

## ESSAY REVIEWS

### **Of a Man and His Microscopes: Widening the Perspective on Early Modern Science**

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Review of: *Alle de Brieven van Antoni van Leeuwenhoek/The Collected Letters of Antoni van Leeuwenhoek*, 12 vols. (Amsterdam: Swets & Zeitlinger, 1939-).

The twelfth volume in the on-going publication of the letters of Antoni van Leeuwenhoek appeared in 1989, bringing that publication up to his letter of 16 October 1699 to Antonio Magliabechi. With almost a quarter-century of correspondence yet ahead, 206 of Leeuwenhoek's surviving letters have thus far been gathered into this edition, carried out under the oversight of a committee of the Koninklijke Nederlandse Akademie van Wetenschappen. Assisted by the *Nederlands Tijdschrift voor Geneeskunde* (through volume eight), the Hendrik Muller's Vaderlandsch Fonds (for volumes five through eleven), and more recently the Nederlandse Organisatie voor Wetenschappelijk Onderzoek, the academy has also borne the burden of funding the project throughout. At this advanced point in the publication of the edition, it seems an appropriate moment to consider the progress and the promise of the work. How effectively are the purposes of the edition being realized, and what, indeed, is its potential?

The explicit aims of those who launched the publication were to make Leeuwenhoek himself and his accomplishments more familiar to a broader modern readership. Originally conceived as a "perennial monument" to a "great man" and a "great Dutchman,"<sup>1</sup> the enterprise was also decidedly adulatory in its intent. Given these intentions – and the fact that Leeuwenhoek published his discoveries only in the form of personal letters – the edition is more in the spirit of a collection of "works" than of correspondence. The explicit "first aim" was to gather together the letters written by Leeuwenhoek, and, to date, the texts of only a half-dozen letters that were written to him (and that he did not recite in his own letters) have been included. Where offered, the justification for the inclusion of these letters cites their usefulness to the understanding of Leeuwenhoek's own letters and researches.<sup>2</sup> The letter from Pieter Rabus in volume

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<sup>1</sup> Vol. 1, pp. 7, 7 n. 1, 9, 17.

<sup>2</sup> See the prefaces to vols. 9, 11, 12.

nine, however, consists largely of only a panegyric on Leeuwenhoek, and the entry in volume ten for a letter from Richard Waller of which there is no surviving text is also something of an anomaly.

An essential first step in rendering Leeuwenhoek's work more accessible has been the elucidation of the language of his letters. The successive volumes, hence, have always included ample notes on what are now the archaisms of seventeenth-century Dutch as well as on Leeuwenhoek's own stylistic idiosyncracies, his "remarkable and peculiar expressions."<sup>3</sup> J. I. H. Mendels also appended a commentary on Leeuwenhoek's language to volume four, and volume nine contains an extended study of the "syntactic phenomena" in Leeuwenhoek's letters by B. C. Damsteegt, former professor of Dutch philology at the University of Leiden.

In addition to the original Dutch – or in some cases Latin – texts (with notes indicating different variants in manuscript and print), English translations are also provided on the facing page. Given the limited familiarity with Dutch abroad, the accompanying translations are critical to the quest for a broader modern audience for Leeuwenhoek. There are, to be sure, the occasional slips in English usage – such as the use of "shooted" for "shot" in the latest volume<sup>4</sup> – and I have elsewhere argued that, in one instance in an earlier volume, the mingling of interpretation and translation led to a seriously misleading English rendering.<sup>5</sup> For those with scholarly purposes in mind, of course, relying on translations alone will always be a risky business, and, in this case, the linguistic annotations, often pointing out nuanced interpretations imposed on Leeuwenhoek's choice of words and phrasing, are characteristically limited to the Dutch texts and hence themselves remain in Dutch. (The English versions of the longer studies by Mendels and Damsteegt are also no more than brief summaries.) Nonetheless, apart from the exceptional instance mentioned above, I have found the translations to be reliable, helpful, and clear – or as clear, that is, as Leeuwenhoek's often tangled syntax allows. As was intended, they will vastly increase the numbers of those now able to peruse his letters.

In order to make Leeuwenhoek's achievement more familiar to a broader audience, however, no less crucial than overcoming the linguistic barriers is the challenge of interpreting and clarifying what Leeuwenhoek in fact observed and described, an effort, notes the general introduction to the edition, that is "a science and an art in itself."<sup>6</sup> "It is remarkable," notes H. W. Julius in the

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<sup>3</sup> Vol. 1, p. 13.

<sup>4</sup> P. 191.

<sup>5</sup> Edward G. Ruestow, "Images and Ideas: Leeuwenhoek's Perception of the Spermatozoa," *Journal of the History of Biology* 16, 1983, p. 192 n. 29.

<sup>6</sup> Vol. 1, p. 9.



preface to volume seven, "that Leeuwenhoek's versatility raises questions that demand answers by so many present-day specialists." Hence, the editorial policy from the beginning has called for a variety of collaborators capable of providing notes relevant to Leeuwenhoek's diverse researches. The first volume listed thirty-seven collaborators, a number that rose to a peak of fifty-seven in volume three. Scientists dominate these lists, but early volumes also exploited the expertise of not only historians but representatives of such varied industries as vinegar, soap, ink, and pottery manufacturing as well as sheep breeding and the wine trade. The lists of collaborators in the more recent volumes have tended not only to diminish in number, however, but to concentrate more exclusively on scientists and, together with a few linguistic specialists, a small but important nucleus of historians of science.

As editors, indeed, those with a preeminent interest in the history of science per se, an interest increasingly reflected in their institutional roles and affiliations, have exercised an influence over the edition far exceeding what their numbers suggest. A. Schierbeek, the editor from 1947 to 1958, was a major source of initiative from the very beginning of the enterprise, and the subsequent editors have been members either of the Biohistorisch Instituut or the Instituut voor Geschiedenis der Natuurwetenschappen at the Rijksuniversiteit at Utrecht. Those directing the edition had initially been housed in the offices of the *Nederlands Tijdschrift voor Geneeskunde*, but with volume six the editorial staff also settled at the Biohistorisch Instituut, although the present editor, L. C. Palm, is now affiliated rather with the Instituut voor Geschiedenis der Natuurwetenschappen.

In addition to providing a number of technical notes of its own, the editorial staff has also furnished a more modest but very valuable type of annotation, cross references. Given the helter-skelter scattering of research subjects throughout a half-century of letters, the cross-referring maintained throughout the volumes is, with the indexing, an invaluable aid to anyone exploring the diverse lines of Leeuwenhoek's inquiries or the development of his thinking. Together with the linguistic and technical notes – and I might add the identification as well of individuals and literature referred to in the letters – the completion of that cross-referring and indexing will greatly facilitate meaningful research in Leeuwenhoek's letters.

More eye-catching than the annotation and indexing, however, has been the generous illustrative material of the successive volumes. It has included modern illustrations as well as those, both printed and in manuscript, that originally accompanied Leeuwenhoek's accounts. Of particular interest is the initial intention to provide not only illustrations of modern microscopic preparations for comparison but photographs as well of the results of efforts to reproduce

Leeuwenhoek's own methods and hence even his artifacts.<sup>7</sup> It was a notion anticipating what some historians of science would later dub "practical history."<sup>8</sup> Although they have been largely abandoned in recent volumes, the abundance of modern illustrations as well as the efforts to recreate what Leeuwenhoek saw by duplicating his methods and circumstances made for a richly illustrated series of volumes that gave the non-scientist a much more vivid understanding of what Leeuwenhoek was looking at.

In most cases, with the profuse illustrations being the notable exception, the successive volumes have maintained the earlier editorial practices intended to win a broader and more appreciative audience for Leeuwenhoek. Some changes along the way have also made the volumes easier to use. The early decision in volume three to provide modern English translations even when seventeenth-century translations (from the *Philosophical Transactions*) were available was a good one, and the introduction of running heads with the dates of the letters corrected an irritating initial oversight. Although detrimental to the appearance of the set on the shelf, the reduced size introduced in volume ten makes the more recent volumes easier to use – and presumably less expensive to publish.

To be sure, there are also editorial practices that either irritate or simply puzzle me. Among the latter, the flexibility regarding the spelling of Leeuwenhoek's name – Leeuwenhoek, Leeuwenhoeck, or van Leeuwenhoek<sup>9</sup> – led to the curious inconsistency between the title page and the "General Introduction" of the initial volume, an inconsistency that also recurs, for instance, on a single page in the preface to volume six. Given the decision to use modern English translations, the capitalization in the English letters of later volumes, conforming to that in the Dutch originals, strikes me as odd as well. Among the more bothersome editorial practices is the mixing at the end of each volume of two separately numbered series of "figures" and "illustrations," which makes the process of tracking down the illustrations (now in a general sense) cited in the text more troublesome than it needs to be. Personally, I also find the use of single parentheses with the footnote numbers in the text distracting and downright confusing in the proximity of legitimate parentheses.

Potentially more consequential, however, is the reduction in the number of collaborators and of modern illustrations in the recent volumes. It apparently relates to what has been a major and ongoing difficulty for the editors, that of preparing and publishing the successive volumes in a reasonable length of time.

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<sup>7</sup> Vol. 1, p. 15; vol. 5, p. 25.

<sup>8</sup> Edwin Clarke and J. G. Bearn, "The Brain 'Glands' of Malpighi Elucidated by Practical History," *Journal of the History of Medicine and Allied Sciences* 23, 1968, pp. 309-311, 329-330.

<sup>9</sup> See vol. 1, p. 7 n. 1.



In all the prefaces of volumes four through ten, the time required to publish each volume has been a subject of concern. The first volume appeared in 1939, eight years after the enterprise was initiated, but the second saw the light of day only two years later, in 1941. That was already in the midst of the devastating circumstances of the German invasion, however, and the following volume would require another seven years before its completion. The prefaces of these two volumes still evoke something of a shudder, the first, in volume two, by its grotesquely understated allusion to "the exceptional circumstances that have prevailed in Holland for over a year," and the second, by its matter-of-fact citation, among the reasons for the volume's delayed appearance, of the trials of the German occupation and "the constant hunger and cold, the everlasting danger of imprisonment and death."

The subsequent volumes appeared after periods, respectively, of four years, five years, four years, three years, three years, nine years, three years, four years, and six years. Judging from the prefatory comments to the successive volumes, the academy committee responsible for the edition aspired to a period of three years or less. Technical problems in publication have perhaps inevitably been one cause of delay, as, at times, have been changes in personnel.<sup>10</sup> But, in the post-war years, the major obstruction to prompt publication has arisen from the desire to involve a number of experts from diverse fields in the task of elucidating the subject matter of Leeuwenhoek's letters. The resultant difficulties appear to have markedly affected the editorial policies of the more recent volumes.

Very conscious of the time it took to produce volume five, H. W. Julius, then chairman of the academy committee, pinpointed the collaborating scientists from whom commentaries on Leeuwenhoek's letters had been solicited as the source of the problem, and the preparation of volume seven, we are told, also repeatedly ran up against "the very great burden of work already in the hands of all contributors, who can only with difficulty snatch away some time from the never-ending attention and exertion which modern life demands of a scientific worker ..."<sup>11</sup> After the preface to volume nine had referred less sympathetically to "the tardy way in which requested notes were forthcoming," that of volume ten explained that, with an eye on preventing delay in publication, the editor had decided to restrict the explanatory notes provided by external collaborators and to limit how long he would wait for notes that were slow in arriving. The narrowing of the number of collaborators in these last volumes – down to nineteen persons in volumes ten and twelve – is presumably also a reflection of the effort to gain greater control of the process of collecting the explanatory notes.

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<sup>10</sup> See the prefaces to vols. 7 and 9.

<sup>11</sup> Vol. 5, p. vii; vol. 7, preface.

Is the *quality* of the annotation likely to suffer as a consequence as well, however? It is not reassuring to be told as we are in volume ten that, because of the desire to hasten the appearance of the volume, the notes are less developed than in the past.<sup>12</sup> A smaller circle of collaborators is certainly capable of maintaining a high level of textual commentary, and volume twelve still offers a substantial and instructive body of notes. But volume twelve also took six years to prepare. Hence, the reduced number of collaborators has not in itself made for speedier publication, and the editorial staff apparently still lacks a policy that can consistently assure both the quality of annotation *and* expeditiousness.

Also reflecting, I assume, the concern over the time – and very likely the rising costs – of publication, the number of modern illustrations provided in the last three volumes has also drastically declined, and photographs of actual microscopic preparations have completely disappeared. With only eight plates comprising thirty-one illustrations (including, that is, both "figures" and "illustrations"), volume twelve contrasts strikingly with the abundantly illustrated earlier volumes, whose illustrations reached a peak in volume three with its forty-eight plates comprising thirty-two photographs of Leeuwenhoek's own drawings and sixty-one other illustrations.

The significance of this retrenchment is uncertain, however. Many of the past illustrations are presumably unnecessary for the volumes' readership of scientists, nor are they of urgent significance to historians of science interested primarily in Leeuwenhoek's outlooks and practices or in the influence of ideas, cultural commitments, and social contexts. Consequently, I am by no means convinced that the *scholarly* use of these volumes will be greatly affected. But the general reader's understanding of Leeuwenhoek's experience of observing – and for whom else, after all, are such notes as the repeated reminders of how many centimeters in an inch intended? – will surely be diminished, and the original aspiration to make Leeuwenhoek's achievement more broadly accessible will inevitably suffer.

I would urge that the recourse to modern illustrations and to photographs of microscopic materials similar to those observed by Leeuwenhoek be more selective than in earlier volumes but not abandoned. There are instances – such as Leeuwenhoek's shift from the perception of the striations of muscle fibers as circular folds to the perception of them as spirals, a shift to which the distortion of the striations that can arise in teasing the fibers apart may be relevant – in which such photographs might render Leeuwenhoek's accounts and opinions not only more accessible but more comprehensible as well. The effort to convey the visual experience that encompassed Leeuwenhoek's efforts should be forsaken only very reluctantly.

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<sup>12</sup> Preface.



Nonetheless, timeliness in completing this modern edition of Leeuwenhoek's letters should remain a preoccupation. The problems of administering and editing such an undertaking are known to me only second-hand, but the six-year gestation period of the last volume is discouraging. For the remaining volumes, a determined effort should be made to adhere to the goal of three years between volumes that has characterized the most expeditious publication in the past (and was roughly the average pace for the magisterial *Oeuvres complètes* of Christiaan Huygens).<sup>13</sup> The challenge, surely, is to do so without sacrificing the substantial annotation that has characterized previous volumes or wholly forsaking modern illustrative materials that attempt both to clarify Leeuwenhoek's accounts and to reproduce his microscopic experience. A decline in the quality of the annotation or the abandonment of modern microscopic illustrations altogether would diminish the impact of an edition that will assume a prominent place among the major sources for the history of science.

Those who will derive the most from this edition of Leeuwenhoek's letters, however, constitute what is now in important respects a different readership than originally foreseen, and they will be probing the letters in ways that are not likely to have been anticipated. The audiences to which the edition was initially directed would appear to have been laymen, on the one hand, and modern scientists, on the other.<sup>14</sup> But surely the professional community that will make the greatest use of this edition and its editorial apparatus will be the historians of science, and the development of their discipline will prompt them to ask a widening range of questions. Indeed, as a consequence of that development, we are now able to perceive a broader potential in Leeuwenhoek's letters than were those who initiated the edition more than a half-century ago.

They were committed in 1932 to acclaiming Leeuwenhoek and to commemorating "his modest character and incomparable merits,"<sup>15</sup> and the effort they began does indeed encourage a fuller appreciation of the stature of his achievement. With the aid of cross references, the easier accessibility of the full span of Leeuwenhoek's letters will reveal, for instance, that there was a more

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<sup>13</sup> Twenty-two vols. (The Hague: M. Nijhoff, 1888-1950).

<sup>14</sup> The "General Introduction" to the edition indeed began by expressing concern over what botanists, zoologists, chemists, crystallographers, bacteriologists, histologists, physiologists and physicians did and did not know about Leeuwenhoek's work, and it concluded by remarking that, to scientists (the translators' typical rendering of *geleerden* in the front matter), the edition "will mean a unique compilation, bringing everything that modern criticism and contemporary science [*wetenschap*] can learn from Leeuwenhoek's achievement." In paying tribute to Schierbeek's considerable contribution to the edition, the preface to volume six credited him with having been largely responsible for keeping Leeuwenhoek "a living force in the growth of biology and medicine."

<sup>15</sup> Vol. 1, p. 17.

long-term, thoughtful purposefulness to many of his researches than has often been allowed him. But present-day historians eager to understand the dynamics of early modern science will seize as well upon the evidence in his letters of mixed motivations and of the role of his own stubbornness and aggressiveness in the progress of his science. And although also intending to place Leeuwenhoek in the context of his "day and society" (*tijd en omgeving*),<sup>16</sup> it is unlikely that those who initially conceived the edition foresaw the kind of interest historians of science will now show in exploring his complex interactions with the society of his day.

A decade ago, for instance, K. van Berkel offered a study entitled "Intellectuals against Leeuwenhoek" that also addressed Leeuwenhoek's own "anti-academic attitude."<sup>17</sup> It is also clear, however, that Leeuwenhoek found the attention of learned society stimulating, and I am convinced that his ambivalence towards the learned elites of Europe played a far more critical role in shaping his science than we as yet fully appreciate. Still awaiting serious consideration as well is the impact of that diversified society in the midst of which he lived out his daily life in Delft. In the latest volume, for example, his letter of 12 September 1696 to Anthonie Heinsius gives ample evidence of the significant involvement of the local butchers in Leeuwenhoek's efforts. But on the other hand, although he still characteristically insisted on his own modest birth, elsewhere in the volume he no less characteristically identifies beliefs his research had overturned with the "common man."<sup>18</sup> These are but hints of the weave of social attitudes intermingled with his researches, and it is precisely the kind of intermingling that is of preeminent interest to a growing number of historians of science.

Leeuwenhoek's letters, hence, are a promising source for a more nuanced study of the dynamic interactions that tied early modern science to its social contexts. The emphasis on broad European or even national social and economic tides in the shaping of early modern science has tended to bog down after the initial generalizations. Leeuwenhoek's letters, on the other hand, offer rich testimony to the diversity and complexity of the social environments that affected early modern science, and, in this one notable instance, his letters offer an insight into how diverse social relationships – from his continuing correspondence with an international learned elite to his day-to-day exchanges with neighbors, merchants, fishermen, farmers, and artisans – influenced an in-

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<sup>16</sup> Vol. 1, pp. 15-17.

<sup>17</sup> In *Antoni van Leeuwenhoek 1632-1723: Studies on the Life and Work of the Delft Scientist Commemorating the 350th Anniversary of His Birthday*, ed. L. C. Palm and H. A. M. Snelders (Amsterdam: Rodopi, 1982), pp. 188-195.

<sup>18</sup> Pp. 66-67, 40-41, 56-57.



novative scientific investigator over the course of a half-century of research.

To be sure, the uniqueness of Leeuwenhoek's situation and pursuits may argue that a fuller understanding of the roots of his efforts will cast little light on those aspects of seventeenth-century science on which historians of science have largely focused for the last half-century. But the notion of the Scientific Revolution, embodying that focus, has become fuzzier of late,<sup>19</sup> and Leeuwenhoek's letters may indeed speak with particular pertinence to other aspects of early modern science that may appear of great consequence even to the Whiggish effort to reach, through the study of the period, a better understanding of science today.

Perhaps, after all, nothing is more distinctive of modern science than its identification with instruments, and yet they are scarcely mentioned in a recent collection of "reappraisals" of the Scientific Revolution.<sup>20</sup> By contrast, Albert Van Helden has stressed that the period 1550-1700 saw not only the birth of modern scientific instruments but the gradual determination of their place in science and the shaping of the attitudes that now surround them.<sup>21</sup> "By the end of the seventeenth century," he writes, "science without instruments had become inconceivable."<sup>22</sup>

The systematic recourse to new scientific instruments was indeed more than simply the unproblematic consequence of the advent of new technologies; lenses had been a commonplace for centuries without provoking an interest in or recognition of the possibility of exploring the very small. The tiny, exquisite single lenses used by Leeuwenhoek were very different from the spectacle lenses of the late Middle Ages, to be sure, but simple techniques for making small glass beads proved capable of producing instruments of similarly astonishing capacities. Consequently, the supposition of some crucial technological breakthrough does not adequately explain the beginnings of serious microscopic research. Changes in perception, in motivation and in behavior were certainly no less decisive, and they were very likely nurtured by social influences. Hence, Leeuwenhoek's letters emerge as a unique and important source for exploring

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<sup>19</sup> See David C. Lindberg and Robert S. Westman, eds., *Reappraisals of the Scientific Revolution* (Cambridge, etc.: Cambridge University Press, 1990), and Roy Porter, "The Scientific Revolution: A Spoke in the Wheel?," in *Revolution in History*, ed. Roy Porter and Mikulás Teich (Cambridge, etc.: Cambridge University Press, 1986).

<sup>20</sup> Lindberg and Westman, *Reappraisals of the Scientific Revolution*, xix, 248.

<sup>21</sup> "The Birth of the Modern Scientific Instrument, 1550-1700," in *The Uses of Science in the Age of Newton*, ed. John G. Burke (Berkeley, Los Angeles, and London: University of California Press, c. 1983), pp. 49, 57, 65-69.

<sup>22</sup> *Ibid.*, 66. See also W. D. Hackmann's opening comments in "Scientific Instruments: Models of Brass and Aids to Discovery," in *The Uses of Experiment: Studies in the Natural Sciences*, ed. David Gooding, Trevor Pinch, and Simon Schaffer (Cambridge, etc.: Cambridge University Press, 1989).

the circumstances that gave rise to a defining feature of modern science.

Moreover, these letters speak directly as well to a development of no less significance *for* science, even if it did not alter the pristine core (if such exists) of science itself: the widening embrace of science by European society. Roy Porter has written of the loyalty science now aroused in diverse social "niches,"<sup>23</sup> a suggestion (or so I incline to read it) that emphasizes that the place science won for itself in European society was in fact rather a multitude of places, just as science itself consisted of a number of diverse enterprises. As the foundation of a broad and enduring social commitment to science, the winning of those varied niches was as consequential in the long run as the stunning conceptual advances most appropriately identified with the Scientific Revolution. Reflecting a social arena otherwise rarely so richly represented in the literature of early modern science, Leeuwenhoek's letters thus again constitute a source of unique potential for probing this crucial social dimension of seventeenth- and early eighteenth-century science.

It is the sharpened awareness of such possibilities that makes – or *should* make – the recognized potential of these letters greater now than when this modern edition was first conceived. Should that sharpened awareness be reflected as well, however, in constantly evolving editorial policies? Should one expect to see the editorial apparatus of the letters expanding and broadening as the discipline of the history of science itself develops? Perhaps, but not if the effort to keep up with the shifting – and sometimes wayward – inclinations of the discipline were to divert editorial attention, already hard pressed for time, from the task of clarifying the technical aspects of both Leeuwenhoek's language and his researches. Such clarification is essential to a more effective use of his letters whatever directions historians of science may pursue in the future, and adhering to those editorial commitments is still the surest way to carry out the aims that launched the project. It is now up to historians of science at large to exploit the new accessibility of Leeuwenhoek's letters by exploring their rich potential.

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<sup>23</sup> Porter (n.19), "The Scientific Revolution," p. 305.