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THE MÉMOIRES OF ABRAHAM TREMBLEY: II. THE MÉMOIRES AS A RESEARCH MONOGRAPH

BY

Sylvia G. LENHOFF¹ and Howard M. LENHOFF¹

BACKGROUND

Stir Created in early 1740s by Trembley's Discoveries on the Polyp

When in 1740 Abraham Trembley began to make his remarkable discoveries on the “polyp,” or fresh-water hydra as it is currently known, he was a young Genevan emigré employed as tutor-in-residence for the two young sons of Count Bentinck of Holland. As an unknown in the scientific and academic communities, Trembley needed the helping hand of the illustrious French scientist Réaumur and the confirmation of his work by other “recognized authorities” in order for his startling discoveries to be acknowledged, published and accepted.

It was Réaumur who carried news and demonstrations of Trembley’s discoveries to the Paris Academy, and Buffon and Bentinck who first introduced his findings to the Royal Society of London. The *Philosophical Transactions* for 1742-1743 include selections from a letter by the physician J.F. Gronovius (1744, pp. 218-220) of Leiden which illustrate the initial scepticism in academic and scientific circles that greeted the unknown Trembley’s findings.

This Discovery was and is very surprising to all our Virtuoso’s, and really not believed, until the Professors *Albinus* and *Mussenbrock* were provided with the Animals, and after having well examined this Creature, found the Prodigy of increasing itself in that wonderful Manner, very true.

One of the Gentlemen that made this Discovery was Mr. *Allemand*, a Man of great Learning and Ingenuity, Tutor to the Sons of Mr. *s’Gravensande* [sic].

There have been several of these wonderful Creatures sent to *Paris*, to Mr. *Réaumur*, from whom we hope for a particular Dissertation [sic].

The Royal Society argued and withheld recognition of Trembley’s work for two years after having been informed of it, asking Trembley to supply animals so that the President, Folkes, might himself repeat and verify the experiments. Only then did Folkes, speaking for the Society (see Trembley, 1943, p. 166), proclaim Trembley’s work on regeneration to be “one of the most beautiful discoveries in natural philosophy.”

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Henry Baker's Book on the Polyps

During the process of verifying Trembley's findings, Folkes had shared some of the polyps sent him by Trembley with other members of the Society. One of these was the English scientist, Henry Baker. Using these and some hydra found locally, Baker repeated many of Trembley's experiments and pursued a number of interesting observations on his own. In his enthusiasm, he rushed into print in 1743 a volume several hundred pages long in the form of an extended letter to Folkes, which contained both his and some of Trembley's results. Thus Baker's *An Attempt towards a natural History of the Polype* (Figure 1) was actually the first book devoted to the hydra to be published, not Trembley's *Mémoires*.

Though both Folkes and Réaumur were angered by Baker's publication of Trembley's discoveries before Trembley had completed his promised volume on the polyps, Trembley does not appear to have shared this reaction (Trembley, 1943, pp. 190-191). It had taken several years of prodding by Réaumur, during which time Trembley was elected to the Royal Society, received the Copley Medal, and was invited to become a *Correspondant* of the Paris Academy of Sciences, before Trembley was finally prepared to publish "that lovely work," as Dr. Baker (1952, p. 40) calls it, the *Mémoires, pour servir à l'histoire d'un genre de polypes d'eau douce, à bras en forme de cornes*.

Publication of Trembley's Mémoires

The year 1744 saw the publication both of the elegant, authorized Leiden *Mémoires* (Figure 2) by the company of Jean and Herman Verbeek (Trembley, 1744a), and of the pirated two-volume Parisian edition by the firm of Durand (Trembley, 1744b), the latter version described intriguingly by Réaumur (see Trembley, 1943, pp. 195, 232) as a kind of "book for the pocket." We learn from one of Trembley's letters to Charles Bonnet that Trembley had negotiated with the Verbeeks an agreement by which he retained an unusual degree of control over details of the publication of the Leiden *Mémoires*, including choice of engraver, paper, print and format (Trembley, 1943, p. 190).

Physically the Leiden edition of the *Mémoires* is particularly handsome. The book still retains its beauty in the quality of paper, print, and design, as well as in the figures and vignettes (Figure 3) and other artistic embellishments found at the start and close of each section. The three artists who contributed to the *Mémoires* were indeed, in Trembley's words, "gifted." As he puts it in a tribute to them in the preface. "I was as fortunate in this respect as in my discoveries on the Polyps." He calls the reader's attention to the engraved drawings on the fold-out leaves following each Memoir which help to explicate the text, particularly the last eight plates (Figures 4 and 5) engraved by Lyonet, who at that time had just learned the art of engraving. Lyonnet's artistry has

An ATTEMPT towards a
NATURAL HISTORY
 OF THE
POLYPE:
 In A LETTER To
Martin Folkes, Esq;
 PRESIDENT of the *Royal Society*.

DESCRIPTING

JA.

Their different Species; the Places where to seek and how to find them; their wonderful Production and Increase; the Form, Structure and Use of their several Parts; and the Manner they catch their Prey:

With an Account of their DISEASES and CURES; of their amazing REPRODUCTION after being cut in Pieces, (as first discovered by Mr. TREMBLEY, at the Hague;) of the best Methods to perform that Operation, and of the Time requisite to perfect the several Parts after being divided: And

Also full DIRECTIONS how to feed, clean, manage and preserve them at all Seasons of the Year.

Likewise a COURSE of real EXPERIMENTS, performed by cutting these Creatures in every Way that can be easily contrived: shewing the daily Progress of each Part towards becoming a perfect POLYPE.

The Whole explained every where by great Numbers of proper Figures, and intermixt throughout with Variety of OBSERVATIONS and EXPERIMENTS.

By *HENRY BAKER*, Fellow of the *Royal Society*,
 and Member of the Society of *Antiquaries*, in *London*.

Rerum Natura nusquam magis quam in Minimis tota est.
 PLIN. Nat. Hist. Lib. xi. c. 2.

London:

Printed for R. DODSLEY, at *Tully's Head* in *Pall-Mall*, and sold by M. COOPER in *Pater-noster-Row*, and J. CUFF, Optician, in *Fleetstreet*. 1743.

(Price bound Four Shilling^{c.})

FIG. 1. — Title page from Henry Baker's 1743 volume on the polyp.

MÉMOIRES,
POUR SERVIR À
L'HISTOIRE
D'UN GENRE DE
POLYPIES
D'EAU DOUCE,
À BRAS EN FORME DE CORNES:

Par A. TREMBLEY, de la Société Roïale.



A LEIDE,
Chez JEAN & HERMAN VERBEEK,
M. D C C. X L I V.

FIG. 2. — Title page from the 1744 Leiden edition of Trembley's *Mémoires*.

been widely recognized for his detailed anatomical renderings of the goat-moth caterpillar, which Mees (1946, pp. 149-150) tells us "is an example of accuracy and careful observation that is thought by many good judges never to have been surpassed to this day." Lyonet's similarly fine contributions to the *Mémoires* of his colleague, Trembley, lead a commentator like Rudolph (1977, p. 53) to say that readers who have seen only the pirated two-volume Paris version minus the "beautiful engravings" of Lyonet are missing something special. On the other hand, the drawings used by Baker in his book on the hydra (1743), though useful in elucidating his text, are cartoonish in style and not at all artistically noteworthy.

Translations of the Mémoires

Baker's study of the polyp (1743) was published in a French edition (Baker, 1744) only one year later, but there was no similar immediate translation of Trembley's *Mémoires* into English or any other language. In 1746, a self-described "Mathematical, Philosophical, and Optical Instrument-Maker" by the name of George Adams published in his *Micrographia Illustrata*, what he called "A very particular Account of that surprising Phaenomenon, *The Fresh Water Polype*, translated from the French Treatise of Mr. Trembley." This twenty-eight page section of the *Micrographia* is part summary, part paraphrase of particular portions of Trembley's *Mémoires*, however, rather than a translation.

It seems likely that Trembley's Leiden *Mémoires* were published in a rather limited edition. As early as 1774, Bonnet wrote the prospective editor of a German translation, Johann Goeze, that Goeze might have to be satisfied with securing a copy of the inferior Paris edition since supplies of the Leiden *Mémoires* had been exhausted (see Trembley, 1791, pp. XXV-XXVI). Goeze, with Trembley's approval, did proceed with his German translation, which appeared in 1775 (Trembley, 1791). It was one hundred and sixty-two years later, 1937, before the only other complete translation of the *Mémoires* was published, this time in Russian by the Soviet biologist, I.I. Kanaev (Trembley, 1937).

In the decades since there have been several efforts of other kinds to recognize and create greater awareness of Abraham Trembley's contributions. The year 1943 saw the publication of the Réaumur/Trembley correspondence, gathered painstakingly during a period of more than forty years by Trembley's great-great grandson, Maurice. A landmark event was the publication in 1952 of John Baker's biography of Trembley. The biography, which incorporated certain critical portions of the *Mémoires* in fine English translation by Dr. Baker, seems to have stimulated new interest in Trembley and the *Mémoires* among English-speaking readers.

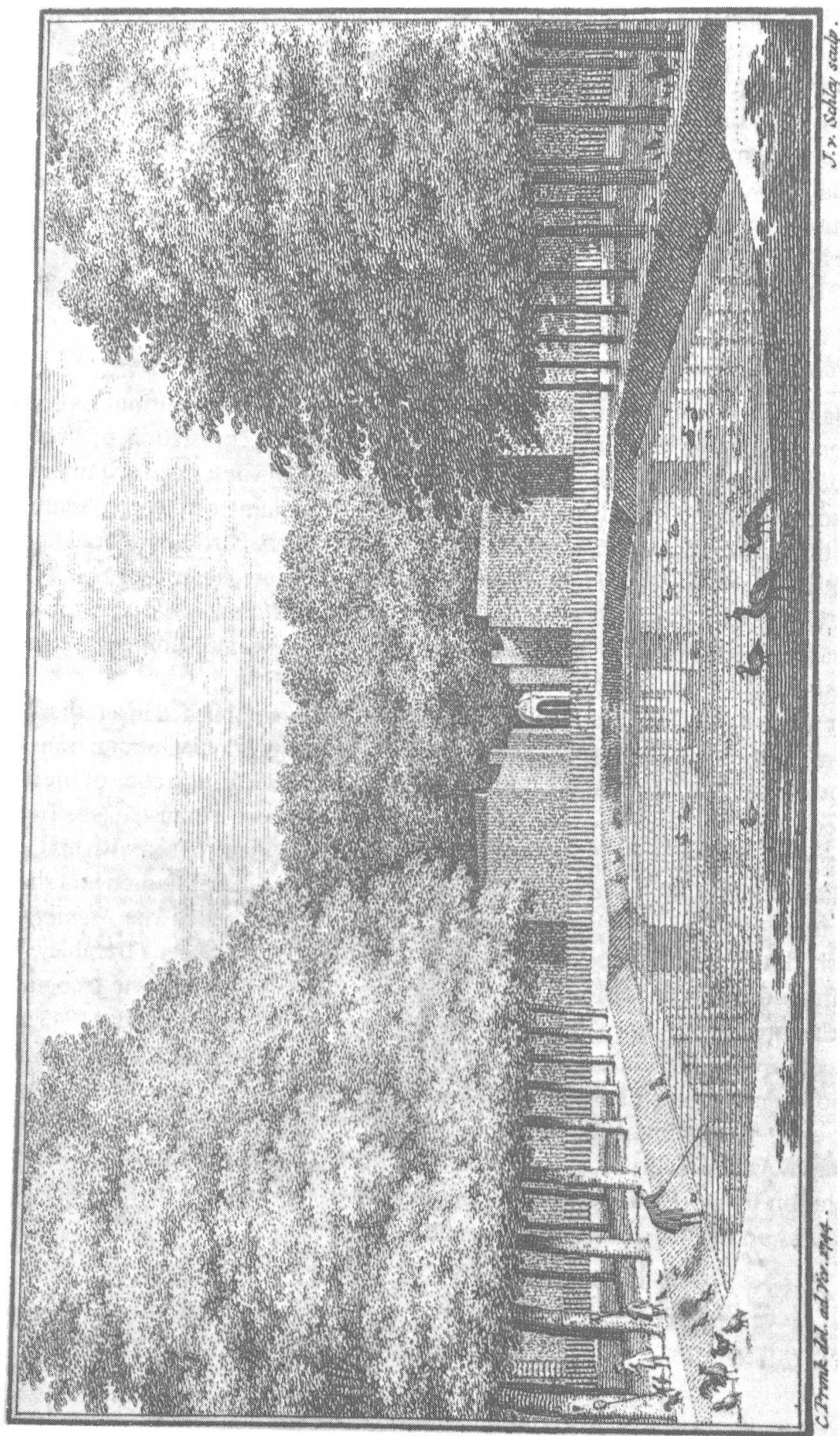


FIG. 3. — Trembley and the two Bentinck boys at the pond in Sorgvliet fishing for daphnia. This vignette heads the second Memoir, Leiden edition.

THE MÉMOIRES AS A RESEARCH MONOGRAPH

From the vantage point of the biological scientist or student of hydra in the 1980s who turns to Trembley's work, the distinctive pragmatic experimentalism of the *Mémoires* is quite gratifying. Readers who may be seeking insight into the animal, detailed information about it, guidance in delicate experimental procedures, and ideas of related investigations yet to be done using modern technology will appreciate the insistent anti-speculative factualism of the *Mémoires*, which stands in such sharp contrast to much of the work of the period.

Publications on Natural History During the Period

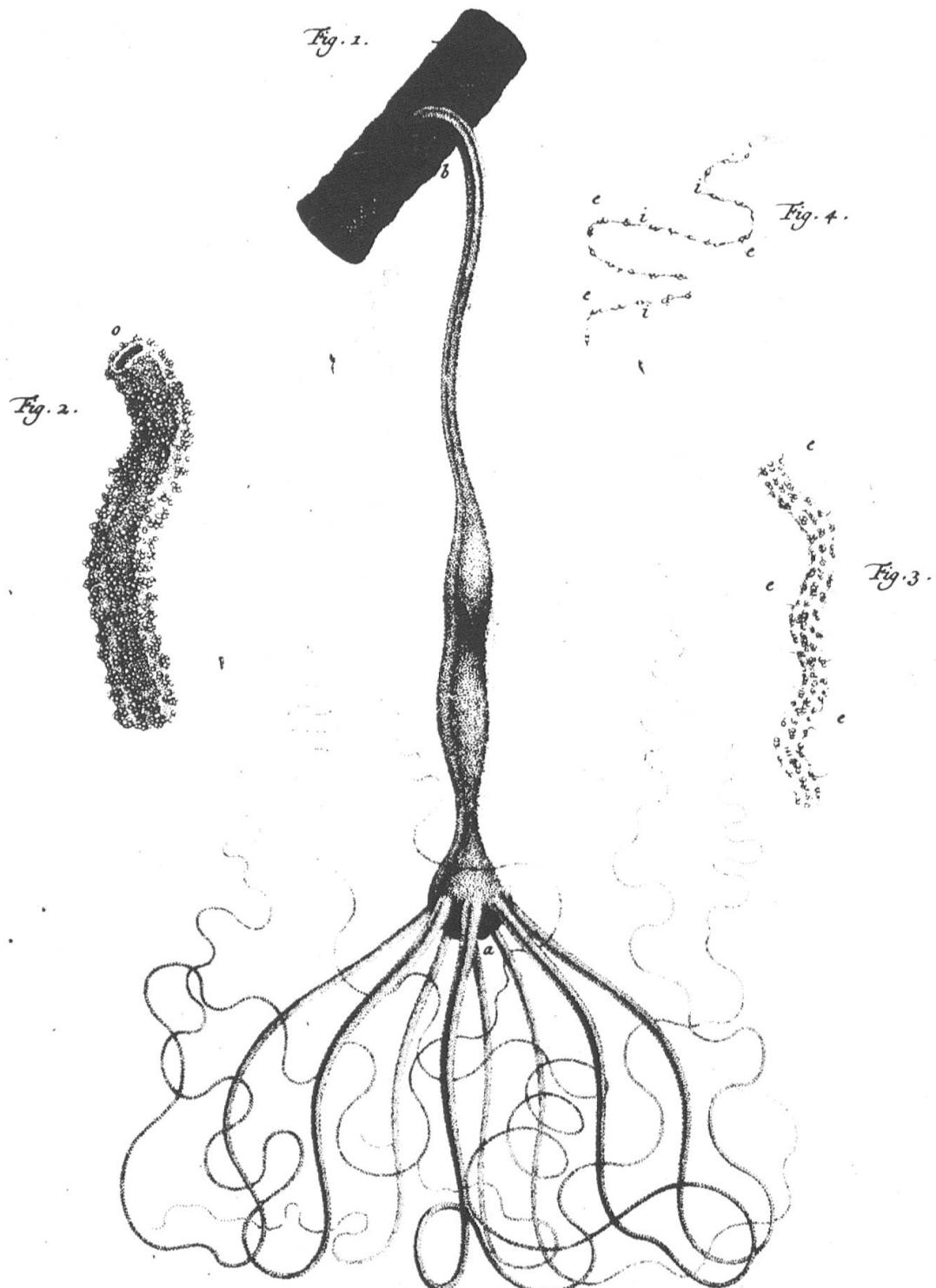
Trembley's *Mémoires* are in many ways characteristic of a large genre of mid-eighteenth century writings on natural history and on "small creatures" in particular. Similar works were produced during this period, for example, by the other two members of the Bonnet-Trembley-Réaumur trio: Réaumur's multi-volume *Mémoires* on the insects, appearing over the years from 1732-1742, and Bonnet's *Insectologie* in 1745. Books of the period on "the Insects" are the work of both professional scientists and amateurs, of academics and virtuosi. Some are pietistic in the vein of the Abbé Pluche, others iconoclastic like La Mettrie's; some enshrine the lofty theoretical debate of university faculties, whereas other exude the humbler air of the country doctor or parson during his free time examining the beauty of God's handiwork as expressed in His minute creatures. Some are multi-volume and range over a wide array of subjects, Buffon's running in encyclopedia style to forty-four quarto volumes, Réaumur's to six, and Bonnet's to eight.

Trembley may have modeled his *Mémoires* on Réaumur's classic in various elements of design and format. The *Mémoires* of both men also are similar in an insistent emphasis on careful reporting of observations and experiments, as contrasted with the heavy theoretical speculation that was still rampant in many of the treatises on natural history popular throughout the Age of Enlightenment even while those treatises included material from the rigorous scientific inquiry that some of their authors were beginning to pursue. On such juicy philosophic issues of the time fed by Trembley's discoveries as questions of the materiality and divisibility of the soul, emboitement or preformation versus epigenesis, or the Ladder of Beings, there is but little to be had from exploring Trembley's *Mémoires*. Later in life Trembley acknowledged a preformationist view in his only published venture into such speculative matters, but even then he did so with considerable qualms (Trembley, 1775, Vol. I, p. 326 ff. and Baker, 1952, p. 186). The *Mémoires* have nothing to say regarding preformation.

Trembley's Purposes and Audiences

It appears to us that Trembley wrote for particular audiences and with several major purposes. As he expresses it in his preface, he believed his observations on the polyps

Pl. 5. Mem. 1.



P. Lyonet delin.

J. v. Sodley sculp. 1742.

FIG. 4. — Plate 5 from the Leiden *Mémoires*, drawings by Pierre Lyonet.

“could bring pleasure to the inquisitive and contribute something to the progress of Natural History.” Such expressions of purpose were common throughout his era. Enlightenment figures like Diderot and Condorcet exhorted their philosopher colleagues to perform the important duty of popularizing philosophy and science in order to hasten the progress of mankind (Mornet, 1911, p. 174; Vartanian, 1963, p. 19; Hahn, 1971, pp. 37-38).

Trembley may have been concerned that his discoveries, which were so much the vogue in the salons of Europe and so provocative of both scientific and philosophic speculation and controversy, be properly understood by the general literate public. Discoveries so contrary to generally held ideas require “the clearest proofs,” he states at the outset of the first Memoir. If Trembley hoped by his careful account to restrain the excesses of reaction to his discoveries by the virtuosi, and to “bring pleasure to the inquisitive,” one nonetheless feels that Trembley was writing most of all to the likes of the amazed Réaumur, to de Jussieu, Allamand, de Villars, Folkes, Baker, Lyonet and those many other “competent judges” of whom he often speaks. These were his colleagues in England and on the continent, whether amateur or professional, country parson or academician, who were engaged in the increasingly widespread serious study of small creatures.

One way to encourage the “progress of Natural History” was for these far-flung colleagues who would read the *Mémoires* to repeat and verify his experiments and to contribute new and varied experiments of their own, both on the polyps and on other related animals. To this end Trembley penned his detailed “considerations” and “precautions,” or in current scientific terms, “materials and methods.” In his preface, Trembley tells us that from the outset, as he began to make his discoveries, he was eager to have them confirmed by others. Thus he followed the practice of often performing experiments in the presence of observers. In addition, he shared hydra from his own stocks, as well as instructions on how to carry out his experiments, with those interested in testing his experiments independently. Trembley’s employer and benefactor, Count Bentinck (1744), in a letter introducing Trembley’s work to Martin Folkes, President of the Royal Society, confirms that the young Genevan makes such sharing a “*Point d’honneur*”.

Trembley’s desire to reach an audience of prospective collaborators appears to have greatly influenced the structure, format and content of the *Mémoires*. The Leiden edition consists of a single volume as contrasted with the generally more voluminous publications on natural history then common. The conciseness of the work reflects in part the author’s style and factual emphasis, and also the nearly exclusive, one might say almost exhaustive, focus on a particular organism in contrast to the compilations of studies on a variety of creatures and concerns contained in many of the similar contemporary works. Trembley does include in the *Mémoires* work on related “polyps”, on animals that serve as food for the polyp, and on other small creatures that appear to share some of the reproductive peculiarities of the polyp, such as the bryozoan

Lophopus and the annelid *Stylaria*. In the preface he devotes several pages to publishing Lyonet's findings on the parthenogenic reproduction of aphids, urging his colleague "to publish a complete work" on his own. With these and a few other minor exceptions, the *Mémoires* essentially constitute a pioneering research monograph on a single animal, the fresh-water hydra.

Structure of the Mémoires

Drawing upon observation and experiment already reported in detail in lengthy letters to Réaumur, to the Royal Society, and others, Trembley organized the *Mémoires* in a very methodical, topical manner.

Trembley tells us in the first Memoir that he will proceed in the order "most natural to me," an order which proves to be remarkably similar to that of a modern scientific report. Memoir I is essentially an "introduction" of the polyp to the reader, with a general description of its form and movements and some observations on the structure of the animal's parts. It is noteworthy that detailed material on structure is reserved for the relevant sections on function. In Memoir II Trembley deals with "materials and methods" of the animal husbandry entailed, how to collect the polyp, feed and maintain it, with some observations on color and functional morphology that are related to its feeding. Memoir III is a "results" section, dedicated entirely to one of the most notable attributes Trembley has discovered in the animal, that is its "amazing reproduction" by asexual means. The first sixty-six pages of Memoir IV complete the "methods" and "results" as Trembley presents all the other "operations" he has carried out on the polyp. These include sectioning the animal in almost every manner conceivable; the making of monsters; and the famous inversion experiment in which Trembley details for us his procedures for deftly turning the tiny creatures inside out, the experiment which led to the first experimental grafts of animal tissue.

The final eighteen pages of Memoir IV, which are set off from the experimental material, are very much analogous to the "discussion" section of a modern scientific paper. Here Trembley discusses the relationship of his polyps to marine polyps, or cuttlefish, and other presumably polyp-like creatures, presenting a "literature search" on the subject. The search is instructive regarding the progress of zoological studies to that time. Trembley dutifully incorporates references to the ancients, Aelian, Aristotle, Augustine, Massarius, Pliny, wryly remarking, "I believe one may be allowed to doubt the accuracy" of some of their assertions. Elsewhere he demurs from judging the degree to which the ancients' views should be heeded since such judgments require knowledge of the specific observations on which their views were based and how they carried out these observations. "Such details," he says with profound understatement, "are not found in the works of any of these writers." From the ancients Trembley leaps centuries to Swammerdam, to Réaumur and to other contemporaries such as the English minister, Mr. Hughes, who have demonstrable factual information to impart.

In his final pages of discussion on the question of characteristics distinguishing animals from plants, Trembley permits himself to hold forth at some length on the perils of general rules, of hypothesizing on the basis of insufficient facts, and on the importance of drawing limited conclusions. Polyps, he says, do not constitute some newly hypothesized class of "Zoophytes" or "Animal-Plants," as he himself had once suggested (Trembley, 1943, p. 61); they should be looked upon instead as simple animals. He urges philosophers to drop the preconceptions that blind them so that they can pay attention to the facts before their eyes, just as children do. He argues that had men not been held back by suppositions that one or another thing was "impossible," natural history would be far more advanced and regeneration among animals, for example, would have been discovered long since. (Disarmingly, Trembley admits that his own supposition of this kind, that pieces of an animal could not become complete animals, contributed significantly to his discovery of regeneration.) He ends this final "discussion" section and the *Mémoires* with a plea for expanding careful observation and experiment and not mixing our own notions with what we learn from close examination of nature itself.

Antipathy to Generalization and Speculation: A Feature of the Mémoires

With counterpoint from his arguments for limited conclusions and suspended judgments, Trembley's antipathy to "general rules" runs like a leitmotif through the *Mémoires*. He pleads with the reader not to be seduced by "general rules," and atypically it would seem for what by all accounts was a tolerant, gentle temperament, he rails against such thinking. According to accepted general rules on plant and animal characteristics the polyps would have to be "neither Plant nor Animal and yet both," Trembley mocks. Then there is the "allegedly universal rule that there is no reproduction without copulation," which Trembley points out already has been discredited by Bonnet's discovery of parthenogenesis in aphids.

Another of Trembley's targets was the widespread practice among naturalists of the period of arguing by analogy. Ritterbush (1964, p. 124 ff.) takes as one of his main themes in characterizing the study of natural history in the eighteenth century the development that he calls the "Triumph of Botanical Analogy," which he describes as particularly pernicious to the progress of the life sciences during that century. Ritterbush terms Trembley "a sound experimentalist" unusual for his time and finds him "indifferent to the idea of botanical analogy". In the *Mémoires* Trembley seems definitely antagonistic rather than simply indifferent to argumentation by analogy. It might certainly be that there were various "imperceptible parts" in the polyps, but to posit them on the basis of "simple analogy," Trembley says, is not "very satisfying." Since the polyps differ in many ways from other animals, they may also differ in regard to any such minute parts.

In the matter of argument by analogy, it is interesting to contrast Trembley with the Englishman who followed him in observing and experimenting with hydra, Henry

Baker. Baker, like Trembley, emphasized careful observation and experimentation. Both wrote as modest experimentalists who loved nature and nature's God, without having great systems to propound, whether religious or scientific. But it is easy to imagine what Trembley's reactions might have been to such an argument from analogy as Baker engaged in regarding the polyp's "teeth." Baker (1743, pp. 32-33) decides the polyp must have teeth even though he cannot see them because of the way it breaks up a worm into manageable-sized pieces it can swallow, and because of "the violent and painful Agonies a Worm experiences the Moment it is taken hold on by the Polyp's Snout."

The Mémoires as an Expression of an Engaging Scientific Personality

It could be said, however, that in one way the *Mémoires*, despite their organization, factualism and experimentalism, do not read like a modern scientific report. Trembley, the scientist, with his emotional reactions, his notions conjured with and dismissed, and reflections and elements of his personality — these remain to enhance the pleasure of reading the science itself. For example, when Trembley first observes hydra that are feeding, he comments: "Only reluctantly did I absent myself for a few hours from this spectacle which had so greatly excited my curiosity. Impatience to know what would become of the Millepede drew me back to my study as soon as possible." He reacts with similar pleasure to his first observation of asexual reproduction by budding in the creature and with high excitement to his discovery of the regenerative powers of the tiny animal.

Trembley often appears almost playful as he experiments. In one passage he tells of deliberately tangling up the arms of a long-armed polyp so badly he does not believe the polyp will be able to disentangle them without help. At another time, while trying to determine the polyp's natural enemies, he is repeatedly unsuccessful in coaxing a perch to swallow and keep down a polyp. After a while he conceives of tricking the fish by presenting it with a polyp that is itself in the process of swallowing a kind of worm much favored by the perch. A similar kind of playfulness is evident in the sectioning experiments and in those on reversal.

Trembley may have been creative and playful while observing and experimenting, but most of all he was painstakingly accurate both in what he did and in how he later described it. John Baker (1952, pp. 164-165) finds the "accuracy of his observations . . . perhaps the most striking feature of Trembley's work. One can read his writings today not simply for their historical interest, but to get reliable information; the student can learn biology and the history of biology at the same time."

STYLE AND LANGUAGE OF THE MÉMOIRES

Mornet tells us (1911, pp. 199, 202) that it was only during the eighteenth century that writers on science began to be anxious about pleasing their readers stylistically.

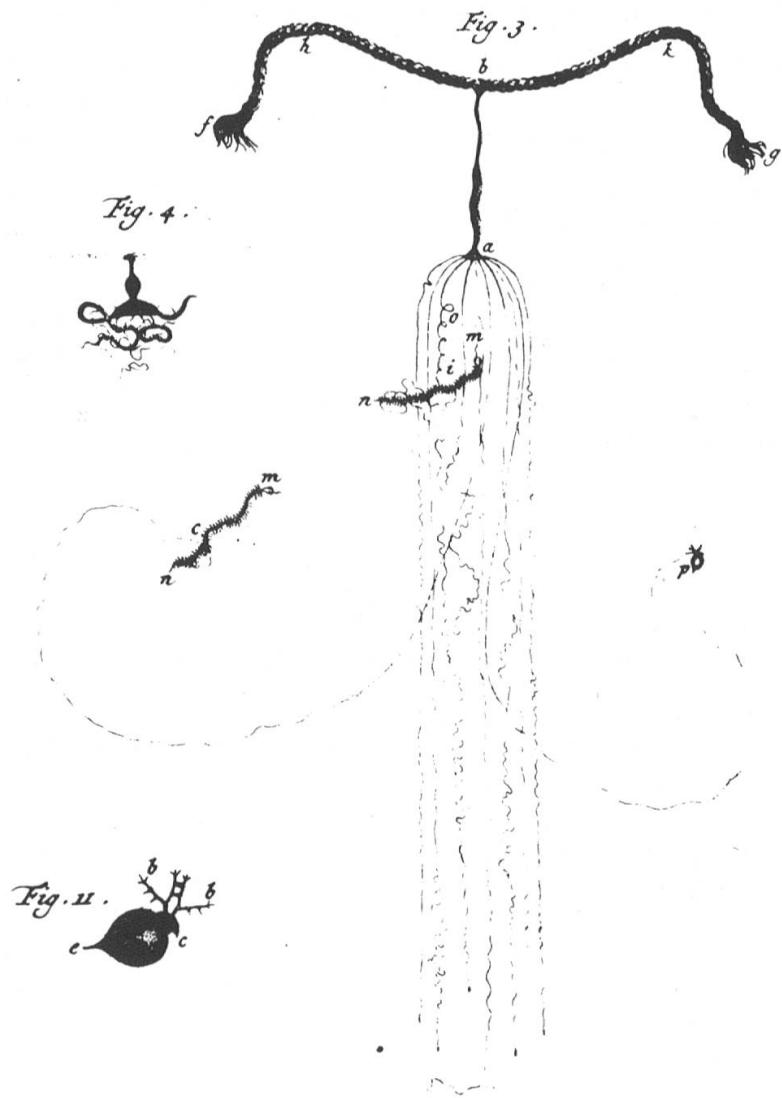


FIG. 5. — Some figures from Plate 6 of the Leiden *Mémoires*, drawn and engraved by Lyonet.

Prior to that era, science was “not an affair of literature,” it was mostly expounded in Latin, and it was not intended for a general public. Biographer Baker (1952, p. 41) speaks of Trembley’s style as “generally limpid in its clarity.”

Wheeler (1926) provides an excellent commentary on the scientific style of the time in the introduction to his edition of Réaumur’s *The Natural History of Ants*. It is not surprising that some of the less attractive elements of Réaumur’s style, as described by Wheeler, do also occasionally appear in Trembley’s writing. These include “the heaping up of relative clauses, the looseness of syntactical construction, the avoidance of concisely periodic sentences and a preference for indirect or negative statements.” Wheeler describes these as “the expression of a calmer, more leisurely and more refined

reaction to the social environment" than that to which the modern reader is accustomed. Though "desire for completeness of description" of which Wheeler speaks seems to lead Trembley occasionally to pile clause upon clause in a paragraph consisting of one long sentence, or to extend an unbroken paragraph for several pages, Trembley is not given to the "slow movement and diffuseness" that Wheeler and others (see also, Mornet, 1911, pp. 11, 202) attribute to Réaumur. Nor is Trembley's prose "very restrained, tenuous and almost atonic, like a minuet performed on an old harpsichord?" There is some harpsichord in the writings of Trembley, but no minuet; to a remarkable degree the sound seems to us modern, bright and fresh.

Trembley's organization of the *Mémoires* is generally clear, logical, straightforward and uncluttered; his language is simple, direct and supple; and he is little given to dramatic apostrophes and circumlocutions often encountered in similar writings on science during this period. The *Mémoires* make good reading.

CONCLUSION: THE MÉMOIRES AS A RESOURCE FOR MODERN INVESTIGATORS

The warm tribute to Trembley's *Mémoires* written in 1890 by the German biologist Nussbaum (see Baker, 1952, p. 48) appears still valid today.

In the year 1744 appeared Trembley's treatise, a masterpiece of precise presentation of carefully and prudently arranged observations, a classical model for a detailed biological investigation that undertakes to give in a single frame a picture of the whole life-history of a group of animals. Such a work, accompanied by the artistic illustrations of a Lyonet, will for ever [sic] remain, as regards form and content, a rich source of information for scientific research-workers, and will excite joyful admiration through the sincere modesty and scarcely surpassable clarity of the style.

Virtually all of the experiments described in the *Mémoires* have been repeated and confirmed over the past two centuries and can still serve today as models for much research in experimental morphology and developmental biology. Today's biologists dipping into the *Mémoires* can gain insight into the nature of hydra, the range of possible experiments that can be carried out on the animal, and also the limitations of conducting research using hydra. Trembley covers virtually every aspect of the biology of the animal including its structure, behavior, physiology, development, and its interaction with prey and predators. In addition he describes methods for finding hydra in nature, for characterizing the different species, and for feeding and maintaining the animals in the laboratory. Further, the processes taking place at the cell and tissue levels that underlie many of Trembley's observations remain to be elucidated. The *Mémoires* of Abraham Trembley appear to be unusual among similar classical scientific works in the extent of their continued factual validity and the provocative questions they continue to evoke.

ACKNOWLEDGEMENTS

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