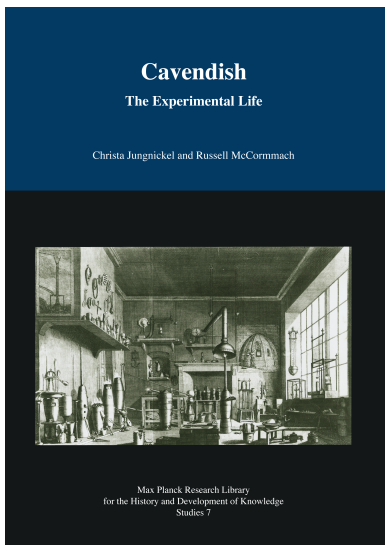


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Christa Jungnickel and Russell McCormach:

Introduction: The Problem of Cavendish



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Introduction: The Problem of Cavendish

Henry Cavendish, 1731–1810, has been described in superlatives, which are often of praise or wonder. On matters of intellect and fortune, he has been called “the wisest of the rich and the richest of the wise.”¹ In his dedication to science, he has been compared with “the most austere anchorites,” who were “not more faithful to their vows.”² Concerning his ability, Humphry Davy called him the greatest English scientist since Newton.³ Superlatives of another kind have been used as well. Cavendish was a man of a “most reserved disposition,” of a “degree bordering on disease.”⁴ Cavendish was, to be sure, one of the best scientists, one of the richest men of the realm, a scion of one of the most powerful aristocratic families, a man of strange behaviors, and a scientific fanatic.

Until we looked closely at the life of his father, Lord Charles Cavendish, 1704–83, we did not have a firm understanding of Henry’s life. Coming from a family of politicians, Lord Charles predictably entered public life as a politician. While he was active in politics, he also pursued science as a side interest, at a certain point leaving politics and becoming more involved with science. His direction was continued by his son Henry, who made a complete life within science. The scientific calling of Charles and Henry Cavendish found a congenial home in the Royal Society of London.

By the time Henry joined his father in the Royal Society, it had been in existence for a century. A legacy of the Scientific Revolution, it retained a measure of its revolutionary potential in English society, as shown by the lives of Charles and Henry Cavendish. Charles found support in the Royal Society for his move from a traditional aristocratic career in politics to the uncommon life of an aristocrat *seriously* engaged in science; his son Henry began where his father left off, on a course of scientific experiment, observation, and theory in close association with the Royal Society. In its membership, the Royal Society was selective, but in its understanding of science, it offered an acceptable path of *public* service, which was taken by our branch of the Cavendish family. Owing to the Society, the lives of Charles and Henry Cavendish were, in part, public careers in science.

Charles Cavendish’s attention to the affairs of the Royal Society was extraordinary by any standard: with the exception of the officers, no member of the Society gave more of his time than he did. Having made no major discovery, he has entered the history of science as, at most, a footnote, but in a biography of the discoverer Henry Cavendish, he holds an important place. Lionel Trilling’s stricture that “every man’s biography is to be understood in relation to his father”⁵ may not be a practical guide for all biographers, but for biographers of Henry Cavendish, it is indispensable. We have written this book as a biography of father and son.

¹J.B. Biot (1813, 272–273, on 273).

²Georges Cuvier (1961, 227–238, on 236).

³Humphry Davy, quoted in John Davy (1836, 222).

⁴Henry Brougham (1845, 444). Thomas Thomson (1830–1831, 1:337).

⁵Lionel Trilling (1949, 15).

Historians of science know of Cavendishes earlier than Charles. Richard Cavendish, one of the Cavendishes of Suffolk from whom the Devonshires descended, was an Elizabethan politician and scholar—for twenty-eight years he was a student at Cambridge and Oxford—who translated Euclid into English and wrote poems including (and in spirit foreshadowing our Henry Cavendish) *No Joy Comparable to a Quiet Minde*, which begins, “In loathsome race pursued by slippery life [...]”⁶ The namesake of one of our Cavendishes, Charles Cavendish, a seventeenth-century politician, solved mathematical problems, performed experiments, improved telescopes, and corresponded with inventors of world systems. This Charles was “small and deformed,” but he had a beautiful mind. In a time of violent controversy, he advocated cooperation as the way to truth, subscribing to Descartes’ maxim, “to strive to vanquish myself rather than fortune and to change my desires rather than the order of the world.”⁷ This Charles and his older brother William, duke of Newcastle, who had a scientific laboratory, were friends of Thomas Hobbes, the philosopher who envisioned a state of war of each against all, and who also wrote the most original scientific philosophy in England. Hobbes tutored and influenced three generations of the other main branch of the Cavendishes, the earls, not yet dukes, of Devonshire. He moved in the great houses of the Cavendishes, Chatsworth and Hardwick Hall, and in the Cavendish library he found the true university that he had not found in Oxford.⁸

By Charles Cavendish’s time, science was not exclusively a male preserve: Margaret Cavendish, duchess of Newcastle, wrote a number of good popular books on the microscope and other scientific subjects. She demanded to be admitted as a visitor to the Royal Society, and in general she behaved in such an original and independent manner that she, the first scientific lady in England, was known as “Mad Madge.”⁹ In Henry Cavendish’s time, Margaret Cavendish Bentinck, duchess of Portland, also of the Newcastle branch of the family, was a correspondent of Rousseau and a passionate collector; at her death, the sale of her natural history collection took thirty-eight days.¹⁰ As if handing on the torch, in the year Henry Cavendish was born, Charles Boyle, earl of Orrery died. Nephew of the first duke of Devonshire, this earl was related to the great seventeenth century chemist Robert Boyle. The same earl gave his name to George Graham’s machine to show the motions of the heavenly bodies, the “orrery,” the embodiment of the scientific worldview of our Cavendishes.¹¹ Other early scientifically inclined Cavendishes include three notable fellows of the Royal Society: the third earl of Devonshire; the first duke of Devonshire, who was tutored by the secretary of the Royal Society Henry Oldenburg; and the youngest son of the first duke, Lord James Cavendish.¹² English aristocrats who actively pursued science were few, and if a titled family was destined to distinguish itself in the eighteenth century, Cavendish had a claim to be that family.

⁶Henry Cavendish’s forebear also wrote, “The enemies of Grace, do lurke under the prayse of Nature.” “Cavendish, Richard,” *Dictionary of National Biography*, ed. L. Stephen and S. Lee, 22 vols. (New York, Macmillan 1909) 3:1266–67. Hereafter *DNB*, 1st ed. The second edition, in 60 vols., edited by H.C.G. Matthew and B. Harrison, published by Oxford University Press in 2004 is denoted by *DNB*. This work being cited throughout the book, the full reference is not repeated in each chapter.

⁷Jacquot (1952, 13, 187, 191).

⁸“Hobbes, Thomas,” *DNB* 1st ed. 6:444–51, on 444–45.

⁹Meyer (1955, 14).

¹⁰Allen (1976, 29).

¹¹“Boyle, Charles, Fourth Earl of Orrery,” *DNB* 1st ed. 2:1017.

¹²A. Rupert Hall (1974, 10:200).

Our Cavendishes descended from two revolutions, one political and the other scientific. The Cavendish who became the first duke of Devonshire took a leading part in the revolution of 1688–89, which deposed one king, James, and replaced him with another, William. Referred to as the “Glorious Revolution,” this change may not seem all that revolutionary when compared with subsequent political upheavals,¹³ but to the British of the eighteenth century, it was the epitome of a major change in human affairs. Joseph Priestley, a scientific colleague of Henry Cavendish’s and a friend of revolutions, said that before the French and American revolutions, the “revolution under King William [...] had perhaps no parallel in the history of the world.” For support he cited the philosopher David Hume’s opinion that this revolution “cut off all pretensions to power founded on hereditary right; when a prince was chosen who received the crown on express conditions, and found his authority established on the same bottom with the privileges of the people.”¹⁴ For his part in the revolution, Devonshire was honored by the victorious court. In return, he and his descendants, who included Charles, recognized a duty to uphold the revolutionary settlement and to give desirable shape to its aftermath.

Science, which had been an occasional interest of various earlier Cavendishes, became for Charles an alternative to politics. Having served a respectable number of years in Parliament, he redirected his public activities without changing their essential nature and motivation. The Royal Society offered him a worthy setting in which he could continue to exercise his highly developed sense of duty. The evidence of continuity in his life is as undramatic as it is indisputable: he moved his committee work from the House of Commons to the Royal Society. If committees are more often associated with endurance than with high endeavor, they are nevertheless the level of organization in scientific and learned institutions in which necessary tasks get done, and where colleagues get to know one another well and decide who has good judgment and who takes responsibility.¹⁵ Owing in part to Charles’ conscientious work as a committeeman and councillor of the Royal Society, he was one of the most important men of science in London. When he turned from assisting in the governing of the nation to assisting in the governing of the national scientific society, he was in middle age. By the time Henry came of age, the alternative lives of politics and science open to a Cavendish were clear, and he could choose between them at the outset.

By the middle of the eighteenth century, the new political notion of revolution as a radical change rather than a cyclic return was applied to science, and with specific reference to Isaac Newton’s *Mathematical Principles of Natural Philosophy*, or *Principia*.¹⁶ Almost to the year, the political Revolution of 1688–89 coincided with the publication of that book, an event which has often been singled out as a culmination of the Scientific Revolution. The *Principia* was the single most important book of science for Henry Cavendish on several levels. It was a treatise on mechanics, a compendium of useful theorems developed from

¹³If the revolution is not viewed as “glorious” in the “Whig” sense of the term, as the “harbinger of Liberal England,” its significance may be seen to have an “even greater global magnitude.” D. Hoak and M. Feingold (1996, vii–viii).

¹⁴On this point, see Joseph Priestley’s *Lectures on History and General Policy* (1826). Quoted and discussed in I.B. Cohen (1976, 263–264).

¹⁵Lewis Thomas, a redoubtable committeeman of science, has remarked in various places on the indispensability and value of committees and on the inescapable disruptiveness of human individuality in the work of committees. For example, in *The Youngest Science: Notes of a Medicine-Watcher* (1983, 171); *The Medusa and the Snail* (1979, 94–98). Although Cavendish served on committees throughout his sixteen years in the House of Commons, we note that his committee work fell off with time.

¹⁶Cohen (1976, 264).

fundamental laws of matter, force, and motion. It contained the derivation of the law of gravitation, the model for future investigations of other forces of nature. It was a model of another kind, too: how to present scientific work. Most important, it demonstrated that mathematics is as important as experiment in natural philosophy. In classifying papers in the *Philosophical Transactions of the Royal Society of London*, the abridgment of this series placed Cavendish's paper on a mathematical electrical theory together with papers on electrical experiments and instruments under "Electricity, Magnetism, Thermometry," and this under "Mechanical Philosophy" (an alternative to "Natural Philosophy"); Cavendish's paper was not placed under "Mathematics."¹⁷ Cavendish treated many subjects in natural philosophy mathematically, and when he did, he was applying the "mathematical methods of natural philosophy"; at his writing desk as in his laboratory, he worked *in* natural philosophy.

Having made Newton's *Principia* a prominent marker in this introduction, we can envision the brickbats flying. For forty years or longer, historians of science have reacted against the idolatry of Newton, arguing that the eighteenth century should be regarded as a time of originating scientific energies of its own.¹⁸ We concede the point; nevertheless, in following the tracks of Henry Cavendish, we repeatedly encounter Newton. He was educated at Cambridge at the time when Newton's *Principia* dominated the curriculum, and although his greatest contributions to science were experimental, he was also a theorist who grasped the new experimental fields in Newton's "mathematical way."¹⁹ New instruments, apparatus, and experimental techniques were invented in the eighteenth century, but not everything about science had to be invented. In Cavendish's electrical researches, we see that for him the *Principia* was still, after a century, the example of science at its best. For the record, we do not subscribe to the view that science in the eighteenth century consisted of filling in the blanks left by Newton's incomplete natural philosophy.

Today when we speak of *the* Scientific Revolution, we recognize it as a long and complex historical process, one which did not consist solely of a preparation for the mathematical principles of mechanics and the gravitational system of the world as laid down in the *Principia*. Human understanding of the vastly more complicated operations of chemistry and of life underwent major reinterpretations as well, and the subtle art of experiment was enriched by advances in techniques and instruments. That ingenious master of experimental apparatus Robert Hooke was hardly less important than Newton in preparing the way for Charles and Henry Cavendish. The same can be said of that eminent model of experimental persistence and perspicacity, Robert Boyle (who, as an aristocrat working in experimental science and shaping the Royal Society, was a model for Charles and Henry Cavendish in another sense). Newton himself was a great experimental as well as mathematical investigator. Together, the scientific examples of Boyle, Hooke, and Newton and the political settlement of the revolution of 1688–89 go far to make intelligible the remarkable lives of Charles and Henry Cavendish.

¹⁷"Contents," *PT*, abr. 13 (1770–76), i–vii, on iv–v. The classification did not use the category "mixed mathematics," a common term then for subjects treated mathematically as opposed to pure mathematics. Like any classification, this one had a rationale, but there is no reason to think that Cavendish considered his researches to belong to different categories of science, only to different methods of natural philosophy.

¹⁸This by now historiographic commonplace was once fresh, serving as an important corrective; for example, R.W. Home (1979).

¹⁹Newton's expression, quoted and discussed in Henry Guerlac (1965, 323).

Charles and Henry Cavendish present their biographers with a problem. The practical concerns, and perhaps the private reserve, of the Cavendish family ensured that every scrap of paper having to do with Charles and Henry Cavendish's property was saved, but little that could be regarded as personal. We have Charles Cavendish's business correspondence but not his and his family's private letters, which were in Henry's possession when he died. Henry Cavendish's business correspondence is preserved too, but in his case, we suspect that there may not have been many personal letters. Virginia Woolf approached her biography of Roger Fry with the question, "How can one make a life of six cardboard boxes full of tailors' bills, love letters, and old picture postcards?"²⁰ The answer is, as she went on to show, that it is possible. Henry Cavendish, whose cardboard boxes contain nothing so personal as even tailors' bills, let alone love letters, presents his biographers with an even harder task. How can they make a life from a record of observations of thermometers and magnetic needles? Once again, we intend to show that it is possible. Cavendish's scientific papers are, in their way, as revealing of his nature as personal letters are of a lover's.

Cavendish's public life was carried out in the Royal Society and other settings where scientific men gathered. His private life was carried out mainly in his laboratory and study, and what he said about it he said primarily in writing, not in speech. Writing can be as impermanent as speech if it is not published, but Cavendish kept what he wrote for fifty years, clearly valuing what he put on paper. Each written report of a scientific observation of his is a record of experience, and as such it is potentially the material of biography. Because Cavendish's life was about science, the trove of scientific manuscripts he left behind is its faithful record, and his life accordingly is one of the best documented lives of the eighteenth century.

When Cavendish died, his unpublished scientific papers passed to his principal heir, Lord George Cavendish. They evidently remained with Lord George's family until his grandson became the seventh duke of Devonshire in 1858, when they were removed to the ancestral house of the Devonshire's, Chatsworth, where they remain.²¹ The papers, which consist of experimental and observational memoranda, calculations, and studies in various stages of writing, are substantial, and to Cavendish's biographers an embarrassment of riches, posing hazards of their own. We have tried to heed Henry Adams' advice to biographers, "proportion is everything,"²² while at the same time we have accepted that Cavendish's life was disproportionate by the usual standards. The distinction between biography and history of science can be fine, and Cavendish's biography calls for a balancing act. We could not have written this book without Cavendish's unpublished scientific papers, and we have relied extensively on them, but at the same time we have tried not to lose a sense of proportion, and with it the man.

A selection of Cavendish's manuscripts has been published, though only one group of them, the electrical, with anything approaching completeness. The electrical manuscripts were examined by a series of experts in that branch of physics, beginning with William Snow Harris, who described them in detail in an "Abstract." They were "more or less confused as to systematic arrangement," not "finished Philosophical Papers," Harris said, but they

²⁰Quoted in Susan Sheets-Pyenson (1990, 399).

²¹*Treasures from Chatsworth. The Devonshire Inheritance*. A Loan Exhibition from the Devonshire Collection, by Permission of the Duke of Devonshire and the Trustees of the Chatsworth Settlement, Organized and Circulated by the International Exhibitions Foundation 1979–1980, (1979–1980, 67).

²²Quoted in John A. Garraty (1957, 247).

showed that “Mr Cavendish had really anticipated all those great facts in common Electricity which were subsequently made known to the Scientific World through the Investigations and writings of the celebrated Coulomb and other Philosophers.”²³ Primarily to show how much of the modern subject Cavendish had anticipated, Harris included extracts from Cavendish’s papers in a revision of his textbook on electricity.²⁴ In 1849 on a visit to Harris, William Thomson examined Cavendish’s electrical manuscripts.²⁵ Concluding that they should be published in their entirety, Thomson together with several other men of science put the case to the duke of Devonshire. In 1874 the duke placed the manuscripts in the hands of the first Cavendish Professor of Experimental Physics, James Clerk Maxwell, who for the next five years repeated Cavendish’s experiments, transcribed the manuscripts, and prepared a densely annotated and nearly complete edition of Cavendish’s unpublished electrical papers together with his published electrical papers.²⁶ This remarkable edition, *The Electrical Researches of the Honourable Henry Cavendish*, was published in 1879 by Cambridge University Press a few weeks before Maxwell’s death.²⁷ At about the same time as his electrical manuscripts, Cavendish’s chemical manuscripts came to the attention of the scientific world, in this case in connection with a resurrected priority dispute over the discovery of the composition of water. In defense of Cavendish’s claim, in 1839 Vernon Harcourt appended a selection of Cavendish’s chemical manuscripts to his published presidential address to the British Association for the Advancement of Science. At the time, Harcourt understood that an edition of Cavendish’s papers was being planned.²⁸ In fact there had been intermittent discussions of such a plan from the time of Cavendish’s death, but for one reason or another it had been put off, as it would continue to be long after Harcourt. In due course, with further delays caused by World War I, in 1921 Cambridge University Press reprinted Maxwell’s edition of the electrical papers and published a new, companion volume containing the rest of Cavendish’s published papers together with a selection of scientific manuscripts from outside the field of electricity, the two volumes appearing as *The Scientific Papers of the Honourable Henry Cavendish, F.R.S.*²⁹ The selection of manuscripts for inclusion in the companion volume was made by the general editor and chemist Sir Edward Thorpe together with four experts from physics, astronomy, and geology.

There are two book-length biographies of Cavendish in English, both written by chemists. The more recent one is by A.J. Berry, who gives an excellent technical account of Cavendish’s papers.³⁰ It does not present anything new about Cavendish’s life, in implicit

²³William Snow Harris, “Abstract of M.S. Papers by the Hon. H. Cavendish.” This twenty-five page abstract, which describes the contents of twenty packets of manuscripts on electricity and four packets on meteorology, is in the Royal Society, MM.16.125.

²⁴William Snow Harris (1854). Wilson (1851, 469). James Clerk Maxwell, Introduction to Henry Cavendish (1879, xl).

²⁵S.P. Thomson (1901, 218).

²⁶Maxwell’s correspondence in 1873 concerning the Cavendish papers is published in *The Scientific Letters and Papers of James Clerk Maxwell*, Harman (1995, 785–86, 839, 858–59).

²⁷Henry Cavendish (1879).

²⁸W. Vernon Harcourt (1839, 45). The address is followed by an “Appendix,” 45–68, containing extracts of Cavendish’s papers on heat and chemistry, which in turn is followed by some sixty pages of lithographed facsimiles.

²⁹Cavendish, Henry (1921). *The Scientific Papers of the Honourable Henry Cavendish*. 2 vols. Ed. by J.C. Maxwell and E. Thorpe. Cambridge: Cambridge University Press. The subtitle of the first volume, edited by Maxwell and revised by Joseph Larmor, is *Electrical Researches*. The subtitle of the second volume, under E. Thorpe’s general editorship, is *Chemical and Dynamical*. Hereafter, this work is cited as *Sci. Pap.* 1 and 2. Because this book is cited often, the full reference is not repeated in each chapter.

³⁰A.J. Berry (1960).

agreement with what the editor-in-chief of the collected papers, Thorpe, said of Cavendish's "personal history": little is known of it, "nor is there much hope now that more may be gleaned," since it is doubtful that "there is much more to learn" about this "singularly uneventful" life.³¹

If ever a biography violated Adams' advice about proportion, it was George Wilson's *The Life of the Hon^{ble} Henry Cavendish*, published in 1851.³² Cavendish's "life," in the ordinary sense of the word, occupies only two chapters, the first and the fourth, which comprise fifty pages out of a total of nearly 500 pages. The "life" in the *Life* was attached to a book with a different purpose, which was to put to rest the controversy over the discovery of the composition of water. The controversy, which had simmered briefly in Cavendish's lifetime, was fanned to white heat in the middle of the nineteenth century by a French *éloge* of one of the discoverers James Watt. Dealing almost exclusively with the water controversy, Wilson's account has elements of a detective story, legal drama, and contest of honor, and for all these reasons it is eminently readable. Independently of the controversy, the book is a useful work in the history of chemistry, though it does not seem to have been used that way. What it has been used for is its "life" of Cavendish.

Wilson's biography was undertaken at the request of the Cavendish Society. Founded in 1846, the Society was one of a number of early nineteenth-century subscription printing clubs, this one for chemical works, named after Henry Cavendish no doubt because of the furor going on then.³³ In addition to the water controversy, there was another reason for Wilson's *Life*. In the middle of the nineteenth century, a call went out for biographies of scientists, presumed to be a neglected category of eminent Britons. In 1845 Henry Brougham published biographical sketches of Cavendish and several other scientists in the belief that scientists together with men of letters gave their age "greater glory than the statesmen and warriors."³⁴ In 1848 the historian of the Royal Society Charles Richard Weld condemned the lack of a biography of the late president of the Society Joseph Banks as a "reproach to scientific England," confident that if Banks had been a military man or a romantic hero, his biography would long since have been written.³⁵ In 1843 Wilson began collecting materials for a book on the lives of British chemists; although he never published it, he completed three biographical essays intended for it. He said of one of his subjects, William Hyde Wollaston, that if he had been a German, "some patient, painstaking fellow-countryman would long ago have put on record all that could be learned concerning his personal history"; or had he been a Frenchman, "an eloquent Dumas or Arago would have read his *éloge* to the assembled men of science in the French capital." But Wollaston's "fate as an Englishman, is to have his memory preserved (other than by his own works) only by one or two meagre and unauthenticated sketches, which scarcely tell more than that he was born, lived some sixty years, published certain papers, and died." In the book about the life of a chemist he did publish, Cavendish, in 1851, Wilson regretted that "no other European nation has so imperfect a series of biographies of her philosophers, as Britain possesses." There was not even a good biography of Newton, Wilson said, let alone biographies of recent British scientists such as Thomas Young, John Dalton, and Wollaston, and only belatedly was there

³¹Thorpe, "Introduction," *Sci. Pap.* (2:1–74, on 1).

³²George Wilson (1851).

³³W.H. Brock (1978, 604–605).

³⁴Brougham (1845, xi).

³⁵Charles Richard Weld (1848, 2:116–117).

a biography of Cavendish.³⁶ That Wilson included a “life” at all in his book on Cavendish would seem to have come from his sympathy with the prevailing desire for biographies of scientists.

When Wilson applied to the Cavendish family for the loan of Henry Cavendish’s manuscripts, he said that he had delayed asking because he understood that Lord Burlington was going to write an account of Cavendish’s discoveries. (The earl of Burlington, we should explain, was an extinct title resurrected as a courtesy title for Henry Cavendish’s heir, Lord George Cavendish, thereafter going to the eldest son of the eldest son of the duke of Devonshire.) This Lord Burlington was the forty-eight-year-old William Cavendish, who would go on to become the seventh duke of Devonshire. Scientifically gifted, as a student at Cambridge he had posted second wrangler in the competitive mathematical examinations and first Smith’s Prizeman, only to return to Cambridge in 1861 to succeed Prince Albert as chancellor. The richest of all the dukes, in 1870 he drew upon his wealth to build a laboratory for experimental physics at Cambridge, where its first professor, Maxwell, would repeat Cavendish’s experiments for his edition of Cavendish’s electrical papers. The laboratory was going to be called the Devonshire Physical Laboratory after the seventh duke, but it was named the Cavendish Laboratory instead, after Henry Cavendish according to one account,³⁷ though this version of the naming has been called into question.³⁸ The duke did not write an in-house study of Cavendish’s work after all, but he established one of the world’s great physical laboratories, which bears the name Cavendish.

Wilson told the future duke that he had been studying Cavendish’s works for ten years, that he admired Cavendish’s character, and that he intended to do him justice in the water controversy.³⁹ He was allowed to see the manuscripts, which proved useful to him in vindicating Cavendish of any wrongdoing in the water controversy, but they did not give him the materials he needed for a “life” of Cavendish. For this purpose, he relied largely on short accounts published in most cases soon after Cavendish’s death, and on first-hand accounts that he and a colleague obtained from older fellows of the Royal Society and former neighbors of Cavendish’s. The accounts of Cavendish’s death, as Wilson noted, were conflicting, as we might expect, given that the words and actions of a person approaching the end were believed to be revealing, but Wilson found the accounts of the rest of his life to be largely consistent. We do too, even as we recognize that they were anecdotal and depended on recollections of events that occurred at least forty years earlier. Guided by these accounts, Wilson tried to understand Cavendish, to “become for the time Cavendish, and think as he thought, and do as he did,” but as he closed on his subject, he conflated it with the remorse he felt on devoting so much time and effort to “so small a matter.” Like all of his past efforts, this effort Wilson saw as “bleak and dark,” and the image of the man he distilled from the accounts of Cavendish corresponds.⁴⁰

³⁶George Wilson (1862b, 254). Wilson (1851, 15).

³⁷John Pearson (1983, 214).

³⁸Peter Harman, editor of Maxwell’s papers, has kindly informed us that he has found no documentation of the switch in name from Devonshire to Cavendish. He thinks it is likely that the name Cavendish stands for the family. Personal communication. J.D. Crowther too does not think that Maxwell regarded the laboratory as a memorial to Henry Cavendish (1974, 35).

³⁹George Wilson to Lord Burlington, 15 Mar. 1850, Lancashire Record Office, Miscellaneous Letters, DDCa 22/19/5.

⁴⁰The quotations are from a letter Wilson wrote at the time, included in his sister’s memoir, Jessie Aitken Wilson (1862b, 340–41).

Wilson kept his promise to Burlington. He portrayed Cavendish as a man of exemplary probity, but there is more to character than honesty, and Wilson did not admire much of what he saw. A deeply religious man, Wilson was then contemplating writing a *Religio Chemici* modeled after Sir Thomas Browne's *Religio Medici*, and in the year following the publication of his biography of Cavendish, he published a biography of the physician John Reid, a man of "Courage, Hope, and Faith," whom he greatly admired. Wilson tried to penetrate to where Cavendish's courage, hope, and faith lay, only to discover that Cavendish was a "man without a heart."⁴¹ In the *Life*, Wilson said that Cavendish was "passionless," "only a cold, clear Intelligence." Wilson is entitled to his image of Cavendish, but we should point out that in addition to being Wilson's conviction, that image is a mid-nineteenth-century Romantic cliché, echoing Keats's Apollonius, whose cold mathematical philosophy denied the imagination by subjecting the rainbow and other mysteries to its "rule and line," conquering them and emptying them of their charm. We have dwelt this long on Wilson's biography because it is the source of the standard interpretation. Wilson accomplished what few biographers do: he made his subject vivid and still after over 150 years compelling. We admire Wilson's biography of Cavendish, and in our own, we make extensive use of his insights and of the accounts of Cavendish on which he based his portrait. But we have consulted a much wider range of sources, and our portrait naturally differs. In addition, times have changed and biographies with them.

We can, it would seem, agree on the appearance of Henry Cavendish, since there is only one picture of him, an ink-and-wash sketch, from which Wilson had an engraving made for his biography. Cavendish is shown walking with something of a slouch, possibly an inherited trait, since a "peculiar awkwardness of gait is universally seen" in the Cavendishes.⁴² The sketch shows him in a rumpled coat and wearing a long wig, both long out of date. Thomas Young, who knew Cavendish in his later years, said that he always dressed in the same way, presumably as in this picture.⁴³ Young also described Cavendish as tall and thin, which is where agreement ends; another contemporary, the chemist Thomas Thomson, described Cavendish as "rather thick" and his neck as "rather short."⁴⁴ The circumstances under which the sketch was made make for one of the better stories about Cavendish, and one there is no reason to doubt. When earlier he had been approached to sit for a portrait, Cavendish had given a blunt refusal. William Alexander, a draftsman from the China embassy, succeeded by subterfuge; with the help of a member John Barrow, he was invited as a guest to the Royal Society Club, at which Cavendish dined once a week. As advised, Alexander sat at one end of the table close to the peg on which Cavendish invariably hung his gray-green (or faded violet, by another account) coat and three cornered hat, both of which Alexander surreptitiously sketched. He then sketched Cavendish's profile, which he later inserted between the hat and coat in the finished portrait. Cavendish, of course, was not shown it, but people who knew him were, and they recognized him. The artist left the sketch at the British Museum, where Wilson obtained it.⁴⁵ It is a wonderful sketch, and part of the wonder is that it ever came into being in the first place. Because of the scarcity of

⁴¹ *Ibid.* (338, 342–43). Wilson completed several chapters of his projected book on chemistry and religion. They were brought out after his death in a volume of essays bearing the title *Religio chemici*, note 39 above.

⁴² Joseph Farington's *Anecdotes of Walpole, 1793–1797*, in Horace Walpole (1937–1983, 15:316–317).

⁴³ Thomas Young, "Life of Henry Cavendish," *Encyclopaedia Britannica*, Supplement (1816–1824), in *Sci. Pap.* (1:435–447, on 444).

⁴⁴ Thomson (1830–1831, 1:339).

⁴⁵ John Barrow (1849, 146–147).

personal sources, we have had to rely upon other kinds of evidence in preparing Cavendish's biography. To form our image of him, to draw the human face between the three-cornered hat and the crumpled greatcoat, we have placed him in all of the settings in which we know he appeared.

"I desire" was one of Cavendish's favorite expressions. His life was filled with desire, and to a greater extent than most persons, what he desired he could have. For he was perfectly placed: born an aristocrat when the aristocracy was in high tide, he could expect his desires to be taken seriously. Because he was not a peer, he escaped the time-consuming duties, rituals, and displays; he was free to choose inherently more rewarding pursuits, while at the same time he could feel as confident of his place in society as if he were a peer. (His diffident behavior in particular social settings was an entirely different matter.) What he desired more than anything else, we know, was to understand the natural world. Given his enviable position, he could separate the rewards of scientific work from those of society at large, which were in any event given to him without having to desire them, an advantage which lent his life its peculiar direction and intensity.

This biography opens in the 1680s, when science began to dominate educated thought in Western Europe,⁴⁶ and it ends just over a century later, at the beginning of the nineteenth century. It was a time of impressive advances in scientific techniques and beginnings of new major fields of investigation. Charles Cavendish took up challenging problems in them, and his son Henry explored them systematically. In terms of the Cavendish family, the period covered by this biography begins when the rooms of the great Cavendish country house, Chatsworth, resounded with the sound of the pugnacious first duke of Devonshire's clanking sword, and it ends when the tone of those same rooms was set by the Proustian languor of the fifth duke of Devonshire. Where the first duke saw a world to conquer, the fifth duke saw an already conquered world in which his comfort was well secured. The fifth duke was no fool. He recognized that his relative, Henry Cavendish, lived partly in a different world, though he may not have recognized it as a new world to conquer, demanding of Henry what had been demanded of the first duke, hard work. (By "conquer," in the borrowed sense, we mean to understand the workings of nature, ruled by the authority of natural laws.) The fifth duke got it nearly right when he ordered his wife Georgiana, duchess of Devonshire to stay away from Henry Cavendish's laboratory on the grounds that "he is not a gentleman—he *works*."⁴⁷ Henry Cavendish and before him his father belonged to what Sir Benjamin Brodie called the "working men of science."⁴⁸ In this biography, we show what it meant for two gentlemen, first Lord Charles Cavendish and then the Honorable Henry Cavendish, to work in science.⁴⁹

⁴⁶Margaret C. Jacob (1988, 105).

⁴⁷Bickley (1911, 202).

⁴⁸In reference to the membership of the Royal Society in Henry Cavendish's day: Benjamin Brody to Charles Richard Weld, 7 Apr. 1848, quoted in Weld (1848, 2:153).

⁴⁹*Work* in the setting of professional science in the next century is the theme of Christa Jungnickel and Russell McCormmach (1986).