup them according to major subjects: exact sciences in antiquity, in the Middle Ages, and in the Byzantine world; modern science; history of philosophy; philology; and so on. To these she added the book reviews and the correspondence. A number of distinguished historians of science, including Heiberg, Zeuthen, and Loria, assisted her in this project. Through their devotion and hers, the seventeen volumes of Tannery's *Mémoires scientifiques* now include all his works, except for his three books on ancient science and his editions of Diophantus, Fermat, and Descartes. With the aid of C. de Waard, Marie Tannery also began work on the edition of the *Correspondance du P. Marin Mersenne* that her husband had hoped to undertake.

It would be impossible in an article of this length to convey the importance of a body of work as extensive and varied as Tannery's. Perhaps its most notable characteristic is an unwavering concern for rigor and precision. The detailed studies that constituted the bulk of his output were, in Tannery's view, only a necessary stage in the elaboration of much broader syntheses that would ultimately lead to a comprehensive history of science that he himself could only initiate. While some of the results that he published during thirty years of scholarly activity have been brought into question by documentary discoveries or by new interpretations, a large number of his studies retain their value. Even more important, however, is the fruitful influence that Tannery's work has exerted on historians of science in the twentieth century.

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been offered by G. Sarton in *Osiris*, 4 (1938), 703–705; and by R. Taton in *Revue d'histoire des sciences et de leurs applications*, 7 (1954), 369–371. And on the occasion of his candidacy at the Collège de France in Apr. 1903, Tannery drew up “Titres scientifiques de Paul Tannery,” reproduced in *Mémoires*, X, 125–136.

Tannery's published work consists of several books, major editions of scientific writings, and a very large number of articles. The three principal books are devoted to ancient science: *Pour l'histoire de la science hellène. De Thalès à Empédocle* (Paris, 1887); 2nd ed. prepared by A. Diès with a pref. by F. Enriques (Paris, 1930); *La géométrie grecque . . .*, I, *Histoire générale de la géométrie élémentaire* (Paris, 1887), the only part to be published; and *Recherches sur l'histoire de l'astronomie ancienne* (Paris, 1893). A fourth, briefer publication concerned the preparation of the ed. of Descartes: *La correspondance de Descartes dans les inédits du fonds Libri* (Paris, 1893).

His major eds. of scientific works are *Oeuvres de Fermat*, 3 vols. (Paris, 1891–1896), edited with C. Henry, plus IV (*Compléments*), published by C. Henry (1912), and V (*Suppléments*) (1922), published by C. de Waard; *Diophanti Alexandrini opera omnia*, 2 vols. (Leipzig, 1893–1895); and *Oeuvres de Descartes*, 12 vols. and supp. (Paris, 1897–1913), with C. Adam—Tannery participated in the editing of vols. I–VII and IX. He also began work on eds. that were continued at the urging of Mme Tannery: *Correspondance du P. Marin Mersenne*, C. de Waard, R. Pintard, and B. Rochot, eds. (Paris, 1932–); and Georgius Pachymeres, *Quadrivium*, E. Stéphanou, ed. (Vatican City, 1940).

Most of Tannery's articles, as well as his correspondence, were collected in the *Mémoires scientifiques*, published by Mme Tannery with the aid of several historians of science. The material is grouped as follows: I–III, *Sciences exactes dans l'antiquité* (Toulouse–Paris, 1912–1915); IV, *Sciences exactes chez les Byzantins* (1920); V, *Sciences exactes au Moyen Âge* (1922); VI, *Sciences modernes* (1926); VII, *Philosophie ancienne* (1925); VIII, *Philosophie moderne* (1927); IX, *Philologie* (1929); X, *Supplément au tome VI. Sciences modernes. Généralités historiques* (1930); XI–XII, *Comptes-rendus et analyses* (1931–1933); XIII–XVI, *Correspondance* (1934–1943); and XVII, *Biographie, bibliographie, compléments et tables* (1950).

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RENÉ TATON

TARDE, JEAN (*b.* La Roque-Gageac, France, 1561 or 1562; *d.* Sarlat, France, 1636), *astronomy, geography.*

After receiving a doctorate in law from the University of Cahors, Tarde continued his studies at the Sorbonne. Ordained a priest, he was assigned to the parish of Carves, near Belvès, and later rose to be the canon theologian of the cathedral church of Sarlat. In 1594, when the bishop wished to determine the effects of the religious wars in France on the diocese of Sarlat, he designated Tarde vicar-general and commissioned him to make a map of the bishopric.

Tarde charted the neighboring diocese for the bishop of Cahors in 1606. In this topographical survey he used a small quadrant equipped with a compass needle and attached to a sundial. In compliance with the bishop's request that he publish an explanation of this instrument, Tarde wrote and dedicated to the bishop *Les usages du quadrant à l'esguille aymantée* (1621), for which the royal privilege was dated 8 June 1620. On the same day Tarde obtained privileges for the two other works published during his lifetime: *Borbonia sidera* (1620) and his translation of this Latin treatise into French, *Les astres de Borbon* (1622). These works were based on Tarde's conversations with Galileo, whom he had visited in Florence on 12–15 November 1614. Among the numerous subjects they discussed were the recently discovered sunspots. After returning to France, Tarde observed the spots for five years and reached the erroneous conclusion that they were planets, which he proceeded to name in honor of the French royal house, as Galileo had done with the satellites of Jupiter and the Medici family.

Tarde's interpretation of the sunspots was demolished by Gassendi in a letter to Galileo dated 20 July 1625. In that communication he pointed out that despite an assiduous program of observations, Tarde had been unable to identify any sunspot that exhibited the periodic returns characteristic of the true planets, as Tarde himself acknowledged.

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