

for laying between Newfoundland and Ireland. In August 1858, after several abortive attempts, the first complete transatlantic cable was laid by crews aboard the USS *Niagara* and HMS *Agamemnon*. Shortly afterward the cable began to malfunction, and failed permanently a few weeks after its installation.

In 1859 the British government appointed a joint committee to investigate the causes of the cable's failure. During the course of the investigation it was discovered that the cable and transmitting system suffered from fatal design flaws, and steps were taken to correct these based on the recommendations of the physicist William Thomson (later Lord Kelvin). In 1865 Field and his companies launched another cable-laying voyage, this time aboard Isambard Kingdom Brunel's enormous steamship *Great Eastern*, but the cable snapped and sank after two-thirds of the job had been completed. A third voyage, attempted the following year, was successful: a new cable was laid, and the cable lost the previous year was grappled for and recovered. Rapid telegraphic communication between North America and Europe was finally possible.

Field's association with Latimer Clark began when Clark was hired as an engineer by the Atlantic Telegraph Company some months after the failure of the 1858 cable. In the present letter, Field offers Clark his services in selling Clark's one-third interest in "Gray's patent for England" to the British government. "Gray" refers to Elisha Gray, the American inventor; a few months earlier, Field had obtained from Gray a one-third share in Gray's British patents in return for his assistance in marketing the patent rights and instruments. *Origins of Cyberspace* 142. 39037

Rosalind Franklin Discovers the First Geometry of a Protein Structure: Six Offprints

35. **Franklin, Rosalind** (1920-58). (1) Structure of tobacco mosaic virus. Offprint from *Nature* 175 (1955). 7, [1]pp. Text illustrations. Without wrappers as issued. 215 x 146 mm. Fine. (2) Five offprints by Franklin and her colleagues on tobacco mosaic virus, as listed below. 1955-1959. Overall fine. \$7500

(Reprinted from *Nature*, Vol. 175, p. 379, February 26, 1955)

STRUCTURE OF TOBACCO MOSAIC VIRUS

By DR. ROSALIND E. FRANKLIN
Birkbeck College Crystallography Laboratory,
21 Torrington Square, London, W.C.1

TOBACCO mosaic virus is a rod-shaped virus, of (most frequent) length 3000 Å., diameter 150 Å., and molecular weight 50 million¹. It contains 6 per cent by weight of ribonucleic acid, the remainder being protein. Many chemical and physico-chemical studies indicate that the tobacco mosaic virus protein may be built up of identical or nearly identical sub-units of low molecular weight²⁻⁷. A similar conclusion has been reached as a result of X-ray diffraction studies^{8,9}. More recent X-ray work, the results of which are summarized here, provides further evidence for a protein sub-unit of molecular weight consistent with that obtained by chemical methods, and also gives more indication of the arrangement of the protein chains within the sub-unit.

Chemical Evidence

End-group determination using carboxy-peptidase indicates that all C-terminal amino-acids are threonine, and gives a minimum molecular weight of 17,000^{4,5}. The amino-acid present in smallest quantity is cysteine. The cysteine content of tobacco mosaic virus is constant in all strains and corresponds to a minimum molecular weight of about 18,000⁴. The molecular weight of the protein fragments obtained by disintegrating the virus with sodium dodecyl sulphate has been given as 10,000-20,000⁷, and here again the only C-terminal amino-acid is threonine⁶.

Schramm⁸ found N-terminal proline in amount corresponding to the C-terminal threonine; but Fraenkel-Conrat and Singer⁹ showed that his analytical method was capable of breaking peptide bonds. Unable to detect any N-terminal amino-acid, these authors conclude that tobacco mosaic virus protein has a cyclic structure.

Several authors have shown¹⁰ that, in certain circumstances, a protein of low molecular weight having properties similar to the protein obtained by degradation of tobacco mosaic virus is present in the sap of infected but not of normal plants. This protein has been shown to be capable of aggregating to form rods of the same diameter as the virus but

(1) **First Edition, Offprint Issue.** Rosalind Franklin, whose X-ray photographs of DNA were crucial to Watson and Crick's discovery of the molecule's double helix structure in 1953, began researching the molecular structure of the tobacco mosaic virus (TMV) after moving from King's College to Birkbeck College in mid-1953. Between 1953 and her death in 1958, Franklin and her team of researchers made enormous and profoundly significant advances in our knowledge of the virus's molecular structure, beginning with the present paper announcing her discovery, based on her X-ray photographs, that the rod-shaped TMV units are all the same length and that they are made up of identical protein subunits. Preceding Perutz and Kendrew's mapping of the structures of myoglobin and haemoglobin by several years, this was the first discovery of the geometry of a protein structure.

Regarding Franklin's groundbreaking work on TMV, J. D. Bernal, her supervisor at Birkbeck College, wrote the following

[James] Watson had put forth the hypothesis that the [TMV] virus structure was . . . spiral, but one of a different order from that which existed in proteins and in deoxyribonucleic acid. Miss Franklin, with the help of very much better X-ray photographs than had hitherto been obtained, was able in essence to verify this hypothesis and to correct it in detail. . . . Using the method of isomorphous replacement, she showed that the virus particle was not solid, as had previously been thought, but actually a hollow tube. . . . The combined methods of chemical preparation and X-ray examination in the hands of Miss Franklin and her associates was a valuable, and indeed a decisive, weapon in the analysis of these complex structures (Bernal, "Obituary notice of Rosalind Franklin," *Nature* 152 [1958]: 154).

Aaron Klug, who worked closely with Franklin on the TMV virus at Birkbeck, notes that Franklin "determined the precise helical geometry of the protein units, and above all showed that the ribonucleic acid (RNA) of the virus, the carrier of the infectivity, in other words of the genetic information, formed a long single chain embedded deeply within the protein framework" (Klug, "Rosalind Franklin obituary," *The Times* [London], April 19, 1958). Maddox, *Rosalind Franklin: The Dark Lady of DNA*, pp. 250-253.

The remaining papers in this collection are listed below:

1. Structural resemblance between Schramm's repolymerised A-protein and tobacco mosaic virus. Offprint from *Biochem. et Bioph. Acta* 18 (1955). 2pp., on single unbound sheet. Text illustration. 245 x 166 mm.
2. (with K. C. Holmes). The helical arrangement of the protein sub-units in tobacco mosaic virus. Offprint from *Biochem. et Bioph. Acta* 21 (1956). 405-406pp., on single unbound sheet. 244 x 168 mm.
3. Ribonucleic acid in the TMV particle. Extract from unidentified periodical, tipped to blank sheet. N.p., n.d. (ca. 1958). 159 x 152 mm.
4. (with A. Klug, J. T. Finch and K. C. Holmes). On the structure of some ribonucleoprotein particles. Offprint from *The Faraday Society Discussions* (1958). 197-198pp., on single unbound sheet (corners lightly creased). 246 x 154 mm. Ms. correction in margin.

(Reprinted from *Nature*, Vol. 179, pp. 683-684, March 30, 1957)

Structure of Turnip Yellow Mosaic Virus

In this communication we report some of the results of the early stages of an X-ray diffraction study of crystals of turnip yellow mosaic virus^{1,2}. The two most important conclusions from the interpretation of the X-ray diagrams concern: (a) the packing of the virus particles in the crystal; and (b) the arrangement of protein sub-units in the individual virus particle.

Crystals of this virus were first studied by Bernal and Carlisle^{3,4}, who found a cubic unit cell of side about 700 Å. On the basis of the absence of the 222 reflexion they suggested that there were eight particles per unit cell, in a diamond-like arrangement.

We have obtained X-ray precession photographs of single crystals of the virus (crystallized from ammonium sulphate solution¹) and also powder photographs of crystals of the related ribonucleic acid-free virus protein². From observations of systematic absences at spacings out to less than 20 Å, we are able to show that the space-group symmetry is *F*₄³, and to deduce a new crystal structure for the virus, involving 16 particles per unit cell. This structure is described below. Confirmation that the number of particles per unit cell is 16 was obtained (Walker, P. M. B., and Klug, A., to be published) by measuring the ultra-violet absorption per unit path length through a single crystal and comparing it with the known absorption of the virus in solution.

From this result, together with the observation of two classes of systematic absences not required by the space group, we are able to deduce that the virus particles lie with their centres at the lattice points of a pseudo-unit cell which is cubic, body-centred, and of side about 350 Å. The large size of the true unit cell is due to the fact that alternate particles along the cube edge are rotated through 90° about the [100] axis. It may be noted that, viewed at low resolution, so that the two orientations of the virus particles are indistinguishable from each other, the crystal structure is the same as that of tomato bushy stunt virus⁵, namely, a simple body-centred cubic structure.

Such a crystal structure requires that the virus particles themselves have cubic symmetry. Crick and Watson have shown⁶ that the only possible

5. The structure of RNA in tobacco mosaic virus and in some other ribonucleoproteins [abstract]. In: The structure and physical chemistry of nucleic acids and nucleoproteins (offprint from *The Transactions of the Faraday Society* 55 [1959]): 494-95. Whole offprint. 487-499pp. 249 x 156 mm. Original printed self-wrappers. 40705

36. **[Franklin, Rosalind (1920-58).] Klug, Aaron (1926-); Franklin, Rosalind; and John Finch. (1) Structure of turnip yellow mosaic virus.** Offprint from *Nature* 179 (1957). [3]pp. 218 x 141 mm. Without wrappers as issued. **(2) The structure of turnip yellow mosaic virus: X-ray diffraction studies.** Offprint from *Biochimica et biophysica acta* 25 (1957). 242-252pp. Text illustrations. 244 x 168 mm. Without wrappers as issued. Together 2 items. Fine. \$1250

First Editions, offprint issue. Rosalind Franklin, whose X-ray photographs of DNA were crucial to Watson and Crick's discovery of the molecule's double helix structure in 1953, began researching the molecular structure of selected plant viruses after moving from King's College to Birkbeck College in mid-1953. She was aided in this work by Aaron Klug, who would later win the 1982 Nobel Prize in chemistry for developing crystallographic electron microscopy and for elucidating the structure of biologically important nucleic acid-protein complexes. The two began investigating the structure of tobacco mosaic virus (TMV), making several important discoveries regarding the arrangement of the virus's protein subunits and RNA strand; later in their researches Klug and Franklin agreed to divide the work, with Franklin taking on TMV and other rod-shaped plant viruses, and Klug concentrating on spherical plant viruses such as turnip yellow mosaic virus (TYMV). Klug continued his virus researches after Franklin's death, first at Birkbeck and later at Cambridge University's MRC Laboratory of Molecular Biology, which he joined in 1962.

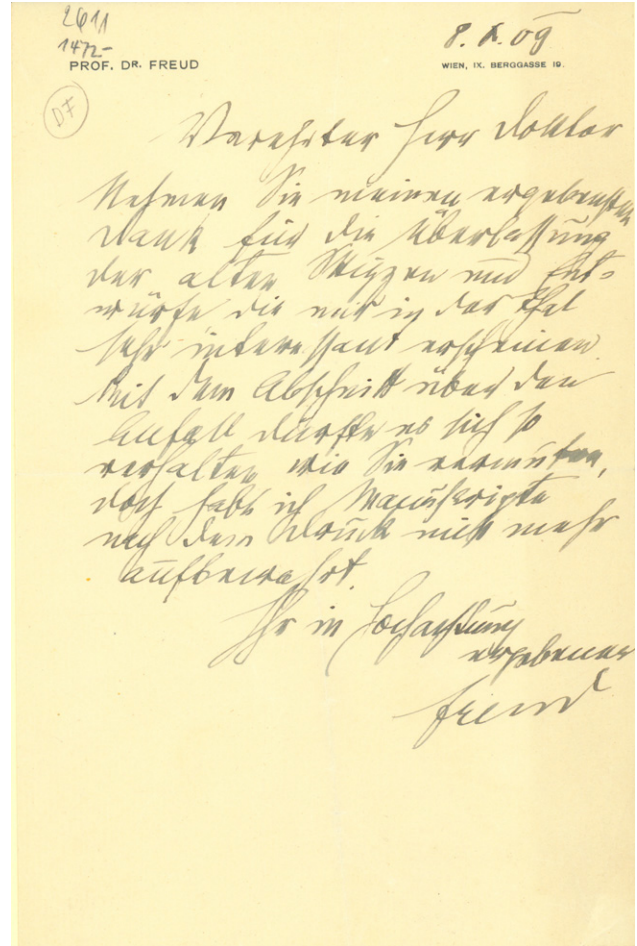
The present papers report "the early stages of an X-ray diffraction study of crystals of turnip yellow mosaic virus (TYMV). This has shown that the virus particle has cubic symmetry, with a strong pseudo-symmetry higher than that of the cubic unit cell of the crystal, and has given an indication of what the actual arrangement of the protein sub-units might be" ("The structure of turnip yellow mosaic virus: X-ray diffraction studies," p. 242). Klug, Franklin and Finch briefly announced their findings in *Nature* (no. [1] above), following up with a longer paper published in *Biochimica et biophysica acta* (no. [2] above). 40706

"I No Longer Kept Manuscripts after Printing"

37. **Freud, Sigmund** (1856-1939). Autograph letter signed to an unidentified medical correspondent. Vienna, 8 October 1909. 1 page, on Freud's stationery. Fine condition. 212 x 137 mm. Transcription and English translation included.

\$6000

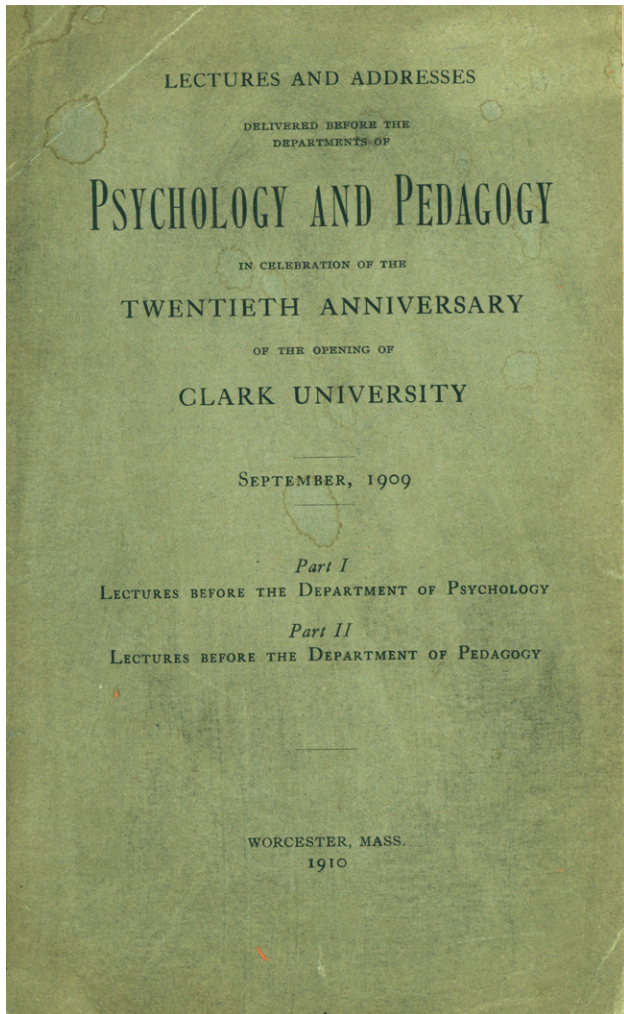
Referring to Freud's habits as a writer:



Nehmen Sie meinen ergebensten Dank für die Überlassung der alten Skizzen und Entwürfe die mir in der That sehr interessant erscheinen. Mit dem Abschnitt über den Anfall dürfte es sich so verhalten, wie Sie vermuten, doch habe ich Manuscripte nach dem Druck nicht mehr aufbewahrt.

[Accept my humblest thanks for allowing me to have the old sketches and drafts, which indeed appear to be very interesting. With respect to the section about the seizure, the case is probably as you surmise, but I no longer kept manuscripts after the printing.]

Freud's correspondent apparently wanted Freud to review the drafts of some of his early writings to explain some technical details about a case regarding a seizure. This could have been something in Freud's early neurological writings, and it may have concerned a psychogenic or hysterical seizure. In the letter Freud thanks the recipient for sending the early manuscripts, and



points out that he did not retain manuscripts after works were published. This explains why so few early Freud manuscripts have survived. 40590

Freud's Only Visit to the U.S.

38. **Freud, Sigmund** (1856-1939). The origin and development of psychoanalysis. Translated by Harry W. Chase. In: *Lectures and Addresses Delivered before the Departments of Psychology and Pedagogy in Celebration of the Twentieth Anniversary of the Opening of Clark University, September 1909* (Worcester, Mass. [n.p.], 1910), pp. 1-38. Whole volume. viii, [6], 175; vi, [2], 80pp. Frontispiece, text illustrations. 224 x 146 mm. Library buck-

ram; original gray printed front wrapper bound in. Bookplate of Haskell F. Norman. \$950

First Book-Form Edition in English. In 1909 Stanley Hall, president of Clark University in Worcester, Massachusetts, invited Freud to give a course of lectures at the university to help celebrate the twentieth anniversary of its founding. The lectures, delivered extempore in German, summarized the history, scope and techniques of psychoanalysis; they proved to be quite popular, going through eight German editions and translations into ten foreign languages. Freud also received an honorary doctorate from Clark University, which constituted the first official recognition of his life's work. The lectures were first published in an English translation in the *American Journal of Psychology*, Vol. 21 (1910); a German version appeared a few months later. These lectures document Freud's only trip to the United States; he formed a bad impression of the country and never returned.

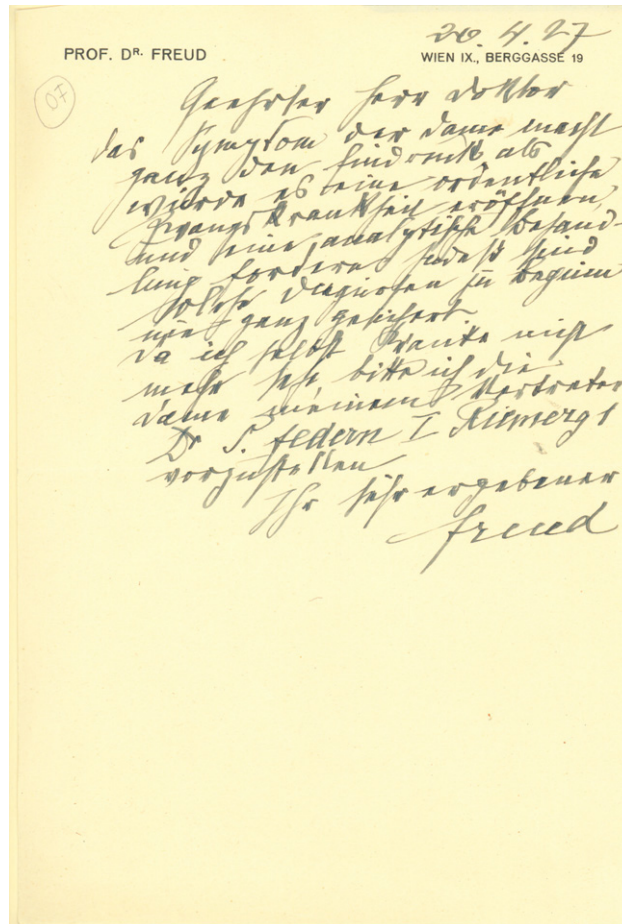
The present volume also includes Carl Jung's lecture on "The association method," as well as papers by William Stern, H. S. Jennings, Franz Boas, Adolf Meyer and E. B. Titchener. The frontispiece is a group portrait of 42 participants in the Clark University celebration, including Freud, Jung, William James, Ernest Jones, A. A. Brill and Sandor Ferenczi. Grinstein 186. Norman F77. 40683

"The Beginning of a True Compulsive Disorder that Would Require Analytic Treatment"

39. **Freud, Sigmund** (1856-1939). Autograph letter signed to an unidentified medical correspondent. Vienna, 26 April 1927. 1 page, on Freud's stationery. Fine. Transcript and English translation included. \$7500

A very fine one-page letter signed, in which Freud provides a tentative diagnosis of an analytic patient, pointing out, however, that such tentative diagnoses "are never completely certain," and referring the patient to Dr. Paul Federn.

Das Symptom der Dame macht ganz den Eindruck, als würde es eine ordentliche Zwangskrankheit eröffnen, und eine analytische



Behandlung fordern. Indes sind solche Diagnosen zu Beginn nie ganz gesichert.

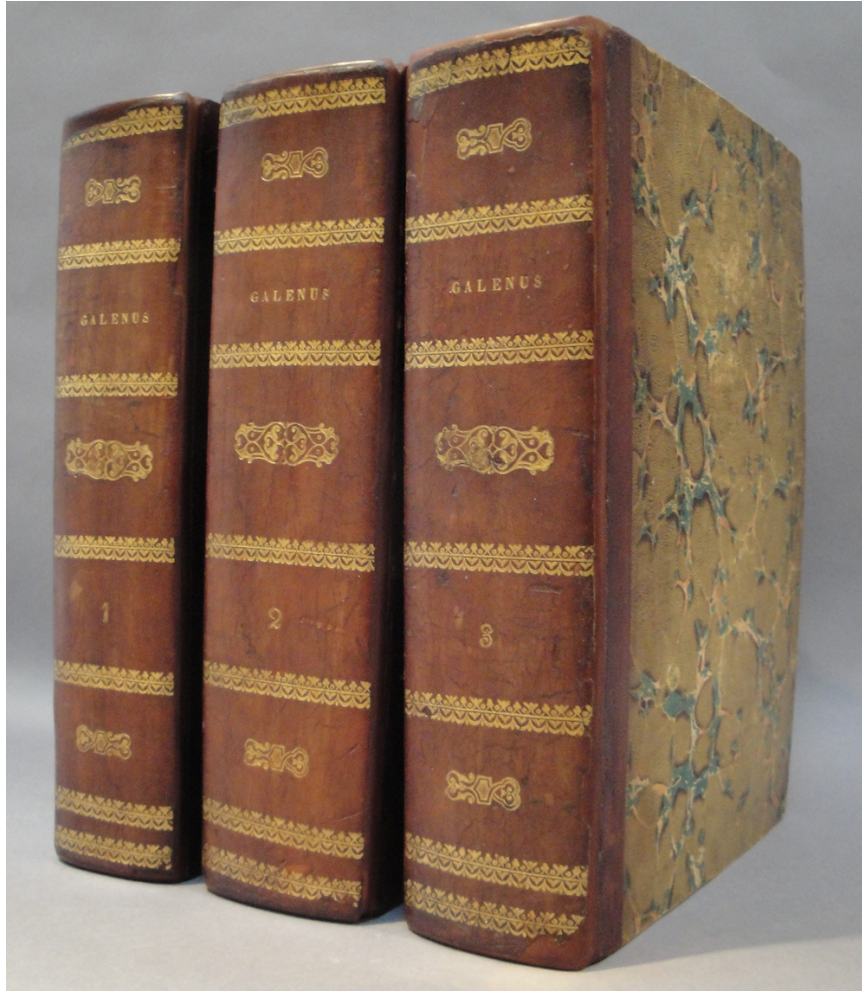
[The lady's symptom certainly gives the impression of the beginning of a true compulsive disorder that would require analytical treatment. However, at the outset such diagnoses are never completely certain.]

In the letter Freud states that he is no longer seeing patients himself, and recommends that the woman consult "meinem Vertreter Dr. P. Federn" [my representative Dr. P. Federn] at Riemerg 1 in Vienna. Dr. Paul Federn (1871-1950) was one of Freud's "most trusted adherents in the Vienna Psychoanalytic Society" (Gay, *Freud: A Life for our Time*, p. 176); in 1924 he became Freud's official representative. Federn, who emigrated from Austria to America in 1938, developed original and influential theories of ego psychology and the therapeutic treatment of psychosis. 40591

The First Bio-Bibliography

40. **Galen** (A.D. 129 / 130–199 / 200). *Omnia, quae extant, in Latinum sermonem conversa*. Edited by **Conrad Gesner** (1516-65). Folio. 11 vols. in 3. *Vol VIII lacking leaves d3-d4*. Woodcut title border, text woodcuts, initials and headpieces. [Basel: Hieronymus Froben & Nicolas Episcopius, (1561)-1562 (colophons).] 346 x 234 mm. Early 19th century quarter calf, rebacked preserving original spines. Some browning and dampstaining, minor marginal worming in Vol. II, but very good overall. Signature on title of **Jean-Jacques Chifflet** (1588-1660), physician to the city of Besançon and to Philip IV of Spain; Chifflet's marginal annotations in the text. \$9500

First Froben Edition, and Best Sixteenth Century Collected Edition in Latin of Galen's works, prepared by the Swiss scholar-physician, naturalist and



bibliographer Conrad Gesner, with a bibliography and preface supplied by Gesner especially for this edition. This bibliography entitled *Prologomena ad Galenum*, which first appeared in this edition, was the first bio-bibliography, and Gesner's most developed bibliography, covering Greek editions, Latin editions, lost works, writers on Galen, and a classified bibliography of Galen's writings. The bio-bibliography occupies 37 unnumbered leaves, following the title to volume 1, and Gesner's two unnumbered leaves of dedication, dated February 1562.

"Galen stands second only to Hippocrates in importance in ancient Greek medicine. His writings dominated Byzantine, Arabic and medieval medicine for over a millenium, being superseded in anatomy only with Vesalius, in physiology with Harvey, and in pathology with Boerhaave" (G-M 27, citing the Aldine Greek *editio princeps* of 1525). Gesner's edition, first published in Lyons in 1549-51, appeared during the

height of Renaissance interest in Galen's works, evidenced by the enormous increase in new translations published between 1525 (the year of the Aldine Greek *editio princeps*) and 1560.

Jean-Jacques Chifflet, whose signature and notes appear in our copy, was city physician of Besançon and served as personal physician to the Archduchess Isabella of the Netherlands and Philip IV of Spain; he also published a number of medical and political works (see NBG). Adams G-39. Durling, *Galen*, p. 280. 30721

Fine Set in 17th-Century Binding

41. **Galen** (A.D. 129 / 130–199 / 200). Galeni librorum . . . nona hac nostra editio. 13 vols. in 5, folio. Variously foliated (see below). Woodcut titles illustrating the life of Galen, woodcut illustrations in text. Venice: Giunta, 1625. 341 x 232



mm. 17th century calf, gilt spines, light rubbing. Minor marginal worming in a few places, but a very fine set. \$5000

Ninth edition of the monumental Giunta Galen *Opera omnia*, first published in 1541, and probably the most widely-read edition throughout the 16th and early 17th centuries. This is a very fine set, in a contemporary French binding, with most or all of the blank leaves present. The collation and foliation of each volume is available on request.

Prior to the 1541 *Opera omnia* Lucantonio Giunta had issued two earlier editions of Galen's collected works; these, published in 1522 and 1528, were little more than reprints of the 1515-16 Galen *Opera* issued in Pavia. Since these early editions had been financially successful, Giunta "determined not only to continue the venture but to improve the next edition so that it would at once become the standard collection of

Galen's writings and prevent competition from other publishers. This new edition required either revisions of older, faulty translations or completely new renderings by competent scholars . . . and some effort was made to collate more manuscripts of Greek texts in order to improve the Latin versions and even to add hitherto unprinted works" (O'Malley, pp. 102-3). Editorship of the venture was given to the scholar-physicians Agostino Gadaldino and Giambattista da Monte, who were responsible for choosing the editors and translators of Galen's individual works. Among those they selected was **Andreas Vesalius**, who edited three Galenic texts: *On the dissection of nerves*, *On the dissection of veins and arteries*, and *Nine books on anatomical procedures*. This last is Galen's major anatomical work, and the choice of Vesalius to edit its text is indicative of the stature he had attained in Padua as a professor of anatomy just before publication of the *Fabrica*.

The editorial work Vesalius did on the *Anatomical procedures* was no doubt put to good use during his composition of the *Fabrica*, a work that Vesalius intended as a revision of Galen's traditional teachings. The entrenched authority of Galen, whose works had dominated the teaching of the whole of medicine for over 1000 years (and would continue to do so, albeit to a reduced extent, throughout the 17th century), could not be overthrown by any single work, no matter how revolutionary. Nevertheless, editing Galen's texts would have clarified their limitations in Vesalius's mind and perhaps strengthened his resolve to reform the teaching of anatomy. "If any further assurance of Galen's dependence upon the dissection of animals, and so his unreliability as a guide to human anatomy, was required . . . this work of revision must have supplied it" (O'Malley, p. 108). Cushing, *Vesalius*, pp. 65-71. O'Malley, *Andreas Vesalius of Brussels*, pp. 101-8. 40523

Accepting Membership in the British Psychological Society

42. **Galton, Francis** (1822-1911). Autograph letter signed to Charles Samuel Myers (1873-1946). [London,] June 6, 1905. 1 page plus integral blank. 158 x 102 mm. Fine. \$850

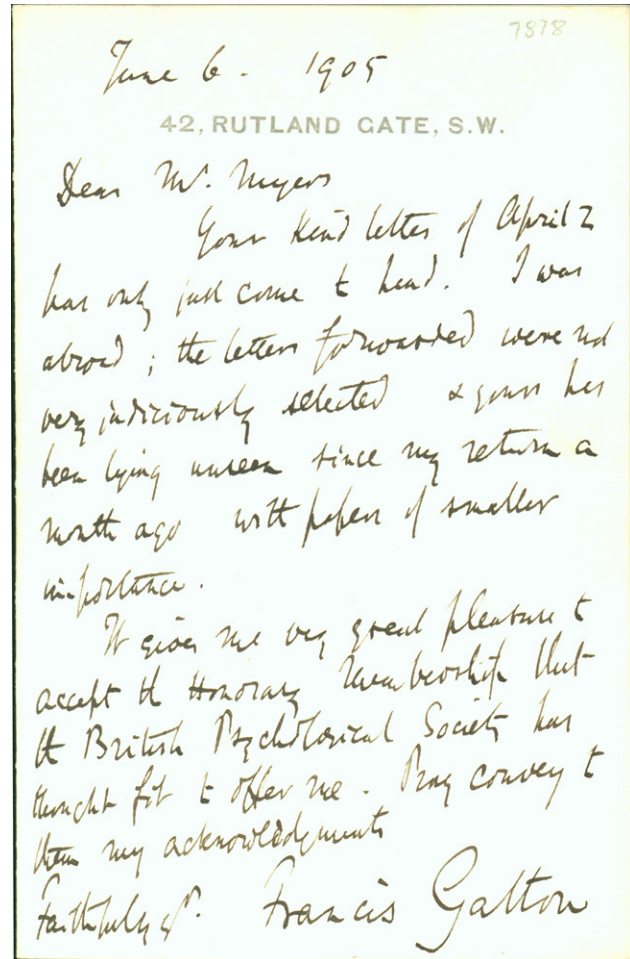
To British psychologist Charles S. Myers, Secretary of the British Psychological Society:

Dear Mr. Myers

Your kind letter of April 2 has only just come to hand. I was abroad; the letters forwarded were not very judiciously selected & yours has been lying unseen since my return a month ago with papers of smaller importance.

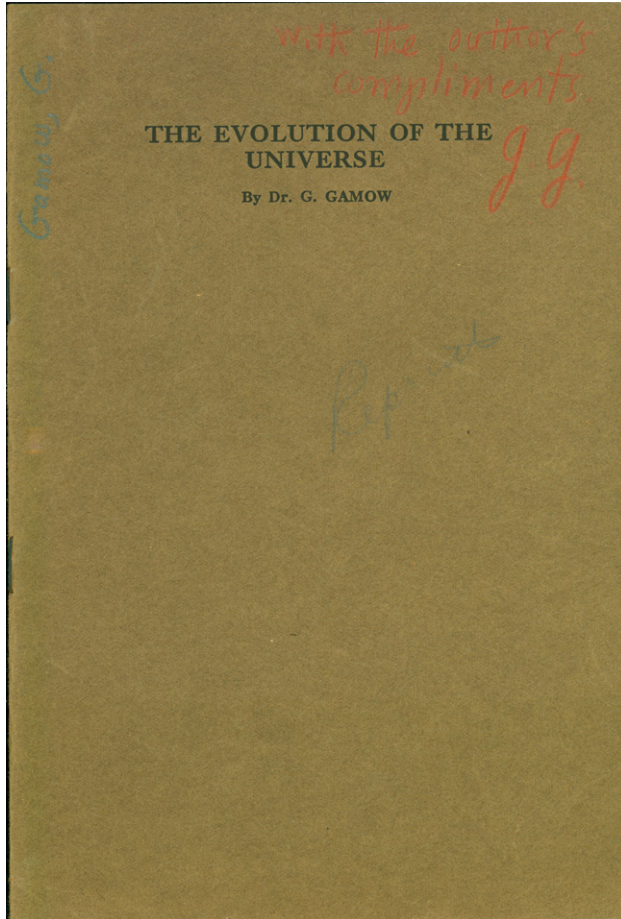
It gives me very great pleasure to accept the Honorary Membership that the British Psychological Society has thought fit to offer me. Pray convey to them my acknowledgements. Faithfully yrs. Francis Galton

Galton made substantial contributions to the emerging field of psychology, performing the earliest formal studies on mental imagery, publishing *Inquiries into Human Faculty* in 1883, establishing his Anthropometric Laboratory in 1884 and helping to found the experimental psychology laboratory at University College,



London in 1898. "Galton's ultimate impact in the field of experimental psychology was actually quite substantial. He is remembered not just for his pioneering work in mental imagery, but also for developing statistical tools like the correlation coefficient" (Gillham, *A Life of Sir Francis Galton*, p. 226). It was thus highly appropriate that he be offered an honorary membership in the British Psychological Society, which had been founded in 1901.

Galton's correspondent, Charles S. Myers, was an eminent British psychologist who coined the term "shell-shock" (now known as combat stress reaction) in 1915. In 1909 Myers became the first lecturer at Cambridge to devote himself wholly to experimental psychology, and in 1912 he helped to found the Cambridge Laboratory of Experimental Psychology. He co-edited the *British Journal of Psychology* with W. H. R. Rivers from 1911 to 1914, and in 1914 took over as sole editor of the journal, continuing in this post until 1924. In 1920



he was elected the first president of the British Psychological Society. 40608

Presentation Copy

43. **Gamow, George** (1904-68). The evolution of the universe. Offprint from *Nature* 162 (1948). 7, [1]pp. Original printed wrappers. *Presentation copy*, with Gamow's inscription in red pencil on the front wrapper: "With the author's compliments, G. G." From the library of Theodore von Karman (1881-1963), with his characteristic docketing on the front wrapper. \$1500

First Edition, Offprint Issue of Gamow's follow-up to the famous 1946 "Alpher, Bethe, Gamow" paper, which was the first to look at the effects of cosmic expansion on the nuclear matter that must have existed in the early universe. In "The evolution of the universe," published two years later, Gamow "developed

equations for the mass and radius of a primordial galaxy (which typically contains about one hundred billion stars, each with a mass comparable with that of the sun)" (Wikipedia). This copy is from the library of Theodore von Karman, founder of the Jet Propulsion Laboratory and author of many key advances in aerodynamics, rocketry and supersonic flight. 40666

Large-Scale Lunar Map

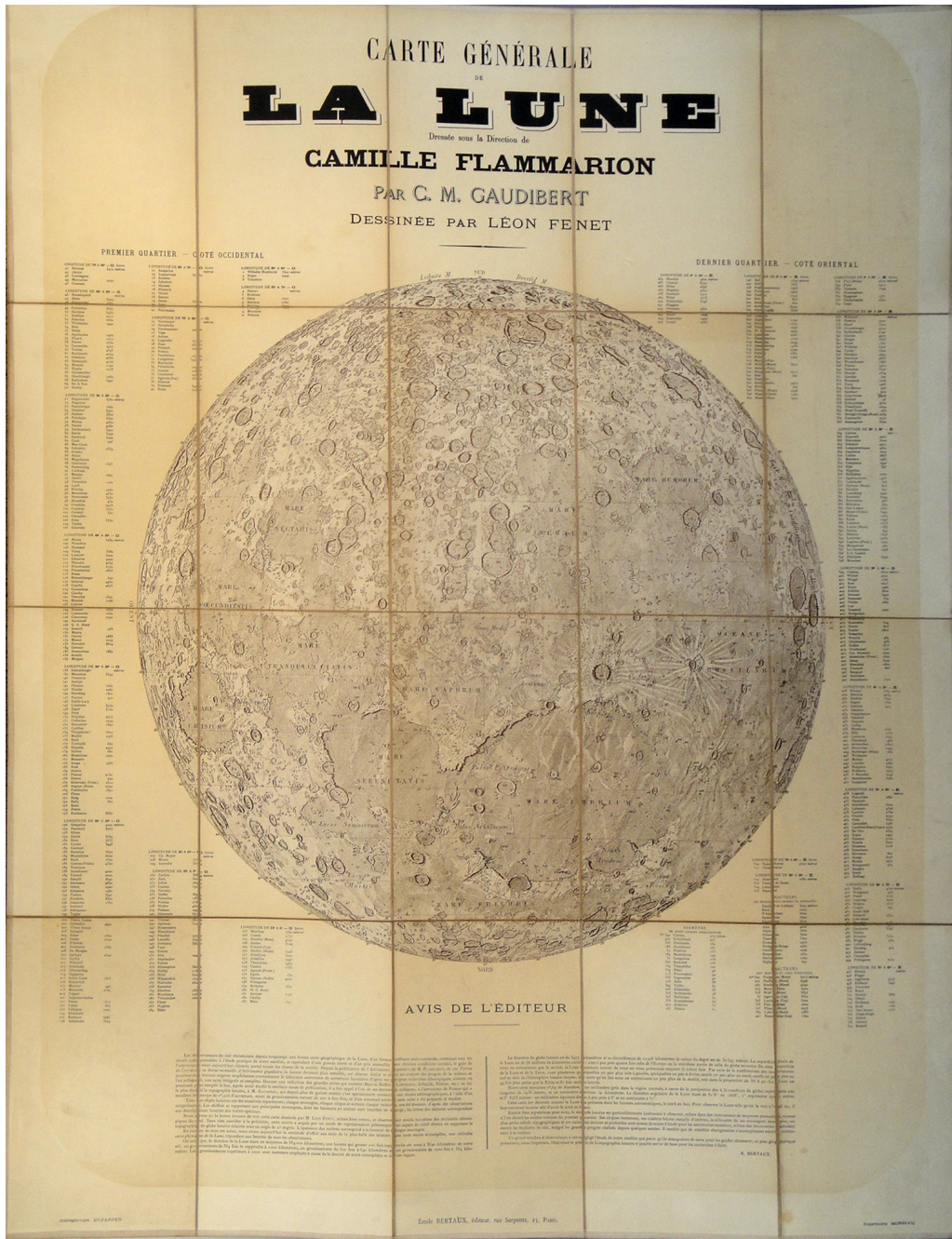
44. **Gaudibert, Casimir Marie** (1823-1901). Carte générale de la lune dressée sous la direction de Camille Flammarion . . . dessinée par Léon Fenet. Lithographed map, cut into sections and mounted on linen; boxed. Paris: Emile Bertaux, n.d. [1887]. 1164 x 1800 mm. Minor spotting and soiling, but very good. \$2750

Rare large-scale lunar map prepared by French astronomer Casimir Marie Gaudibert under the direction of Camille Flammarion (1842-1925), founder and the first president of the Société Astronomique de France and author of numerous popular works on astronomy. Gaudibert's map, drawn by Léon Fenet, introduced six crater names later adopted into the International Astronomical Union's original lunar nomenclature (1935): Carpenter, Flammarion, Frères Henry (later changed to Henry Frères), Mouchez, Nasmyth and Rutherford. Whitaker, *Mapping and Naming the Moon*, pp. 149-50. 40790

"The Systematic Arrangement of the Fishes into Families"

45. **Girard, Charles Frédéric** (1822-95). Autograph letter signed to an unidentified correspondent (most likely **David Humphreys Storer** [1804-91]). [Washington D.C.,] Smithsonian Institution, June 15, 1857. 4pp. 268 x 209 mm. Two tiny tears along central fold, but fine otherwise. \$950

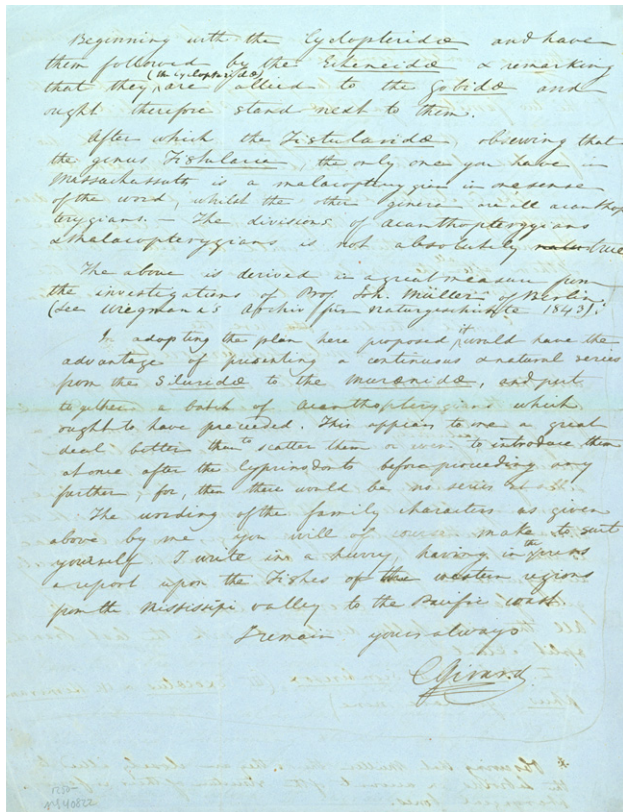
A letter with excellent scientific content on the taxonomy of Massachusetts fishes, almost certainly written to David H. Storer in connection with Storer's



monumental survey of Massachusetts fishes and reptiles, then being published in installments in the *Memoirs of the American Academy of Arts and Sciences*. The writer, Charles Girard, was a specialist in ichthyology and herpetology. A native of France, he had studied natural history under Louis Agassiz at Neuchatel, and accompanied Agassiz to the United States as his assistant when Agassiz was appointed professor of zoology and geology at Harvard University in 1847. In 1850 Girard left Harvard for the Smithsonian, where for the

next ten years he worked on the institution's growing collection of North American reptiles, amphibians and fishes under the supervision of Spencer Fullerton Baird. While at the Smithsonian Girard published numerous papers on North American fishes, particularly the new species discovered in the western United States during the Mexican Boundary and Pacific Railroad surveys of the 1850s.

Girard's letter begins as follows:



My dear Sir, Your missive of the 8th instant came while absent from this city for a few days.

It just so happens that I am engaged gathering up from the investigations of late years data in reference to the systematic arrangement of the fishes into families. Having not quite done when your letter was read I had to postpone answering it until now.

The point at which you have arrived in the printing will prevent giving the Fistularids their actual position in the System. They are Acanthopterygians and ought to have come somewhere after the Labroids.

Hence I would suggest the following: next to the Cyprinodonts, which is the last family treated of, introduce that of *Scopelidae* . . .

Girard gives a detailed scientific account of this fish family's characteristics and notes that only one genus from this family, *Scopelus*, is found in Massachusetts. He goes on to provide similar accounts for the families *Salmonidae*, *Esocidae*, *Clupeidae* and *Scomberesocidae*, along with instructions for classifying various fish families in the proper order. After noting that his informa-

tion "is derived in great measure from the investigations of Prof. Joh. Müller of Berlin" (i.e., physiologist and comparative anatomist Johannes Peter Müller [1801-58]), Girard concludes as follows:

In adopting the plan here proposed it would have the advantage of presenting a continuous & natural series from the *Siluridae* to the *Muraenidae*, and put together a batch of Acanthopterygians which ought to have preceded. This appears to me a great deal better than to scatter them or even to introduce them at once after the Cyprinodonts before proceeding any further, for, then there would be no series at all.

The wording of the family characters as given above by me you will of course make to suit yourself. I write in a hurry, having in the press a report upon the Fishes of the western regions from the Mississippi Valley to the Pacific Coast. I remain yours always, C. Girard.

David H. Storer, the likely recipient of Girard's letter, was a physician and naturalist who in 1837 was appointed one of the commissioners of the Natural History Survey of the Massachusetts Commonwealth authorized by the state's legislature. He spent 30 years recording and classifying Massachusetts's fish and reptiles, publishing his findings both as part of the survey and in separate works such as *A History of the Fishes of Massachusetts* (1867). He also enjoyed a distinguished career as a physician, serving as Professor of Obstetrics and Medical Jurisprudence at the Harvard Medical School. Both Storer and Girard exerted a considerable influence on the development of ichthyology in America. Hubbs, "History of ichthyology in the United States after 1850," *Copeia* 1964, no. 1 (Mar. 26, 1964): 42-60. "David Humphreys Storer," *Proceedings of the American Academy of Arts and Sciences* 27 (1893): 388-391. 40822

Portrait of the Discoverer of "Graham's Law"

46. **Graham, Thomas** (1805-69). Portrait photograph from *Photographic Portraits of Living Celebrities* (London, 1856-60). 305 x 254 mm. Light browning at edges. \$1500



Portrait of Scottish chemist Thomas Graham from Maull and Polyblank's *Photographic Portraits of Living Celebrities* (1856-60). Graham formulated Graham's law of gas diffusion, which states that the rate of effusion of a gas is inversely proportional to the square root of the mass of its particles. He also discovered dialysis (the process of separating molecules in solution by the difference in their rates of diffusion through a semi-permeable membrane), and founded the field of colloid chemistry. 40510

Asa Gray and Joseph Hooker

47. **Gray, Asa** (1810-88). Autograph letter signed to Edward L. Youmans (1821-87). Cambridge, Mass., July 5, 1877. 1-1/2pp., on stationery of the Herbarium of Harvard University. 201 x 126 mm. Mounted on larger sheet. Very good. \$1500

From America's leading botanist of the nineteenth century to the founder and editor of *Popular Science*, regarding the impending arrival of British botanist Sir

HERBARIUM OF HARVARD UNIVERSITY,
BOTANIC GARDEN, CAMBRIDGE, MASS.

Over
Sept. 1875

Dear Prof. ^{July 5} ~~Hooker~~ 187

Sir Joseph is, I presume on the Parthia due here Monday. But there is still a little uncertainty. If not, he will be on the Cunarder leaving Liverpool the 30th ult. And in that case your kind offices would be useful in N.Y. If I get any information to that effect I will let you know.

Comeing from, I think we must just pass thro' N.Y. as time is money. Over

Joseph Dalton Hooker (1817-1911), director of the Royal Botanical Gardens at Kew:

Sir Joseph is, I presume on the Parthia due here Monday. But there is still a little uncertainty. If not, he will be on the Cunarder leaving Liverpool the 30th ult. And in that case your kind offices would be useful in N.Y. If I get any information to that effect I will let you know.

Gray was largely responsible for persuading Hooker to travel to the United States in 1877 for what would be the last major botanical expedition of Hooker's lifetime. After visiting a number of cities and botanical institutions in the eastern United States, Hooker traveled with Gray to the western states, where they collected plant specimens in Colorado, Utah, Nevada and California. "Both botanists were interested in the floristic similarities of the eastern United States and eastern continental Asia and Japan. Hooker was of the opinion that the Miocene flora in western North America had

New York. 29th September 1875

Dear Sir,

I have made an arrangement with Mr. Cyrus F. Field, by which he purchases one third of all our Patents except that in Great Britain, and of that I propose to transfer to him one third of my own half. I intend taking immediate steps towards pushing forward the sale of rights and instruments, and we are confident that he can render valuable assistance in these efforts.

I hope you will at once signify your approval of the sale to him of the share in the English patents.

Have you any news to give me or any plans to propose?

I remain,
Dear Sir,
Yours truly,
Elisha Gray

Latimer Clark Esq;
London

P.S. - Please answer Care Cyrus F. Field 145 Broadway New York

been eliminated by glaciations, but that such flora had managed to survive on the eastern side of the continent and in eastern Asia" (*Dictionary of Scientific Biography*). Hooker returned from his American expedition with 1,000 botanical specimens. Dupree, *Asa Gray*, p. 406. 40650

Referencing Cyrus Field

48. **Gray, Elisha** (1835-1901). Letter signed, with autograph postscript, to Latimer Clark. New York, September 29, 1875. 1 page. 255 x 205 mm. Traces of mounting on verso, some spotting, small tears in left margin (not affecting text). Provenance: Latimer Clark. \$1250

Elisha Gray, a prolific inventor of telegraph and other electrical devices, was a founder of the firm Barton and Gray, an ancestor of the Western Electric Company. In July 1875 Gray obtained two patents for a system of "electro-harmonic telegraphy" for transmitting musical tones as a means of increasing the number of messages that could be sent over a single wire. This led him to consider the possibility of a device that

could transmit speech by wire, and on February 14, 1876, he filed a caveat (a confidential report of an invention not yet fully perfected) for such a device with the United States Patent Office, just hours after the filing of Alexander Graham Bell's patent application for a speaking telephone. Gray's and Bell's patents were later the subject of a bitter infringement battle, which ended with the court's determination that the Bell telephone patents were valid. Although deeply disappointed by this outcome, Gray continued to invent electrical devices, including the "telautograph," an ancestor of the facsimile machine.

Gray's letter to Clark reads as follows:

I have made an arrangement with Mr. Cyrus Field, by which he purchases one third of all our Patents except that in Great Britain, and of that I propose to transfer to him one third of my own half. We intend taking immediate steps forward pushing forward the sale of rights and instruments, and we are confident that he can render valuable assistance in these efforts.

I hope you will at once signify your approval of the sale to him of the share in the English patents. Have you any news to give me or any plans to propose?

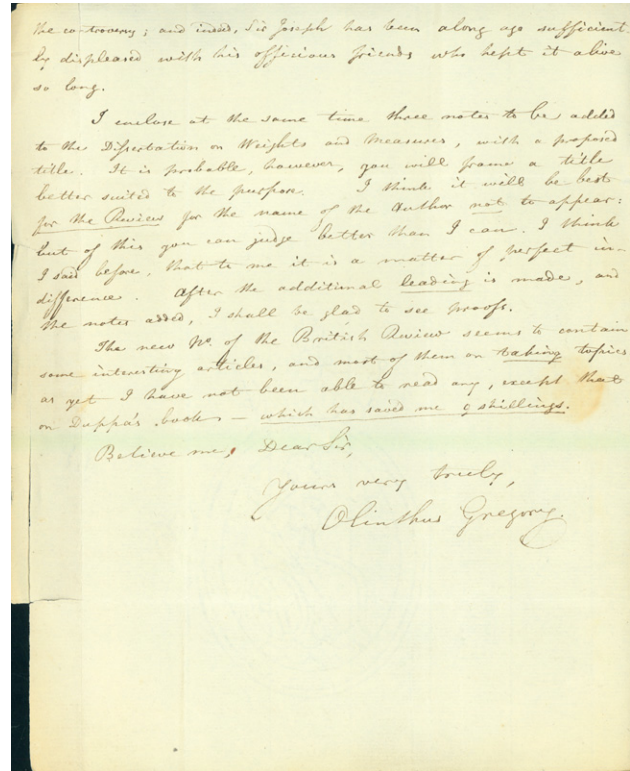
I remain, Dear Sir, Yours truly, Elisha Gray

PS: Please answer care Cyrus W. Field 145 Broadway, New York

It appears from both this letter and from Field's letter to Clark of December 9, 1875, that Clark had an interest in some of Gray's patents. Origins of Cyberspace 147. 40726

"Sir Jos. Banks's Party . . . Flatter and Fawn upon Him"

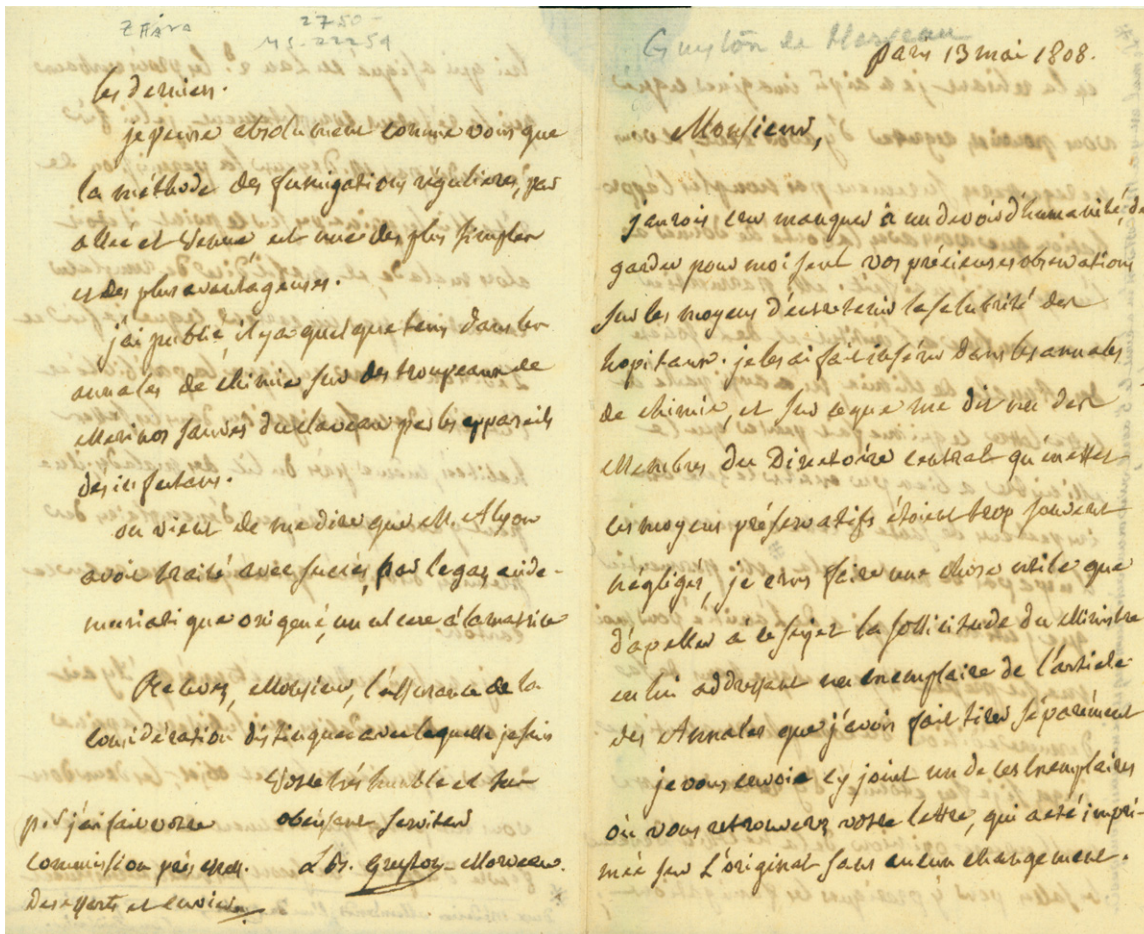
49. **Gregory, Olinthus Gilbert** (1774-1841). Five autograph letters signed, three to Robert Baldwin, of the publishing firm Baldwin, Cradock & Joy, and two to an unidentified officer of the Woolwich Institution for the Advancement of Literary, Scientific and Technical Knowledge. Woolwich, Sept. 28, 1816 - July 16, 1838. 11pp. total. Various sizes (the largest 251 x 203 mm.). One letter mounted with some fraying of the front edge



(slightly affecting a few words), another with a small paper flaw, light soiling, but very good.

\$1250

From British mathematician and writer Olinthus Gregory, professor of mathematics at the Royal Military Academy at Woolwich, author of works on mathematics, astronomy, mechanics, etc., and editor of both the *Gentleman's Diary* and *Ladies' Diary*. Gregory played a role in the controversy surrounding the Trigonometrical Survey of Great Britain, later known as the Ordnance Survey. The survey, which had begun in 1791, was opposed for political reasons by Royal Society President Sir Joseph Banks, who in 1812 published in the *Philosophical Transactions* a memoir by Don José Rodríguez attacking the survey and its leader, Col. William Mudge. Gregory exposed Banks's machinations in a paper published in the *Philosophical Magazine*, which was later collected in *Dissertations and Letters, by Don Joseph Rodriguez, the Chevalier Delambre, Baron de Zach, Dr. Thomas Thomson, Dr. Olinthus Gregory, and Others . . . Tending Either to Impugn or to Defend the Trigonometrical Survey of England and Wales* (1815). Gregory's 1817 letter to Baldwin, one of the publishers of the *Annals of Philosophy*, discusses this controversy, noting that its effect had been to produce "a strong cur-



rent in Col. Mudge's favour among all the men of science in Europe . . . the French Institute has made Col. Mudge a member, expressly on account of his survey: and immediately after this, the Royal Society, or I should rather say Sir Jos. Banks's party, who had for years been doing every thing to sink his reputation, change their conduct, flatter and fawn upon him, elect them into their councils . . .”

Gregory's remaining letters to Baldwin discuss literary matters, including his “account of Biot's new work [*Traité de physique* (1816)] for the next no. of the British review.” His later letters, written to an unnamed official at Woolwich Institution for the Advancement of Literary, Scientific and Technical Knowledge, include a long discussion as to why the Institution's reading room should not provide daily newspapers for its largely working-class clientele. 40852

On Hospital Fumigation

50. **Guyton de Morveau, Louis Bernard** (1737-1816). Autograph letter signed to an unidentified correspondent. Paris, 13 May 1808. 4pp. 185 x 117 mm. Fine. \$2750

Excellent letter from French chemist Guyton de Morveau on hospital fumigation, a practice that he pioneered. In 1773 Guyton de Morveau began using chemical fumigation to control “putrid emanations” in hospitals and other unhealthy environments, believing that epidemic diseases were carried by the foul airs emitted from decaying flesh. He later introduced the practice of chlorine disinfection, which he described in his *Traité des moyens de désinfecter l'air* (1801). He was one of the original editors of the *Annales de chimie*, and worked with Lavoisier, Berthollet and Fourcroy in creating the first systematic method of chemical nomenclature.

Guyton de Morveau's letter, written to someone who had corresponded with him on hospital sanitation, reads in part as follows:

J'aurais [...] manquer à un devoir d'humanité de garder pour moi seul vos précieuses observations sur les moyens d'entretenir la salubrité des hôpitaux. Je les ai fait insérer dans les *Annales de chimie*, et sur ce que me dit une des Membres du Directoire central qu'en effet les moyens préventifs étaient trop souvent négligés je crois faire une chose utile que d'appeler à ce sujet la sollicitude du Ministre en lui adressant un exemplaire de l'article des *Annales* que j'avais fait tirer séparément.

Je vous envoie cy joint un de ces exemplaires où vous retrouverez votre lettre, qui a été imprimée sur l'original sans aucun changement. En la relisant, je n'ai pu imaginer ce que vous pourriez regretter d'y avoir écrit, et vous ne regretterez sûrement pas non plus l'approbation que vous avez la bonté de donner à l'image que j'en ai fait. M. Parmentier mon confrère à l'Institut et de la Société des *Annales de chimie*, m'a aussi parlé de cette lettre, ce qui me fait penser que le Ministre a bien pu exciter le zèle des inspecteurs de santé à cette occasion, mais il n'y a pas de mal à cela . . .

[I would have violated a duty to humanity in keeping your precious observations on maintaining hospital sanitation to myself. I had them inserted into the *Annales de chimie*, and since one of the members of the *Directoire central* tells me that preventive methods are too often overlooked I believe I have done a useful thing in calling this subject to the attention of the Minister by sending him a copy of the article from the *Annales* which I had printed separately.

I send you enclosed one of these copies where you will find your letter printed from the original without any changes. In reading it over, I cannot imagine what you might regret having written there, and you will surely not regret the approval that you kindly grant to the picture I have drawn. M. Parmentier my associate at the Institute and in the Society of the *Annales de chimie*, has also talked to me about this letter, which makes me think that the Minister can very well stir up the health inspectors' enthusiasm on this occasion, but there is no harm in this . . .]

"Parmentier" refers to Antoine-Augustin Parmentier (1737-1813), the famous nutritional chemist and promoter of potatoes as food for humans. *Dictionary of Scientific Biography*. 22254

From the Founder of Experimental Geology, Discussing his Most Important Work

51. **Hall, James** (1761-1832). Autograph letter signed to Dr. Alexander Marcet (1770-1822). Edinburgh, Apr. 28, 1805. 2pp. plus integral address leaf. 252 x 204 mm. Some small tears along folds, lacuna where seal was removed (not affecting text), minor soiling, but very good. Docketed by recipient. \$1250

From Sir James Hall, founder of experimental geology, discussing his most important work—the experimental researches he conducted between 1798 and 1805 in order to prove some of the geological theories advanced in James Hutton's *Theory of the Earth* (1788). In that landmark work, which was the first to recognize the cyclical, "timeless" nature of geologic processes, Hutton had introduced the theory that the interior of the earth was hot, and that this internal heat was responsible for creating new rock from sediments deposited in the ocean. Objecting to this claim, Hutton's critics protested that "if the consolidation of limestones had been effected in the manner Hutton supposed—by the action of subterranean heat—they would have decomposed with loss of carbon dioxide. Hutton had in fact suggested that this would not happen if the limestones were heated under great pressure, such as that which would be exerted by an overlying mass of seawater" (*Dictionary of Scientific Biography*).

Shortly after Hutton's death in 1797, Hall undertook the extraordinarily difficult task of proving Hutton's theory of limestone creation. "Between 1798 and 1805 he carried out more than 500 separate experiments. It was a classic case of proceeding by trial and error. No apparatus suitable for his purpose existed, and Hall had to design and construct his own. His method was to insert small weighed amounts of various types of limestone or carbonate of lime into a tubular container. Among many difficulties he encountered, the principal

tained; and I find that the appearance of the
 carbonate is much improved by being freed
 from the contamination of the Porcelain tube.
 I shall still be glad to have the cups you
 have ordered for me. At the same time
 I wish to have some solid pieces of malleable
 Platina, no matter of what shape, as my
 man can ~~cut~~ squeeze them into plates which
 are easily folded into the form of cups. I shall
 be glad to have solid Platina to the amount
 of 5 or 6 ounces. You will oblige me
 much by sending this last, along with what
 cups may be ready, by the mail, coast with-
 out delay, for now in the act of
 working in this way and my operation are
 limited by scarcity & small size of the
 Platina cups.
 You mentioned in your last that Mr. Tennant
 had done me the honour to take some notice
 of my experiments. If that gentleman will have
 the goodness to send me 40 or 50 grains
 of Pure Carbonate of lime I shall be to ex-
 pose it to some of our trials.
 I beg to be kindly remembered to Mrs
 Marcet
 Yours sincerely
 James Hall

It is so good as to direct the parcel for me
 to the care of Mr Wm Anderson. Good-byes close

ones were the selection of suitable material for the container (which had to be nonporous and capable of withstanding both high temperature and high pressures) and the devising of an effective method of sealing the container after inserting the carbonate of lime . . . “ (*ibid.*). Despite these difficulties, Hall was able to show that limestone can be heated to high temperatures under high pressure without undergoing decomposition. “In the most successful of his experiments the loss in weight of the heated limestone was insignificant. It is probable that in some experiments he produced crystalline marble” (*ibid.*)

Hall’s letter, written to physician and chemist Alexander Marcet, describes one of his more successful experimental efforts:

Some time ago I used the freedom to give you a
 commission for some Platina tubes; but in the
 mean time I have been exerting myself to make a
 shift with what our poor corner could supply.
 This led me to an expedient which has already
 been very successful. My workman has attempted
 in vain to make cups for me but he has supplied
 me with thin plates of Platina formed by squeez-
 ing solid pieces between rollers of steel; these thin

plates I form into little conical cups by ~~double~~ fold-
 ing them three times as you fold paper to make a
 filter & these cups are kept upright by pla sinking
 the apex of the cone into a cup of porcelain. A
 cover of platina with its edges overlapping is
 placed upon the cone and the Carbonate is thus
 exposed to heat under compression without
 touching anything but Platina. I have made about
 a dozen of experiments in this way and some of
 my results tho very small are the most perfect I
 have hitherto obtained. . .

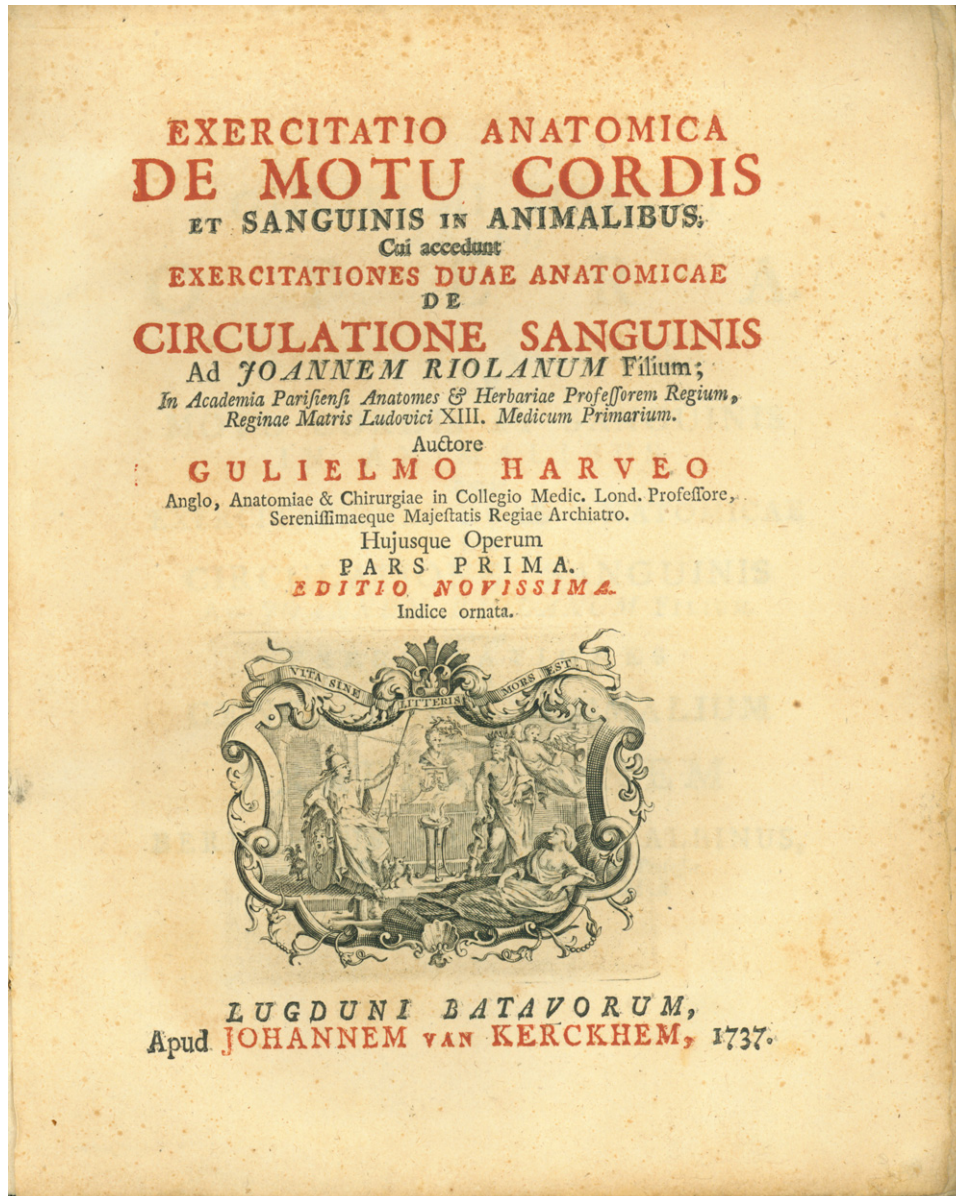
You mentioned in your last that Mr. Tennant had
 done me the honour to take some notice of my
 experiments. If that gentleman will have the good-
 ness to send me 40 or 50 grains of Pure Carbonate
 of lime I shall be to expose it to some of our trials.

“Mr. Tennant” refers to chemist Smithson Tennant
 (1761-1815), discoverer of the elements iridium and
 osmium; the mineral tennantite is named for him. For
 further information on Alexander Marcet, author of *An
 Essay on the Chemical History and Medical Treatment of
 Calculus Disorders* (1817), see the *Dictionary of
 National Biography*. 40870

Fine Copy of Harvey’s Opera Omnia

52. **Harvey, William** (1578-1657). Opera, sive
 exercitatio anatomica. De motu cordis . . . atque
 exercitationes duae anatomicae . . . Preface by Ber-
 nard Siegfried Albinus. 4to. 2 vols., 4to. [16], 167,
 [1]; [24], 404, [38]pp. 2 engraved plates in Vol. I.
 Leiden: J. van Kerckhem, 1737. 210 x 165 mm.
 Uncut. 18th century Italian stiff paper covers,
 paper spines with hand-lettered labels; preserved in
 cloth drop-back box. Fine copy. \$5750

First Collected Edition in Latin. “Harvey’s chief
 works in Latin have only twice been printed in a col-
 lected form, first by van Kerckhem at Leiden in 1737
 and secondly by Bowyer for the Royal College of Physi-
 cians in 1766” (Keynes, p. 100). This edition of Har-
 vey’s works is one of a series of collected works of
 anatomists edited by Bernard Siegfried Albinus (1697-
 1770), author of the monumental *Tabulae sceleti et
 musculorum corporis humani* (1737-47; G-M 399).
 Other collections in the series edited by Albinus
 include the collected works of Vesalius (1725) and of



Fabricius (1738); the Albinus Harvey, however, is much rarer on the market—this is the third copy we have handled in our nearly four decades in business. A few copies of Vol. I were separately issued with a title-page dated 1736; however, “this form of van Kerckhem’s edition is rare, the sheets of the greater part of the issue having been published in 1737 as Part 1 of the *Opera*” (Keynes, p. 49). Keynes, *Harvey* (3rd ed.), 46. 40679

Velocity of the Nervous Impulse

53. **Helmholtz, Hermann** (1821-94). Vorläufiger Bericht über die Fortpflanzungsgeschwindigkeit der Nervenreizung. In *Archiv für Anatomie, Physiologie und wissenschaftliche Medizin* (1850): 71-73. Whole volume, 8vo. vi, 70, 632pp. 22 plates. 217 x 132 mm. 19th century boards, paper spine label, light wear at extremities and corners. Very good apart from some minimal foxing.

\$750

Vorläufiger Bericht
über
die Fortpflanzungsgeschwindigkeit der Nerven-
reizung.
Von
Dr. HELMHOLTZ,
Professor der Physiologie in Königsberg.
(Aus dem Monatsbericht der K. Akademie der Wissenschaften. Ja-
nuar 1850).

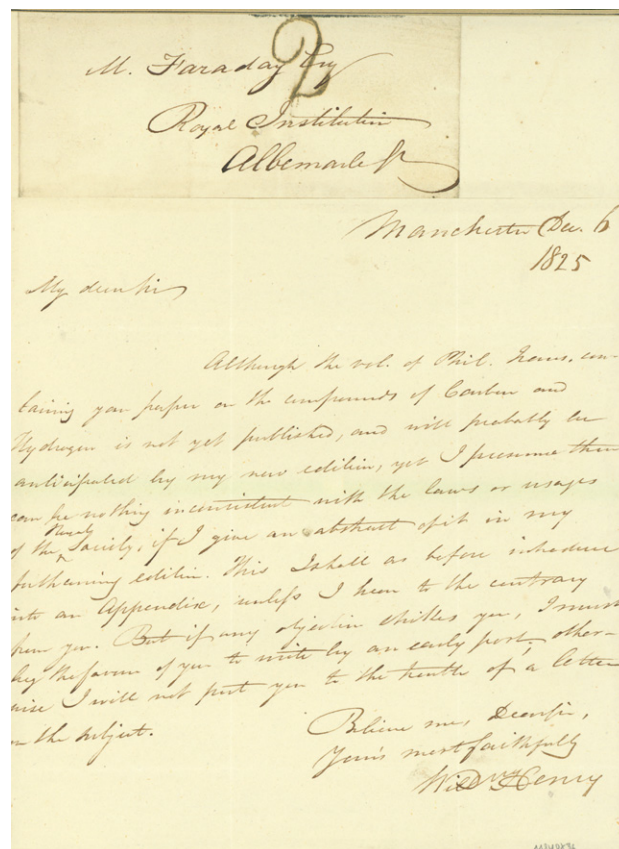
Ich habe gefunden, dass eine messbare Zeit vergeht, wäh-
rend sich der Reiz, welchen ein momentaner elektrischer
Strom auf das Hüftgelenk eines Frosches ausübt, bis zum
Eintritt des Schenkelnerven in den Wadenmuskel fortpflanzt.
Bei grossen Fröschen, deren Nerven 50—60 Millim. lang
waren, und welche ich bei 2—6° C. aufbewahrt hatte,
während die Temperatur des Beobachtungszimmers zwischen
11 und 15° lag, betrug diese Zeitdauer 0,0014 bis 0,0020
einer Sekunde.

Die Reizung des Nerven geschah mittels des Stromes,
den eine Drahtspirale bei der Oeffnung ihres eigenen Stro-
mes in einer andern inducirte. Durch eine eigenthümliche
mechanische Vorrichtung wurde bewirkt, dass in denselben
Augenblicke, wo der Strom in der inducirenden Spirale auf-

First Edition. “Helmholtz succeeded in measuring the velocity of the nervous impulse by applying the knowledge and techniques of ballistics to the problem. Using a pendulum-myograph of his own invention, he measured the duration of an electric current through a galvanometer from the moment the nerve was stimulated to its interruption when the muscle contracted. A more detailed report, “Messungen über den zeitlichen Verlauf der Zuckung animalischer Muskeln und die Fortpflanzungsgeschwindigkeit der Reizung in den Nerven,” appeared in the same journal volume, [276]-364, with its second part in the volume for 1852, 199-216” (Garrison-Morton 1265). 40846

Written to Michael Faraday, Regarding Faraday's Discovery of Benzene

54. **Henry, William** (1774-1836). Autograph letter signed to Michael Faraday (1791-1867). Manchester, Dec. 6, 1825. 1 page plus portion of



address leaf containing Henry's autograph direction to Faraday, the whole mounted on another leaf. Light soiling to address portion, otherwise fine. \$1250

From the noted British chemist William Henry, enunciator of “Henry’s Law” of the solubility of gases and author of *Elements of Experimental Chemistry* (1801 & 10 subsequent eds.), the most popular and successful English-language chemistry textbook of its day; to Michael Faraday, one of the most influential scientists in history, whose investigations of electricity and magnetism established the basis for the electromagnetic field concept in physics and formed the foundation of electric motor technology. Faraday was also one of the most famous chemists of his time, with most of his major discoveries in chemistry being accomplished in the 1820s. The letter, concerning Faraday’s discovery of benzene in 1825, reads as follows:

My dear Sir, Although the vol. of Phil. Trans. containing your paper on the compounds of Carbon and Hydrogen is not yet published, and will probably be anticipated by my new edition, yet I

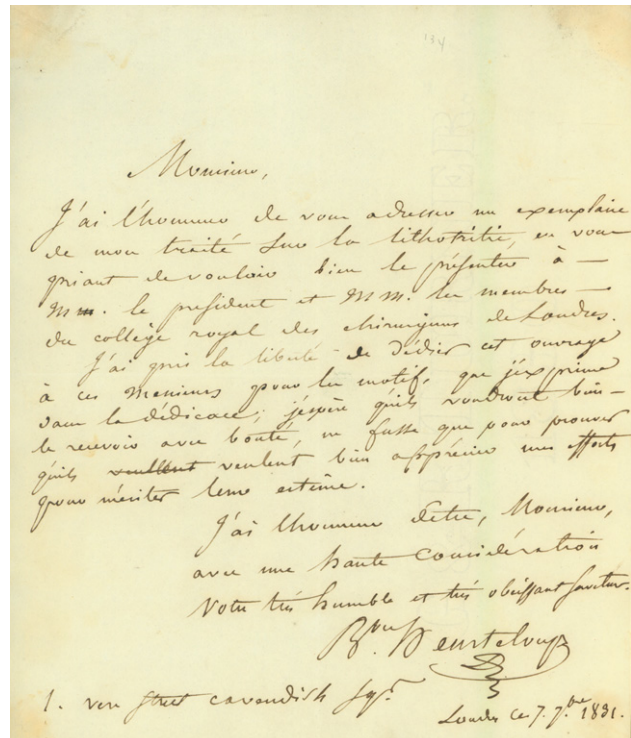
presume there can be nothing inconsistent with the laws or usages of the Royal Society, if I give an abstract of it in my forthcoming edition. This I shall as before introduce into an Appendix, unless I hear to the contrary from you. But if any objection strikes you, I must beg the favour of you to write by an early post, otherwise I will not put you to the trouble of a letter on the subject. Believe me, Dear Sir, Yours most faithfully, Willm. Henry.

Henry is referring here to Faraday's "On new compounds of carbon and hydrogen, and on certain other products obtained during the decomposition of oil by heat" (*Philosophical Transactions* [1825]: 440-66), in which Faraday announced his successful isolation of benzene (C₆H₆), which he named "bi-carburet of hydrogen." It would appear that Henry did indeed get Faraday's permission to abstract the 1825 paper, as an account of Faraday's researches in this area appears in the eleventh edition of Henry's *Elements of Experimental Chemistry* (1829). Williams, *Michael Faraday*, p. 108. 40836

Presenting a Copy of his Book to the Royal Society

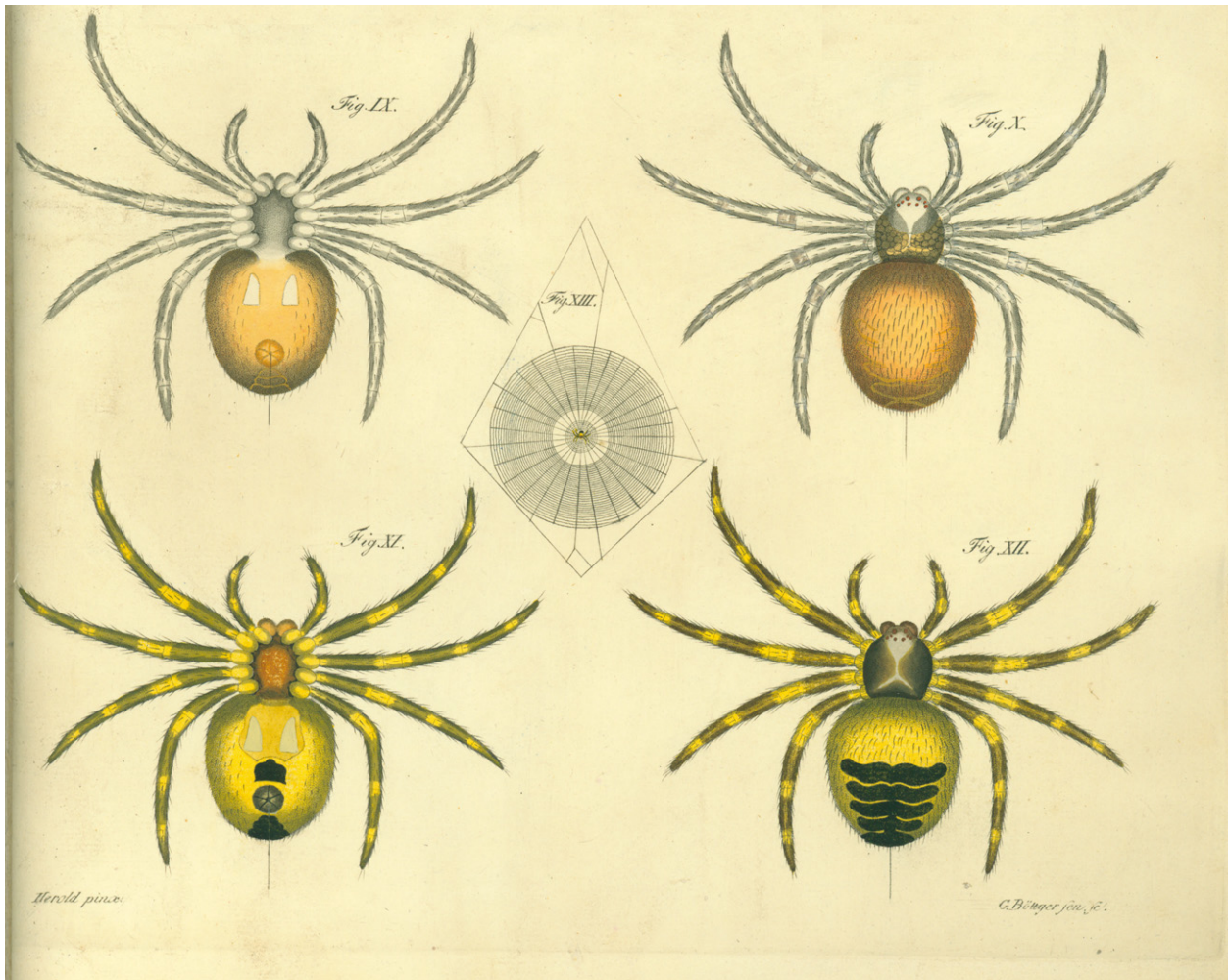
55. **Heurteloup, Charles L. S., Baron** (1793-1864). Autograph letter signed to an unidentified correspondent. London, 7 September 1831. 1 page. 219 x 185 mm. Traces of former mounting present, but very good. \$750

From the inventor of the "perce-pierre" lithotrite for crushing stones in the bladder (see Garrison-Morton 4290), presenting a copy of his *Cases of Lithotrixy, or Examples of the Stone Cured without Incision* (1831) to the president and members of the Royal College of Surgeons, to whom he had dedicated the work. The operation of lithotrixy, in which an instrument is inserted into the bladder through the urethra to pulverize bladder calculi, marks the beginning of minimally invasive surgery. The operation was introduced by Jean Civiale in 1826, but Heurteloup's method was superior. He moved to London in 1829, and was the first to perform lithotrixy in Great Britain. Ellis, *History of Surgery*, p. 192. 32469



Earliest Work on Arthropod Embryology

56. **Herold, Johann Moritz David** (1790-1862). (1) *Exercitationes de animalium vertebris carentium in ovo formatione. Pars prima* . . . [all published]. Folio. x, 63 [i.e., xx, 126]pp. Parallel text in Latin and German, with separate paginations for each. 2 hand-colored engraved plates, each with separate outline key and tissue guard. Marburg: Joh. Christ. Krieger & Comp., 1824. 402 x 255 mm. (uncut). Original printed boards, later cloth backstrip, light wear and spotting. Very good copy. (2) *Disquisitiones de animalium vertebris carentium in ovo formatione*. 2 parts in 1. Folio. [114]pp. Parallel text in Latin and German. 12 hand-colored engraved plates (nos. 1-4, 6-10, 12-14), some printed in colors, each plate with separate outline key and tissue guard. Frankfurt am Main: Johann David Sauerländer, [1835-]1838. 480 x 301 mm. Original printed boards, some wear to extremities and corners. Minor foxing, first outline key loose, but very good. (3)



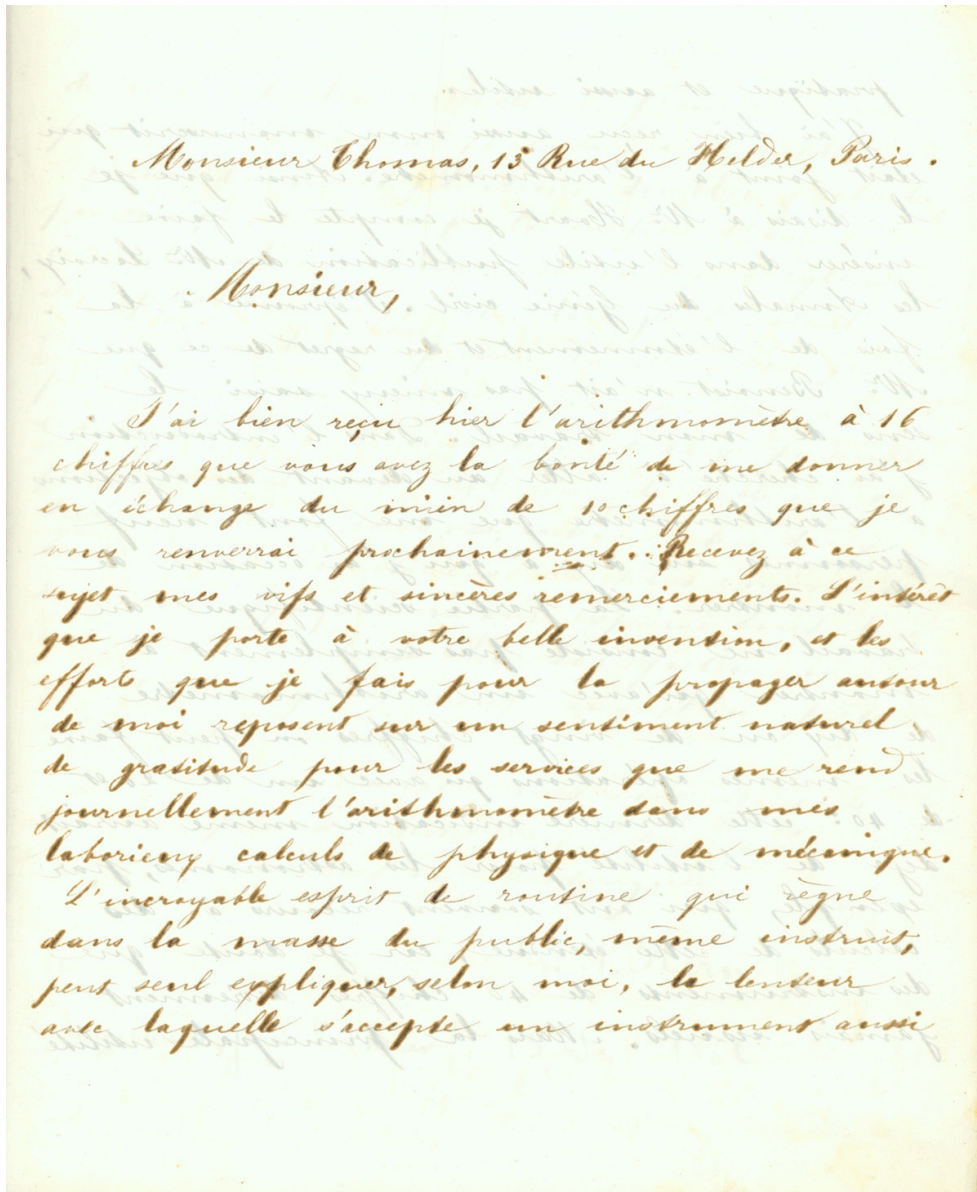
Untersuchungen über die Bildungsgeschichte der wirbellosen Thiere im Ei. [48]pp. 6 hand-colored engraved plates (nos. 5, 11, 15-18), some printed in colors, nos. 5 and 18 with separate outline keys. Berlin: Gutmann'schen Buchhandlung, 1876. 477 x 298 mm. Original printed boards, cloth back-strip, light edgewear, inner hinges cracked. Light toning, first plate a little loose, but very good. Together 3 items. \$2500

Rare First Editions of the earliest works on the embryology of arthropods (insects, spiders and related animals). Herold, professor of medicine and director of the zoological collections at Marburg, had studied the development of invertebrate embryos in the egg since 1811. He paid more than 2000 thalers of his own money to publish the *Exercitationes* and the *Disquisitiones*, which are illustrated with beautifully colored plates

made from Herold's drawings showing the eggs, embryonic stages, and adult forms of various arachnid and insect species.

The *Exercitationes* (no. [1]) describes the embryological development of spiders, and is illustrated with two hand-colored plates (each with outline key) showing the stages of growth, from egg to adult, of the common garden spider (*Aranea diadema*). The first two parts of the *Disquisitiones* (no. [2]) contain 14 hand-colored plates, some also printed in colors. The work describes and illustrates the embryological stages of various orders of insects, including the orthoptera, neuroptera, hymenoptera, hemiptera and lepidoptera; Herold was one of the first to note that newly hatched caterpillars already display male and female sex characteristics.

Sales of the first two parts of the *Disquisitiones* were so small that the publisher refused to issue the third part, which was not published until after Herold's death. This third part (no. [3]) deals with the embryological



development of the blowfly, sphinx moth, chinch bug and firefly; it contains six hand-colored plates (two with outline keys). Nissen 1912 (*Exercitationes*); 1910 (*Disquisitiones*). 40625

Unique Manuscript Archive of his Scientific Thought

57. **Hirn, Gustave Adolfe** (1815-90). Album containing crush-paper copies of ca. 600 A.Ls.s. and Ls.s. written between 13 Sept. 1862 and 9 July 1865. [Colmar, 1862-65]. 280 x 222 mm.

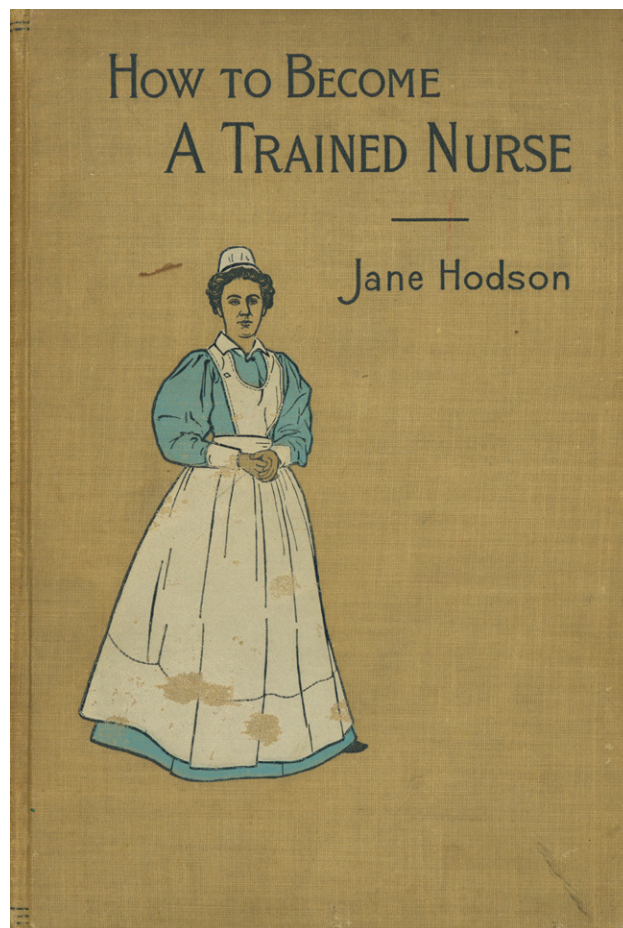
Original cloth, suede backstrip with cloth label, paper label on front cover, worn at edges, corners & spine. One or two small tears, otherwise very good internally. \$9500

Hirn, a civil engineer, was one of the first to investigate the phenomena of the steam engine, and he made several fundamental contributions to mechanics and thermodynamics, including his *Exposition analytique et expérimentale de la théorie mécanique de la chaleur* (1862), one of the first systematic treatises on thermodynamics. The album we are offering contains crush-paper copies of ca. 600 letters that Hirn wrote between 1862 and 1865, shortly after the publication

of his *Exposition analytique* (the crush-paper method of letter duplication involved pressing a freshly written letter against special absorbent paper; only one such copy could be made, so that our album is *unique*). The album almost certainly represents *the most complete manuscript archive* of Hirn's scientific thought and activity during this time, since the original letters duplicated here were sent to a number of different recipients, and many have probably not survived. Among the letters are several written to **François Napoléon Marie Moigno** (1804-84), the eminent Jesuit mathematician and physicist; one of most interesting of these is Hirn's letter to Moigno of 16 February 1864, containing a long and detailed discussion, intended for publication, of the thermodynamic principles of **Rudolf Clausius** (1822-88). Clausius's name appears numerous times in Hirn's correspondence, along with those of physicist **Léon Foucault** (1819-68) and chemist **Henri Étienne St. Claire Deville** (1818-81).

Another letter, of 13 December 1862, is to **Charles X. Thomas**, inventor of the first commercially successful calculator; Hirn thanked Thomas (also a native of Colmar) for the receipt of his 16-digit Thomas Arithmometer, which Hirn used daily in his "laborious calculations in physics and mechanics." Hirn was impressed enough with the Thomas de Colmar Arithmometer that he published a paper on it the following year ("Notice sur l'utilité de l'arithmomètre et de l'hydrostat," *Annales du génie civil*, 2nd part, 2 [1863]: 113-17; 152-64), which included "an exposition of advanced techniques which extended the arithmometer's reach beyond the apparent restrictions of the four basic arithmetical rules" (Johnston).

Other letters in the album relate to Hirn's interests in climatology and meteorology, or to his business activities as director of the mechanical department of the mill he managed jointly with his brother. It was his connection with this mill that first led Hirn to investigate the mechanics of heat. Time has permitted us to make only a cursory examination of this unique album; a thorough study will reveal other letters of equal or greater interest. *Dictionary of Scientific Biography*. Wheeler Gift for Moigno. Aspray et al., *Computing before Computers*, p. 50 (Thomas). Johnston, "Making the arithmometer count," <http://www.mhs.ox.ac.uk/staff/saj/arithmometer>. 34272



Guide to Nursing Schools in North America—First Work of its Kind

58. **Hodson, Jane**, editor. *How to become a trained nurse: A manual of information in detail*. 265pp. 35 plates, including color frontispiece; folding table; advertisements on front and rear endpapers; errata slip. New York: William Abbatt, 1898. 216 x 148 mm. Original pictorial cloth, a little worn, spine a bit darkened. Minor foxing but very good. Ownership signatures on flyleaf.

\$950

First Edition, and *rare*, with only microform and internet copies cited in OCLC. Described in the preface as "the first [work] of its kind," *How to Become a Trained Nurse* provided a comprehensive listing of training schools for nurses in the United States and Canada (including "Schools for Colored Women" and "Schools for Men"). The work also includes articles on

various aspects of professional nursing by some of the pioneers in the field, including Lillian Wald, head of the Henry Street Settlement and founder of visiting nursing in the United States and Canada. Hodson's book, published shortly after the creation of the American Nurses' Association and the National League for Nursing Education, exemplifies the movement towards the professionalization of nursing and its increased acceptance as a suitable career for women. 34375

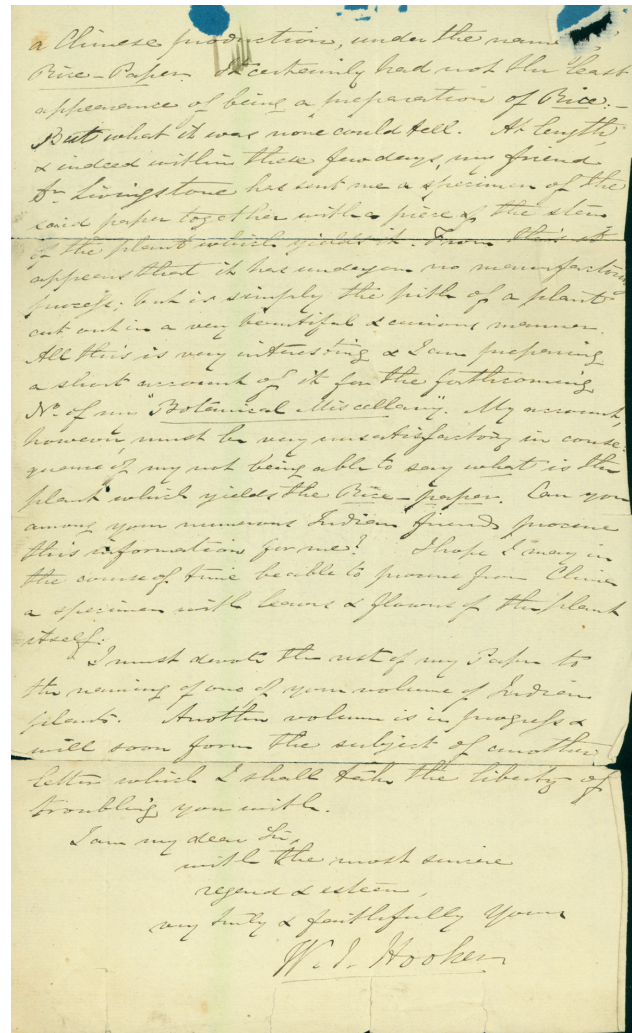
59. **Hook, Diana and Jeremy Norman.** Origins of cyberspace: A library on the history of computing, networking and telecommunications. With contributions by Michael R. Williams. 670pp. 284 illustrations. Printed in two colors. Novato: Historyofscience.com, 2002. Cloth. Limited to 500 copies. \$500

Extensively annotated and illustrated bibliography describing 1411 books, technical reports, pamphlets, blueprints, typescripts, manuscripts, photographs and ephemera on the history of computing and computer-related aspects of telecommunications. Covering the period from the 17th century to ca. 1970, the work includes several lengthy essays and a timeline of significant events and publications in computer history. Indexed. 38301

About "Rice Paper"

60. **Hooker, William Jackson** (1785-1865). Autograph letter signed to an unidentified recipient. Glasgow, April 7, 1828. 2pp. 323 x 202 mm. Tears along horizontal creases and in margins repaired, small hole in upper left corner (not affecting text), traces of mounting on verso. Very good. \$1500

Letter with excellent scientific content from W. J. Hooker, the first full-time director of the Royal Botanic Gardens at Kew. Hooker devoted himself to the study of botany from an early age, specializing in mosses, liverworts and other cryptogamia. He served as regius professor of botany at the University of Glasgow from 1820 to 1841, when he was appointed to head Kew Gardens. Under Hooker's leadership Kew grew from eleven acres to its present size of nearly 300 acres,



and its collections vastly increased, largely due to a network of Hooker's former students who brought in specimens from around the world. Hooker's own herbarium, which contained some 4000 volumes and one million dried plant specimens, was purchased by the British government for the nation after Hooker's death. Hooker was the author of over two dozen works on botany, including *British Jungermanniae* (1816), which established hepaticology (the study of liverworts) as a separate field; he also edited several botanical journals. Hooker's letter, written during his tenure at the University of Glasgow, includes a discussion of the "rice-paper plant" (*Tetrapanax papyrifera* [Hook.] Koch), a subject of lasting interest to him. The pith of this plant, which can be sliced into very thin sheets, was used in China as an alternative to paper, and in the 1820s the Chinese began producing pith-paper paintings and other artifacts for the European market. Hooker had

just received a sample of this “rice paper” from a Dr. Livingstone, who in 1805 brought the first examples of the material to England:

I am extremely interested at this time about a substance which we have long known as a Chinese production, under the name of Rice-Paper. It certainly has not the least appearance of being a preparation of Rice: But what it was none could tell. At length, & indeed within these few days, my friend Dr. Livingstone has sent me a specimen of the said paper together with a piece of the stem of the plant which yields it. From this it appears that it has undergone no manufacturing process, but is simply the pith of a plant cut out in a very beautiful & curious manner. All this is very interesting & I am preparing a short account of it for the forthcoming No. of my “Botanical Miscellany.” My account, however, must be very unsatisfactory in consequence of my not being able to say what is the plant which yields the Rice-paper. Can you among your numerous Indian friends procure this information for me?

Hooker’s short account, titled “Some account of the substance commonly known under the name ‘Rice Paper,’” appeared in Vol. 1 of the *Botanical Miscellany* (1830). Between 1850 and 1856 Hooker published four more papers on the “rice paper” plant, which he named *Aralia Papyrifera*, Hook., classifying it as a member of the *Araliaceae* (ginseng) family. His complete scientific description of the plant, based on living specimens he had received in 1852 and 1855, appeared in Vol. 12 of *Curtis’s Botanical Magazine* (1856). In 1859 the German botanist Karl Koch gave the plant its present scientific name.

Hooker’s letter also discusses the identification of drawings of Indian botanical specimens he had undertaken for his correspondent:

. . . I have not lost sight of the request you made to me, to name the drawings in your volumes of Indian Plants. This I am proceeding with & shall communicate to you from time to time. I have first taken in hand the volume of Grasses: & having completed that, I am desirous of sending you my notes upon its contents. The simple names are sufficient, where I am certain the plant is a described one, but of some I am doubtful, & indeed they probability is that they are new:-- though that cannot satisfactorily be determined



without I had at the same time access to specimens. . . .

“Chinese Botanical Paintings, *Tetrapanax papyrifera* (Hook.)Koch,” Harvard University Herbaria (internet resource). 40863

Dedication Copy, With an Inscribed Photograph of the Author

61. **Hopewell-Smith, Arthur** (1865-1931). Dental microscopy. xxviii, 119pp. 8 lithograph plates after the author’s drawings, text illustrations. London: Dental Manufacturing Company; Philadelphia: S. S. White Dental Manufacturing Company, 1895. 248 x 181 mm. Tree calf gilt ca. 1895, rebaked, minor wear. *The Dedication Copy*, with Hopewell-Smith’s autograph inscription to dedicatee Charles Sissmore Tomes (1846-1928) on the verso of the front free endpaper: “To Charles Sissmore Tomes Esq. as a mark of appreciation of & admiration for his splendid services to

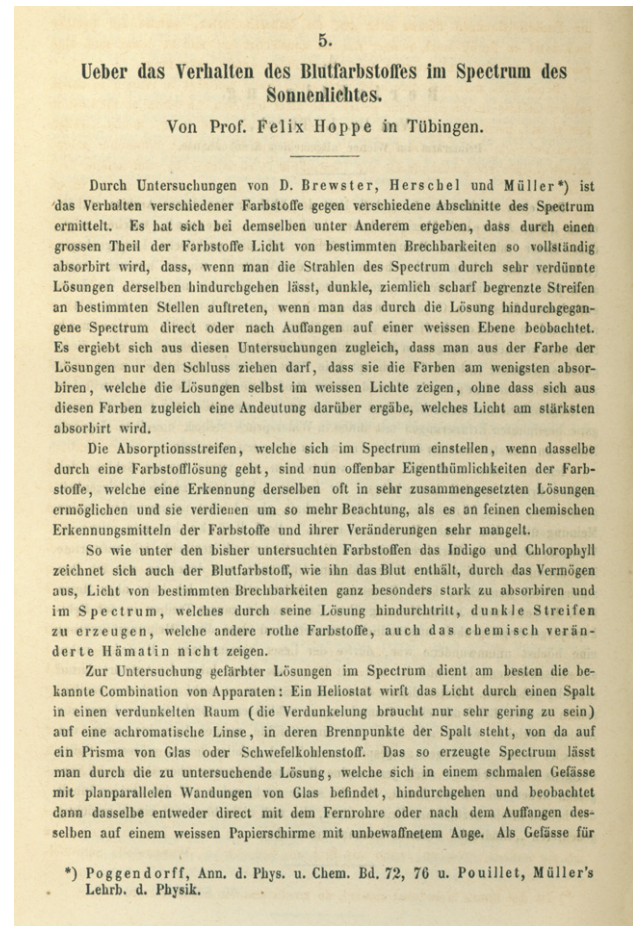
dental science from Arthur Hopewell Smith. Boston June 1895." On the page opposite the inscription is mounted a portrait photograph of Hopewell-Smith (160 x 118 mm.) inscribed in the same hand "Yours sincerely Arthur Hopewell-Smith." \$1500

First Edition. Hopewell-Smith was a specialist in dental histology, having served as a lecturer and demonstrator at the Royal Dental Hospital of London before coming to the United States to take the position of professor of dental histology at the University of Pennsylvania. He was known for "the striking excellence of his practical work in preparing sections of dental tissues and in photomicrography" (*British Medical Journal* 1, no. 3665 [1931]: 606). Hopewell-Smith dedicated *Dental Microscopy* to the eminent British dentist Charles Sissmore Tomes, consulting dental surgeon at the Royal Dental Hospital and author of *Manual of Dental Anatomy Human and Comparative* (1882 and later eds.). We are offering the dedication copy of Hopewell-Smith's work, inscribed to Tomes and with a signed portrait photograph of the author. 40504

Hemoglobin

62. **Hoppe-Seyler, Felix** (1825-95). Ueber das Verhalten des Blutfarbstoffes im Spectrum des Sonnenlichtes. In *Archiv für pathologischen Anatomie und Physiologie und für klinische Medicin* 23 (1862): 446-49. Whole volume. iv, 596pp. 7 lithograph plates. 210 x 132 mm. Half cloth c. 1862, some wear at extremities and corners. Light toning, but very good. 19th century bookplate of the Medical Library of the New York State Lunatic Asylum. \$950

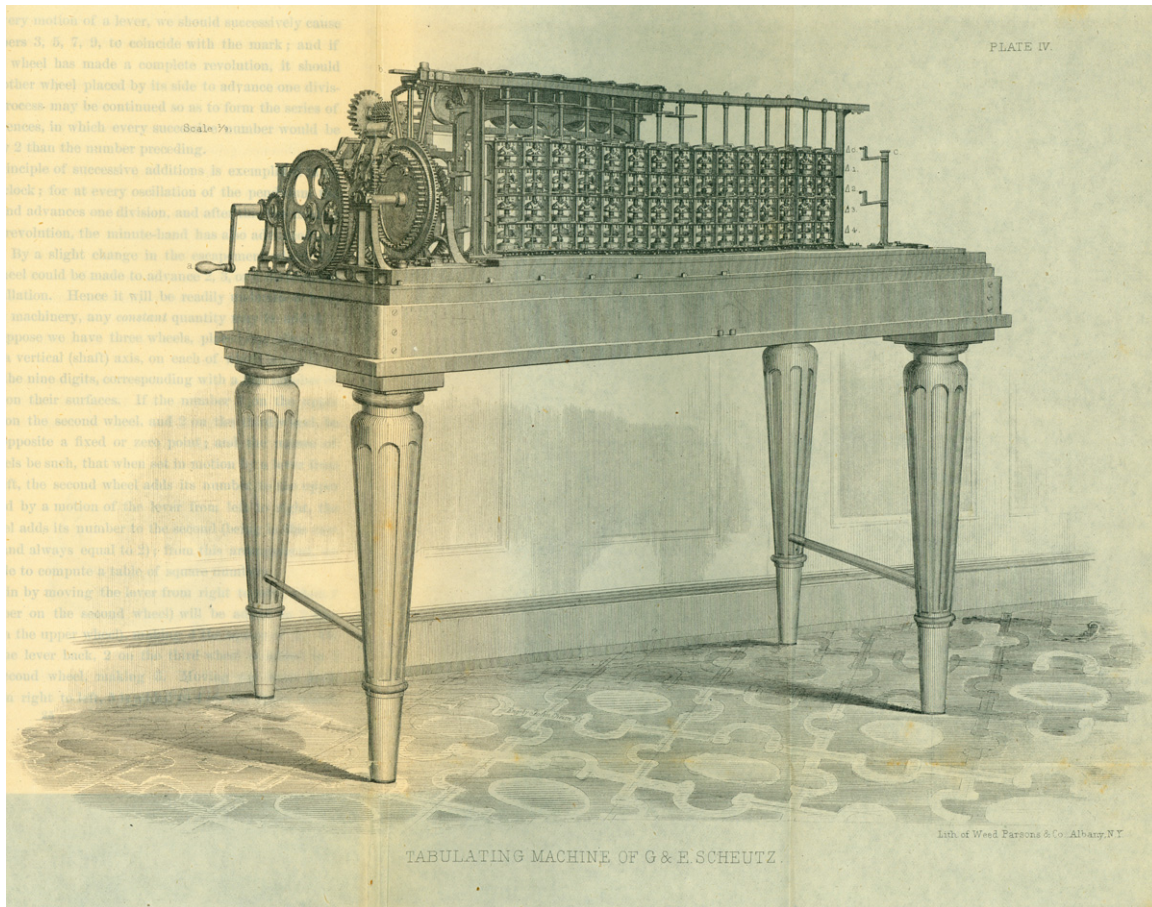
First Edition, journal issue. Hoppe-Seyler was the first to describe the optical absorption spectrum of purified red blood pigment, which he named hemoglobin. He described hemoglobin's two distinctive absorption bands, and confirmed that hemoglobin contains iron. The present paper introduced the new spectroscopy of Bunsen and Kirchhoff into medical chemistry. *Dictionary of Scientific Biography.* Garrison-Morton 870. 40602



The Scheutz Machine

63. **Hough, George Washington** (1836-1909).] The Swedish tabulating machine of G. & E. Scheutz. In *Annals of the Dudley Observatory* 1 (1866): 116-126, plate. Whole volume. lxxvii, 126, [2], 126pp. 16 plates. 227 x 142 mm. Morocco spine, cloth boards in antique style. Tabulating machine plate and last leaf repaired, light toning, library stamp and perforations on title, but very good. \$3750

First Edition. A description of the Scheutz Difference Engine no. 2, constructed by the Swedish father-and-son team of Georg and Edvard Scheutz and completed in October 1853. The Scheutzes were the first to construct a working difference engine capable of producing printed mathematical tables. The Scheutz machine, of which three examples were built, was based



upon Charles Babbage's design for his famous Difference Engine no. 1, which Babbage worked on intermittently between 1822 and 1834 before abandoning the project uncompleted.

Georg Scheutz—described by Lindgren as an “auditor, printer, journalist and editor, political commentator, spokesman for technology, translator and inventor”—first learned of Babbage's Difference Engine circa 1830. Although his imagination was immediately fired by the possibilities of such a machine, he was unable to begin designing his own version until 1834, when Dionysius Lardner published his detailed review of Babbage's Difference Engine in the July issue of the *Edinburgh Review*. Drawing on the information in Lardner's article, Scheutz and his teenage son Edvard began working on their own design for a difference engine, which was both simpler and cheaper to produce than Babbage's machine. The first Scheutz difference engine (no. 1), a trial device, was completed in 1843. A decade later, the Scheutzes produced their first operational engine, the Scheutz Difference Engine no. 2. In 1863 the Scheutzes built their third and final dif-

ference engine for the Registrar General's Office in London.

The Scheutzes worried that Babbage might view them as competitors, but instead he welcomed their contributions, and assisted them in publicizing their machine. Through Babbage's auspices the Scheutz Difference Engine no. 2 was put on display at the Royal Society in November 1854. It won a gold medal at the Great Exposition in Paris in 1855, and in 1857 the Dudley Observatory in Albany, New York, purchased it for the sum of \$5000 for the purpose of calculating astronomical tables, a task for which it was little used. In 1924 the machine was sold to the Felt and Tarrant Company of Chicago, a manufacturer of calculating machines. The machine was later acquired by the Smithsonian Institution. Lindgren, *Glory and Failure: The Difference Engines of Johann Müller, Charles Babbage and Georg and Edvard Scheutz* (1987). Merzbach, *Georg Scheutz and the First Printing Calculator* (1977). *Erwin Tomash Library on the History of Computing* H 171. 40603

A RELATION BETWEEN DISTANCE AND RADIAL VELOCITY
AMONG EXTRA-GALACTIC NEBULAE

By EDWIN HUBBLE

MOUNT WILSON OBSERVATORY, CARNEGIE INSTITUTION OF WASHINGTON

Communicated January 17, 1929

Determinations of the motion of the sun with respect to the extra-galactic nebulae have involved a K term of several hundred kilometers which appears to be variable. Explanations of this paradox have been sought in a correlation between apparent radial velocities and distances, but so far the results have not been convincing. The present paper is a re-examination of the question, based on only those nebular distances which are believed to be fairly reliable.

Distances of extra-galactic nebulae depend ultimately upon the application of absolute-luminosity criteria to involved stars whose types can be recognized. These include, among others, Cepheid variables, novae, and blue stars involved in emission nebulosity. Numerical values depend upon the zero point of the period-luminosity relation among Cepheids, the other criteria merely check the order of the distances. This method is restricted to the few nebulae which are well resolved by existing instruments. A study of these nebulae, together with those in which any stars at all can be recognized, indicates the probability of an approximately uniform upper limit of the absolute luminosity of stars, in the late-type spirals and irregular nebulae at least, of the order of M (photographic) = -6.3 .¹ The apparent luminosities of the brightest stars in such nebulae are thus criteria which, although rough and to be applied with caution,

The Expanding Universe

64. **Hubble, Edwin** (1889-1953). A relation between distance and radial velocity among extra-galactic nebulae. In *Proceedings of the National Academy of Sciences* 15 (1929): 168-173. Whole volume, 8vo. ix, 924pp. 245 x 168 mm. Morocco spine, marbled paper boards in antique style.

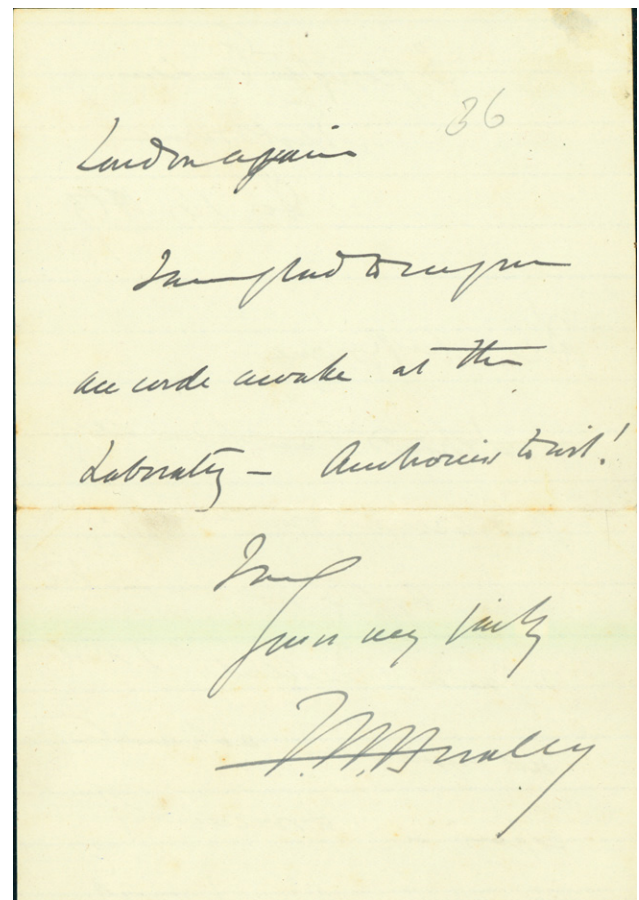
Minor toning and finger-soiling, but very good.

\$4750

First Edition. Hubble's first paper on his discovery of what is now known as Hubble's Law: recession velocity between various galaxies and the earth is proportional to their distance from us, indicating an expanding universe. The recession velocities of these galaxies were inferred from their redshifts, many of which had been measured over a decade earlier by astronomer Vesto Slipher, who related the redshifts to velocity. In combining Slipher's redshift measurements with his own measurements of galaxy distances, Hubble discovered a rough proportionality between the two. By plotting a trend line through the 46 galaxies he studied, he obtained a value for the expansion rate (now called the Hubble constant) of 500km/s/Mpc—a value much higher than the currently accepted 70.1 ± 1.3 km/s/Mpc, due to errors in Hubble's distance calculations.

Hubble's discovery provided the first observational support for the "Big Bang" theory proposed in

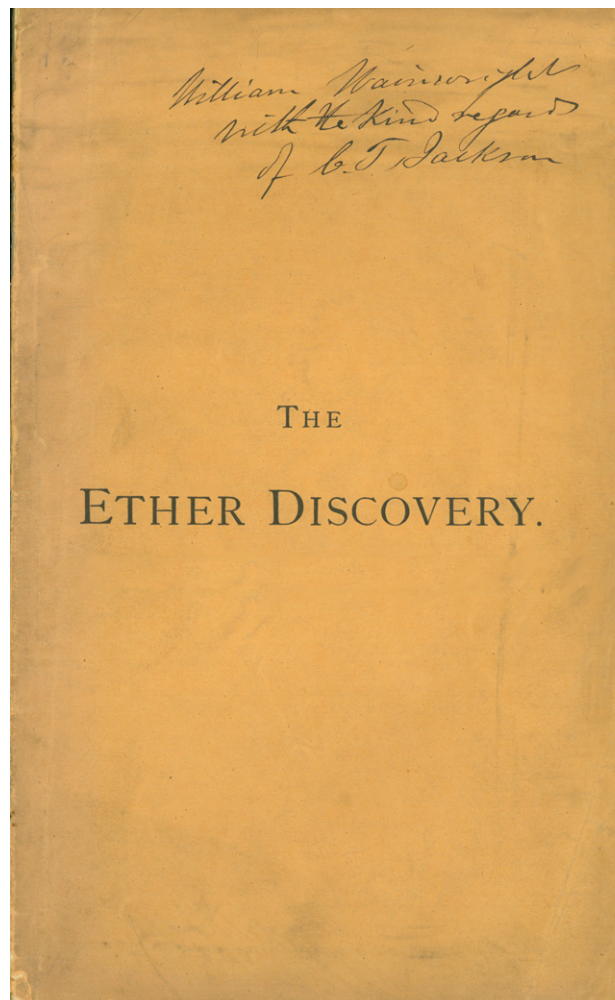
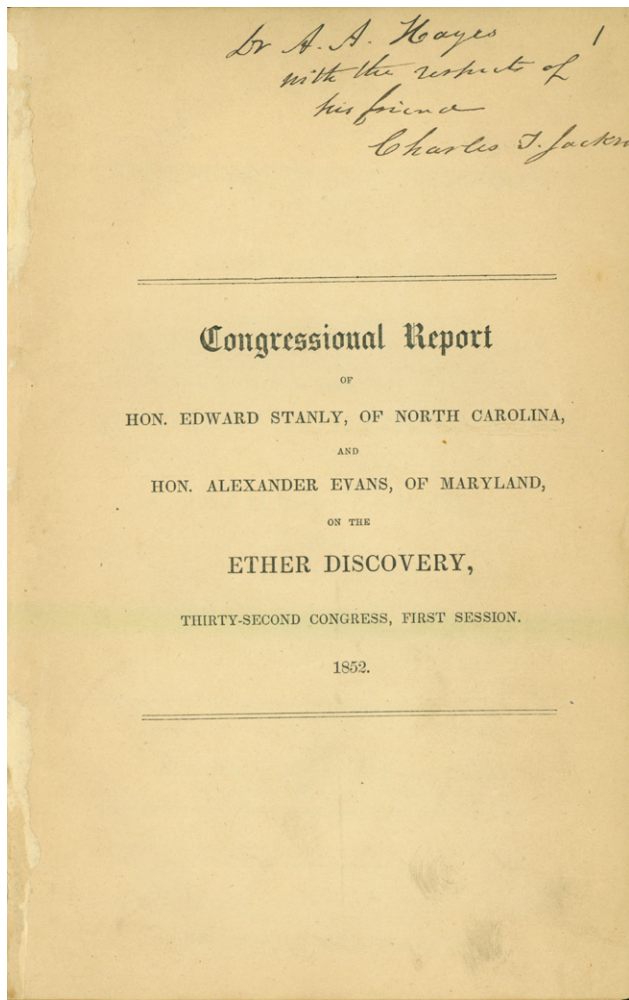
1927 by Georges Lemaître, and led to wider acceptance of the concept of an expanding universe. "Though only six pages in length, Hubble's first paper on the velocity-distance relation represented a giant step in modern cosmology. . . . In place of a static picture of the cosmos, it seemed to many that the universe must be regarded as expanding, the rate of the mutual recession of its parts increasing with their relative distance" (Christianson, p. 191). Hubble's discovery "made as great a change in man's conception of the universe as the Copernican revolution 400 years before" (*Dictionary of Scientific Biography*). Christianson, *Edwin Hubble: Mariner of the Nebulae*, pp. 188-92. 40601



On Oysters

65. **Huxley, Thomas** (1825-95). Autograph letter signed to Mr. Bourne. Eastbourne, Dec. 14, 1889. 2pp. Very good. \$750

"I should have been very glad to send you a copy of my Oyster paper—but so far as I recollect I did not have any separate copies. However I will look when I



visit London again.” The “Oyster paper” was most likely Huxley’s “Oysters and the oyster question” (*English Illustrated Magazine* [1883-84]: 47-55, 112-121), written in Huxley’s capacity as Inspector of Fisheries. 40854

Supporting Jackson’s Priority in the Ether Controversy—Inscribed by Jackson to his Friend A. A. Hayes

66. **Jackson, Charles Thomas** (1805-80)]. **Stanly, Edward** and **Alexander Evans**. Report to the House of Representatives of the United States of America, vindicating the rights of Charles T. Jackson to the discovery of the anaesthetic effects of ether vapor, and disproving the claims of W. T. G. Morton to that discovery. 57pp. [Boston:

Rand, Avery & Frye, 1853.] 221 x 145 mm. Quarter morocco, marbled boards in antique style, original front wrapper preserved. Very good copy, *inscribed by Jackson* on the front wrapper: “Dr. A. A. Hayes with the respects of his friend Charles T. Jackson.” \$2000

First Edition, issue with front wrapper title reading “Congressional report . . .” The “Ether Controversy,” a rancorous dispute between W. T. G. Morton, Charles T. Jackson and Horace Wells over who deserved the credit for discovering inhalation anesthesia, began in 1847 and ended only with Morton’s death in 1868. In late November 1851 Morton, who had hoped to make his fortune from ether anesthesia, made his third petition to Congress for a monetary reward for the discovery. Morton’s claims to priority were reviewed by a congressional committee headed by William H. Bissell. The Bissell committee issued a report



in favor of Morton, but two dissenting members, Edward Stanly and Alexander Evans, authored the present minority report supporting Jackson's priority. There are two issues of the report, one with the front wrapper title beginning with the words "Congressional Report," and the other reading "The Ether Discovery"; see below. Jackson presented this copy to his friend Augustus A. Hayes, a Boston chemist who developed a method of distilling concentrated chloric ether for use as an anesthetic; see Warren, J. M., *Surgical Operations with Cases and Observations* (1867), p. 618. Wolfe, *Tarnished Idol*, ch. 17. 40867

Variant Issue, Inscribed by Jackson

67. **Jackson, Charles Thomas** (1805-80)]. **Stanly, Edward** and **Alexander Evans**. Another copy, issue with front wrapper reading "The Ether Discovery." 242 x 152 mm. Original printed wrappers, spine chipped. Very good copy, *inscribed by Jackson* on the front wrapper: "Wil-

liam Wainwright with the kind regards of C. T. Jackson." \$1500

First Edition, issue with front wrapper title reading "The Ether Discovery." See above. There are two issues of the report, one with the front wrapper title beginning with the words "Congressional Report," and the other reading "The Ether Discovery." Jackson inscribed this copy of the report to a William Wainwright, whom we have not been able to identify. Wolfe, *Tarnished Idol*, ch. 17. 34341

Rare Signed Invitation to the World's First Serious Science Fiction Film, with Promotional Brochure

68. **Lang, Fritz** (1890-1976) and **Thea von Harbou** (1888-1954). (1) *Frau im Mond*. Printed invitation featuring artwork of a lunar scene from the film, **signed and dated in pencil by Lang**, the

director of the film, and also **signed by von Harbou**, the author of the novel on which the film was based. Single sheet, folded to 242 x 158 mm., inside blank. (2) Frau im Mond. Promotional brochure featuring scenes from the film with descriptive text. 8pp. Original printed self-wrappers. 301 x 220 mm. Together two items, framed together under UV plexiglass (frame measures approx. 450 x 555 mm.). Berlin, 1929. Both items creased horizontally, but very good otherwise, and very attractively framed. \$4500

Rare Signed Invitation and program issued in conjunction with the release of Fritz Lang's silent film *Frau im Mond* (Woman in the Moon), generally recognized as one of the world's first serious science fiction films, and the first to present the basics of rocketry to a mass audience. Among the highlights of the film are the use of a multi-stage rocket and the first "count-down to zero" scene prior to a rocket launch. Rocketry pioneers Hermann Oberth and Willy Ley both served as consultants on the film, which was based on the novel *Die Frau im Mond* (1928) by Thea von Harbou, Lang's then-wife and collaborator. Lang's signature on the invitation is dated "18.XI.29," roughly a month after the film's release in Berlin on October 15, 1929. 40862

The Binary System

69. **Leibniz, Gottfried Wilhelm** (1646-1716). Explication de l'arithmétique binaire, qui se sert des seuls caracteres 0 & 1; avec des remarques sur son utilité, & sur ce qu'elle donne le sens des anciens figures chinoises de Fohy. In *Histoire de l'Académie Royale des Sciences année MDCCIII avec les memoires de mathématique & de physique, pour la même année* (1705): 85-89 (*Mémoires*). [With] [Fontanelle, Bernard le Bouyer]. Nouvelle arithmétique binaire. In *ibid.*: 58-63 (*Histoire*). Whole volume, 4to. [10], 148 (*Histoire*), 467 (*Mémoires*)pp., plus errata leaf. Engraved frontispiece and 12 plates (some folding). 248 x 184 mm. Full calf in period style, original marbled front wrapper preserved. Old stamps of the Biblio-

thèque de l'Université de Toulouse and P. Se[...]naire de Grenoble on title, Toulouse library stamp also on plate versos. **Sold**

First Edition of Leibniz's landmark paper on binary (base 2) arithmetic, whose "0's" and "1's" form the basis of electronic computing. Although other mathematicians previous to Leibniz, including Blaise Pascal, had experimented with binary and other non-decimal systems in their writings, Leibniz's paper was the first publication on binary arithmetic to have a significant impact on the scientific community. After its publication, the binary system became a popular subject of study for European mathematicians of the period.

Leibniz's *Explication de l'arithmétique binaire* was his first publication on a topic that had interested him for over two decades (his earliest work on binary arithmetic was an unpublished manuscript entitled "De progressio dyadica" [1679; facsimile ed. 1966] in which he proposed a design for a binary calculating machine). Leibniz saw binary numeration, which reduces all numbers to expressions involving only 0 and 1, as a means of both simplifying calculation and uncovering fundamental principles of number theory. Further, binary arithmetic was for Leibniz an essential key to the discovery of philosophical and theological truths: In a letter to the Duke of Brunswick written on January 2, 1697, Leibniz claimed that binary arithmetic could be seen as an "imago Creationis" (image of the Creation), since "nothing is a better analogy to, or even demonstration of such creation than the origin of numbers as here represented, using only unity and zero or nothing" (quoted in Glaser, p. 31).

In 1701 Leibniz sent an account of his ideas on binary arithmetic to Joachim Bouvet, a member of the Jesuit Mission in China, with whom he had been corresponding since 1697. Bouvet immediately recognized the correspondence between Leibniz's binary notation and the hexagrams of the Yijing (I Ching) or Book of Changes, an ancient Chinese system of philosophy and cosmology based on the dynamic balance of opposites (yin and yang). Bouvet communicated his discovery to Leibniz in a letter written on November 14, 1701, which reached Leibniz on April 1, 1703. In his letter he enclosed a woodcut of the binary arrangement of hexagrams attributed to Fu Xi, the mythical first emperor of China, but in reality derived from the 11th-century *Huangji jingshi shu* (Book of sublime principle which

TABLE 86 MÉMOIRES DE L'ACADEMIE ROYALE
DES
NOMBRES. bres entiers au-dessous du double du plus haut degré. Car icy, c'est comme si on disoit, par exemple, que 111 ou 7 est la somme de quatre, de deux & d'un. Et que 1101 ou 13 est la somme de huit, quatre & un. Cette propriété sert aux Effayeurs pour peser toutes sortes de masses avec peu de poids, & pourroit servir dans les monnoyes pour donner plusieurs valeurs avec peu de pieces. Cette expression des Nombres étant établie, sert à faire tres-facilement toutes sortes d'operations.

1000	4	100	1	1000	8
100	1	10	1	100	4
10	1	1	1	10	1
1	1	1	1	1	1

Pour l'Addition par exemple.

110	6	101	5	1110	14
111	7	1011	11	10001	17
1101	13	10000	16	11111	31

Pour la Soustraction.

1101	13	10000	16	11111	31
111	7	1011	11	10001	17
110	6	101	5	1110	14

Pour la Multiplication.

11	3	101	5	101	5
11	3	101	5	101	5
11	3	101	5	101	5
11	3	101	5	1010	10
1001	9	1111	15	11001	25

Pour la Division.

11	3	101	5
11	3	101	5
11	3	101	5
11	3	101	5

Et toutes ces operations sont si aisées, qu'on n'a jamais besoin de rien essayer ni deviner, comme il faut faire dans la division ordinaire. On n'a point besoin non-plus de rien apprendre par cœur icy, comme il faut faire dans le calcul ordinaire, où il faut sçavoir, par exemple, que 6 & 7 pris ensemble font 13; & que 5 multiplié par 3 donne 15, suivant la Table d'une fois un est un, qu'on appelle Pythagorique. Mais icy tout cela se trouve & se prouve de source, comme l'on voit dans les exemples précédens sous les signes ⊕ & ⊙.

governs all things in the world) by the Chinese scholar Shao Yong (1011-77). Shortly after receiving Bouvet's letter, Leibniz sent his *Explication de l'arithmétique binaire* to be published in the *Mémoires* of the Académie Royale des Sciences; in it, he laid out the principles of binary arithmetic and discussed its remarkable correspondence with the hexagrams of the Yijing.

Bernard le Bouyer Fontanelle, secretary of the Académie, published an anonymous review of Leibniz's *Explication* in the *Histoire de l'Académie Royale des Sciences* for 1703, bound together with the *Mémoires*. "Fontanelle pointed out that ten need not be the base of our arithmetic, and that indeed certain other bases would have advantages over it. . . He reported that Leibniz had worked with the simplest of all possible bases, base two. . . Fontanelle reported further that Leibniz had communicated this binary arithmetic in 1702, but had asked that no mention of it be made in the *Histoire* until he could supply an application. This application eventually came forth in the binary interpretation of the Figures of Fohy [Fu Xi]" (Glaser, p. 44). Glaser, *History of Binary and Other Nondecimal*

Reprinted from the Transactions of the Association of American Physicians, 1923

A HITHERTO UNDESCRIBED FORM OF VALVULAR AND MURAL ENDOCARDITIS*

By EMANUEL LIBMAN, M.D.
AND
BENJAMIN SACKS, M.D.
NEW YORK

In previous communications¹ cases of endocarditis were classified as rheumatic, syphilitic, acute bacterial and subacute bacterial. We have introduced the designation "indeterminate" for an additional group of cases concerning which very little is known. The term is used to include (a) the cases of so-called "terminal" endocarditis and (b) cases of atypical verrucous endocarditis. The object of the present communication is to discuss the cases included in the latter group, which we believe represent a hitherto undescribed form of endocarditis.

In a study of the postmortem material of the Mount Sinai Hospital, two cases of endocarditis were encountered which showed valvular and mural lesions of a peculiar type. These lesions were free from bacteria when studied by the usual methods and differed in morphology and localization from those found in rheumatic and subacute bacterial endocarditis as well as other forms of endocarditis. Moreover, both cases showed fibrinous pericarditis, but there were no Ashoff bodies in the myocardium. Because of the unusual character of the endocardial lesions and their verrucous appearance, these cases were designated: "atypical verrucous" endocarditis. When this form of endocarditis is better understood a more appropriate nomenclature will doubtless be introduced.

* From the Medical and Pathological Departments, Mount Sinai Hospital, New York.

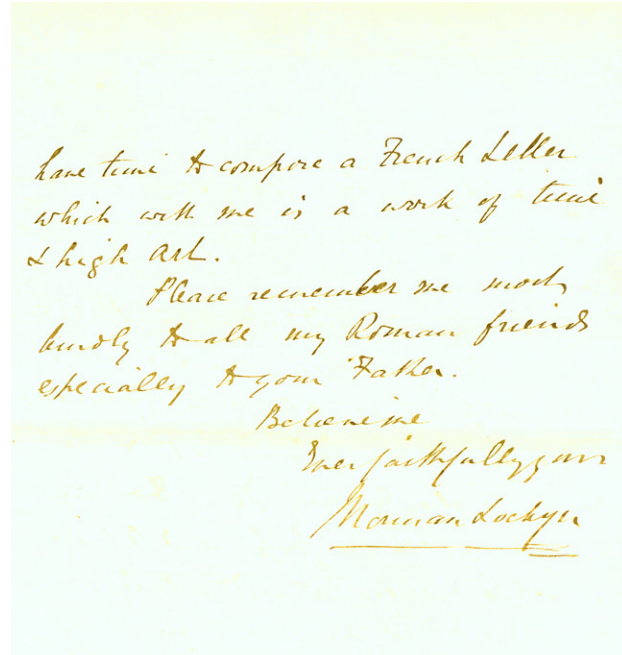
Numeration, pp. 31-44. Ifrah, *The Universal History of Computing*, pp. 87-92. Ryan, "Leibniz's binary system and Shao Yong's Yijing," *Philosophy East and West* 46 (1996) [internet source]. Lodder, "Binary arithmetic: From Leibniz to Von Neumann" [internet source]. 40859

Libman-Sacks Disease

70. **Libman, Emanuel** (1872-1946) and **Benjamin Sacks** (1896-1971). A hitherto undescribed form of valvular and mural endocarditis. Offprint from *Transactions of the Association of American Physicians* 38 (1923). 14pp. 230 x 153 mm. Without wrappers as issued. Fine copy. \$750

First Edition, Offprint Issue of Libman and Sacks's first paper on Libman-Sacks endocarditis, a form of nonbacterial endocarditis that is one of the most common cardiac symptoms of lupus. The follow-

ing year Libman and Sacks published an expanded account of the disease (largely based on the present paper) in *Archives of Internal Medicine* (see Garrison-Morton 2855). 40844



From the Co-Discoverer of Helium

71. **Lockyer, J. Norman** (1836-1920). Autograph letter signed to Volpicelli. [London,] January 24, [1876]. 3pp. 228 x 187 mm. Fine. Docketed by recipient. \$375

From Norman Lockyer, co-discoverer of the element helium and founder of the scientific journal *Nature*, to the son of Italian physicist Paolo Volpicelli (1804-79). Lockyer had recently been appointed to Britain's Science and Art Department, a government body headquartered in South Kensington and dedicated to the promotion of education in art, science, technology and design. His letter to Volpicelli concerns a planned exhibition of scientific apparatus:

I am sure you will forgive me for so long a silence as you can form an idea of the tremendous pressure upon us all here in connection with the Scientific Collection. . . .

We are alarmed about the Italian part of the Collection as there has been such a long delay; the

German and French are overwhelming us & the success is already assured. Do use your power in the press and let me know how matters stand. Italy which should stand first seems as if she is not going to be represented at all. Stir up Blaserna and Respighi to whom I shall write as soon as I have time to compose a French letter which with me is a work of time & high art.

The two names mentioned here refer to Italian physicists Pietro Blaserna (1836-1918) and Lorenzo Respighi (1824-89). Lockyer's letter also refers to papers by physicist Paolo Volpicelli, the father of his correspondent, which apparently were to be translated in *Nature*:

One of your Father's papers has been translated & the other is in hand. The latter has to be delayed as we have a steel engraving of Wheatstone [Charles Wheatstone (1802-75), one of the inventors of the telegraph] to accompany it.

32457

First Work on Blood Transfusion by an Italian Author

72. **Manfredi, Paolo** (d. 1716). De nova et inaudita medico-chirurgica operatione sanguinem transfundente de individuo ad individuum . . . 4to in 8's. 32pp. 2 engraved plates in facsimile. Rome: typis Nicolai Angeli Tinassii, 1668. 209 x 137 mm. Modern wrappers. Some toning and spotting, lower margins a bit frayed, old stamp on title. Copious notes in Latin in an early hand, discussing classical and contemporary references to human blood, on the blank verso of the title and on the first leaf of text. Very good copy. Boxed. \$4750

First Edition in Latin of the first work on transfusion by an Italian. An Italian edition was issued in Rome by a different publisher in the same year. The title of this extremely rare pamphlet may be translated as *On the New and Unheard of Medical-Surgical Operation Transfusing Blood from Individual to Individual, First in Animals and then in Man*. It provides a sense of the sensational aspect of the new procedure of transfusion.