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POLYPE

By Professor LORANDE LOSS WOODRUFF

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BAKER ON THE MICROSCOPE AND THE POLYPE

By Professor LORANDE LOSS WOODRUFF

YALE UNIVERSITY

THE transactions of learned societies during the eighteenth century are replete with microscopical observations instigated directly or indirectly by the pioneer work of Hooke and Grew in England, Leeuwenhoek and Swammerdam in Holland, and Malpighi in Italy. In particular, Leeuwenhoek's long series of letters, published year after year chiefly in the *Philosophical Transactions* of the Royal Society of London, revealed an undreamed-of microcosm beyond the ken of unaided vision and turned the attention of the "Ingenious and Curious," the philosopher and dilettante, to the slowly developing microscope as a source of pleasure or fame. Among the English disciples of Leeuwenhoek, it was Henry Baker, of London, on whom seems to have fallen the Dutch microscopist's mantle—though, it is true, considerably reduced.

Baker was born in London on May 8, 1698, and began his career at an early age as a bookseller's apprentice. In 1720 he undertook to tutor a deaf and dumb child and with such success that he established a private school in London for deaf mutes. His course of instruction comprised speech and lip reading, writing and drawing, but the essential point of his system, which unfortunately he felt constrained to keep a secret, was that, after the preliminary training, he took his pupils on rambles about London and instructed them by conversation on the events of everyday life with which they came in contact. Baker realized a considerable fortune from his school, and the success of his method brought him to the attention of Daniel Defoe, who in 1728 became associated with him in founding the *Universal Spectator and Weekly Journal*. The following year Baker married Defoe's youngest daughter, Sophia, who bore him two sons. He survived both his wife and children, his sole heir being a grandson. After Baker's death on November 25, 1774, the Royal Society established the Bakerian Lecture with a fund given by him for discourses on "anatomical or chymical" subjects.

Baker's first essay as an author was "The Invocation of

Health," which was published without his sanction in 1723. The same year appeared a pamphlet of "Original Poems: Serious and Humorous," printed for the author, and was followed in three years by the "Second Part of Original Poems: Serious and Humorous." In 1727 was published his philosophical verses entitled "The Universe. A Poem intended to restrain the Pride of Man." This was printed for T. Worrall at Judge Coke's Head, against St. Dunstan's Church, in Fleetstreet, and sold for one shilling. "The Universe," as its subtitle indicates, is an attempt to impress the reader with the vastness and grandeur of nature and the folly of insignificant man believing that it was created for his especial edification. This poem, which attained considerable popularity and was frequently quoted, reminds one of the poetical works of Erasmus Darwin. An idea of the whole may be gathered from the following extract, which is one of the most interesting, and apparently one which Baker especially approved since he quoted it before the Royal Society—the first instance of original versification appearing in the *Philosophical Transactions*—and again nearly twenty years later in "The Microscope Made Easy":

Each Seed includes a Plant: that Plant, again,
Has other Seeds, which other Plants contain:
Those other Plants have all their Seeds; and Those,
More Plants, again, successively inclose.

Thus, ev'ry single Berry that we find,
Has, really, in itself whole Forests of its Kind,
Empire and Wealth one Acorn may dispense,
By Fleets to sail a thousand Ages hence:
Each Myrtle-Seed includes a thousand Groves,
Where future Bards may warble forth their Loves.
So ADAM'S Loins contain'd his large Posterity,
All People that have been, and all that e'er shall be.

Amazing Thought! what Mortal can conceive
Such wond'rous Smallness!—Yet we must believe
What Reason tells: for Reason's piercing Eye
Discerns those Truths our Senses can't descry.

During the next decade Baker published two volumes entitled "Medulla Poetarum Romanorum" and also a translation of Molière; but his name has been preserved from oblivion almost solely by his two volumes, "The Microscope Made Easy" and "Employment for the Microscope," which exploited the compound microscope.

For Many have been frightened from the Use of it, by imagining it required great Skill in Optics, and Abundance of other Learning to comprehend

it to any Purpose: whereas nothing is really needful but good Glasses, good Eyes, a little Practice, and a common Understanding, to distinguish what is seen; and a Love of Truth, to give a faithful Account thereof. Others have considered it as a meer Play-thing, a Matter of Amusement and Fancy only, that raises our Wonder for a Moment, but is of no farther Service: which Mistake they have fallen into, from being unacquainted with any Principles whereby to form a right Judgment of what they see. Many, again, have laid the Microscope aside, after a little Use, for want of knowing what Objects to examine, where to find, how to prepare, and in what Manner to apply them. The trouble of managing it has also frightened some. . . .

The likeliest Method of discovering Truth, is, by the Experiments of Many upon the same Subject; and the most probable Way of engaging People in Such Experiments, is, by rendering them easy, intelligible, and pleasant. To effect this, is my Endeavor in the following Treatise. . . .¹

"The Microscope Made Easy" was dedicated to the Royal Society and, receiving its imprimatur in 1742, was published by the famous London bookseller, Robert Dodsley.

Where Tully's bust and honour'd name
Point out the venal page,
There Dodsley consecrates to fame
The classics of his age.²

The book's popularity is attested by the fact that a second edition, with some additions, appeared the following year, and later editions, unchanged, in 1744, 1754, 1769, 1785, etc., not to mention the translations into foreign languages. The scope of the work is given *in extenso* on the title page (*cf.* Fig. 1).

The spirit of the eighteenth century which called forth Baker's volumes is well expressed in the Introduction:

In this inquisitive Age, when the Desire of Knowledge has spread itself far and wide, and we sit not down contented, as heretofore, with the Opinions of ancient Times, but resolve to examine for Ourselves, and judge from our own Experience; it may not, perhaps, prove unacceptable to point out some proper Subjects of Enquiry.

The Works of Nature are the only Source of true Knowledge, and the Study of them the most noble Employment of the Mind of Man. Every Part of the Creation demands his Attention, and proclaims the Power and Wisdom of its Almighty Author. The smallest Seed, the minutest Insect, shews the Skill of Providence in the Aptness of its Contrivance for the Purposes it is to serve, and displays an Elegance of Beauty beyond the utmost Stretch of Art.

The Wise in all Ages have been sensible of this Truth; and, as far as they were able, have studied and enquired into the Recesses of Nature; but for Want of proper Helps have frequently been mistaken. As certain Principles must first be learned ere we can become Masters of any Science, so in the School of Nature, we must begin with the *Minutiæ*, the smallest and most uncompounded Parts, ere we can understand the larger and more considerable. . . .

¹ "The Microscope Made Easy," Dedication.

² *London newspaper*, 1756.

That Man is certainly the happiest, who is able to find out the greatest Number of reasonable and useful Amusements, easily attainable and within his Power: and, if so, he that is delighted with the Works of Nature, and makes them his Study, must undoubtedly be happy; since every Animal, Flower, Fruit, or Insect, nay, almost every Particle of Matter, affords him an Entertainment. Such a Man never can feel his Time hang heavy on his Hands, or be weary of himself, for want of knowing how to employ his Thoughts: each Garden or Field is to him a Cabinet of Curiosities, every one of which he longs to examine fully; and he considers the whole Universe as a Magazine of Wonders, which infinite Ages are scarce sufficient to contemplate and admire enough. . . .

All these, and numberless Wonders more, the MICROSCOPE can exhibit to us. I shall therefore proceed to describe this noble Invention, shew how far it is improved at present, give a brief Account of what Discoveries have been made, and point out some Objects for the Curious to examine by it. In doing this, I shall avoid as much as possible all Affectation of Learning, or Expressions that are not in common Speech, being desirous that every body may understand me.

The author, then, in Part I. of the book, first describes and illustrates in succession the Single Microscope and a new invention for "giving Light to it by a Speculum," the Double Reflecting Microscope, the Solar or Camera Obscura Microscope and the Microscope for Opake Objects, and then devotes the remaining chapters to general microscopical technique, concluding with some sound advice:

Beware of determining and declaring your Opinion suddenly on any Object; for Imagination often gets the Start of Judgement, and makes People believe they see Things, which better Observations will convince them could not possibly be seen: therefore assert nothing till after repeated Experiments and Examinations, in all Lights, and in all Positions.

When you employ the Microscope, shake off all Prejudice, nor harbour any favourite Opinions; for, if you do, it is not unlikely Fancy will betray you into Error, and make you think you see what you would wish to see.

Remember, that Truth alone is the Matter you are in Search after; and if you have been mistaken, let no Vanity seduce you to persist in your Mistake.

Part II. of the work (*cf.* Fig. 1) is devoted to an account of microscopical discoveries and to "Pointing out many uncommon Subjects to the Enquiry of the Curious." The material presented is largely gleaned from the works of others, chiefly Leeuwenhoek, Swammerdam, Hooke, Power and Derham—to whose works he gives page references in every instance—but in addition he inserts many observations of his own, some new and some from his papers before the Royal Society, and also intersperses the whole with pertinent remarks in regard to the subject under immediate consideration. For example, in his account of blood:

I believe it will be allowed, that where one Person dies from a Dis-

THE MICROSCOPE Made Easy:

O R,

I. *The Nature, Uses, and Magnifying Powers*
of the best Kinds of MICROSCOPES
Described, Calculated, and Explained:

FOR THE

Instruction of such, particularly, as desire to search
into the WONDERS of the *Minute Creation*,
tho' they are not acquainted with *Optics*.

Together with

Full Directions how to *prepare, apply, examine, and preserve*
all Sorts of OBJECTS, and proper Cautions
to be observed in viewing them.

II. An Account of what surprizing Discoveries
have been already made by the MICROSCOPE:
With useful Reflections on them.

AND ALSO

A great Variety of new *Experiments* and *Observations*,
pointing out many uncommon Subjects for the
Examination of the CURIOUS.

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

Illustrated with COPPER PLATES.

The SECOND EDITION: With an additional *Plate*
of the *Solar Microscope*, and some farther Accounts of the
POLYPE.

Rerum Natura nusquam magis quàm in Minimis tota est.

PLIN. Nat. Hist. Lib. xi. c. 2.

L O N D O N.

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

FIG. 1.

EMPLOYMENT FOR THE MICROSCOPE. In TWO PARTS.

I. An Examination of *Salts* and *Saline Substances*, their amazing *Configurations* and *Crystals*, as formed under the Eye of the Observer:

WITH

Plain Directions how to prepare such Substances, and preserve them in constant Readiness for Inspection; whereby the *Curious* may always be furnished with numberless Objects hitherto little known.

ALSO

Occasional Considerations on *Gems*, *Poisons*, the *Vegetation of Metals*, the *Resuscitation of Plants*, the *Formation of Amber*, *Corals*, and many other Subjects.

II. An Account of various ANIMALCULES never before described, and of many other *Microscopical Discoveries*:

With OBSERVATIONS and REMARKS.

LIKEWISE

A Description of the MICROSCOPE used in these Experiments, and of a new *Micrometer* serving to shew the Size of magnified Objects.

Together with

Instructions for printing off any *Medal* or *Coin*.

Illustrated with SEVENTEEN COPPER PLATES.

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

Rerum Natura nusquam magis quàm in Minimis tota est.

PLIN. Hist. Nat. Lib. XI. cap. 2.

L O N D O N:

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 Fleet-street. 1753.

order in the containing Vessels, twenty miscarry by some unnatural Alteration in the Fluids that pass through them: and therefore, if we can find what their natural State is, the Means whereby it may be preserved in such State, by what Accidents it may be prejudiced, and how it may be restored, our Pains will be well employed.

In order to obtain this useful Knowledge, it will be necessary to examine the human Blood and other Juices, frequently, with the *Microscope*, in every Condition, and under every Distemper, as well as in a State of Health: by which we shall have ocular Demonstration of its different Appearances in each State, and of the Changes it undergoes; and by Experiments of various Mixtures with it, may possibly discover by what Means it can be altered from one Condition to another. . . .

Would our learned Physicians, who are best able to judge of such Matter, be induced to take this Method into their Practice, it is reasonable to believe, that in a few Years the Causes of Diseases would be better known, and the Art of Healing brought to a much greater Certainty, than it is at present. . . .

Many Distempers might perhaps be cured by an immediate Admission of some Medicine into the Veins, which elude the Power of all that can be taken by the Mouth. For the Stomach, by its Heat, its Action, and a Mixture of its Juices, works such an Alteration in Things before they can be admitted into the Blood, that they are unable to produce the same Effects as if they were received into it simply and unchanged.

In the chapter on the generation of organisms he says that

Nothing seems now more contrary to Reason, than that *Chance* and *Nastiness* should give a Being to Uniformity, Regularity, and Beauty: that two such unlikely Principles should produce, in different Places, Millions of Vegetables of the same Kinds, and alike exactly, even in the most minute Particularities: or, what is yet more amazing, that dead *corrupting Matter*, and blind *uncertain Chance*, should create living Animals. . . . This, however, was the Opinion, not only of the Ignorant and Illiterate, but of the most learned grave Philosophers of preceding Ages; and would probably still have been taught and believed, had not *Microscopes* discovered the Manner how all these Things are generated. . . .

And, again, that

The Growth of Animals and Vegetables seems to be nothing else but a gradual Unfolding and Expansion of their Vessels, by a slow and progressive Insinuation of Fluids adapted to their Diameters; until, being stretched to the utmost Bounds appointed them by Providence at their Formation, they attain their State of Perfection, or, in other Words, arrive at their full Growth

—a view which called forth the verses from *The Universe* which were quoted on an earlier page.

The numerous illustrations which are grouped on 15 copper plates include, for example, good reproductions of Leeuwenhoek's original figure of *Hydra* from the *Philosophical Transactions*, and what is probably the first figure of a *Paramecium*, from an anonymous communication in the same publication.

Concordant with the custom of the time:

Before this Treatise is concluded, it will not perhaps be thought unprofitable to examine some of the finest and most exquisite Performances of human Art, and compare them with the Productions of Nature; as such a Comparison must tend towards humbling the Self-conceit and Pride of Man, by giving him a more reasonable and modest Opinion of himself; and at the same time may in some Degree conduce towards improving his imperfect Conceptions of the SUPREME CREATOR. . . .

The Use of the *Microscope* will naturally lead a thinking Mind to a Consideration of *Matter*, as fashioned into different Figures and Sizes, whether Animate or Inanimate: it will raise our Reflections from a Mite to a Whale, from a Grain of Sand to the Globe whereon we live; thence to the Sun and Planets; and, perhaps, onwards still to the fixt Stars and the revolving Orbs they enlighten, where we shall be lost amongst Suns and Worlds in the Immensity and Magnificence of Nature.

Although the proportion of Baker's own observations is relatively very small, the work is far from being merely an excellent compilation, as it is permeated throughout with the spirit of a man who is a constant, enthusiastic devotee of microscopic study and who is acquainted first hand with a large part of the material he is presenting.

The success of "The Microscope Made Easy" led Baker to publish ten years later his "Employment for the Microscope," which is practically a supplement to the second part of his first book—and after 1753 the two works were usually sold together under the title "Baker on the Microscope." This second volume is largely a compilation of Baker's own studies of animalcules from various sources and here we find a Suctorian figured for the first time, apparently *Podophrya quadripartita*, as well as a number of other hitherto undescribed organisms. Baker, like Joblot, makes an attempt to give more or less appropriate names to the various organisms which he describes but he does not apply a binomial nomenclature or classify them—Dr. John Hill, during the previous year, being the first to give animalcules definite Latin names (*e. g.*, *Paramecium*) and to arrange them in groups, under the influence of the rapid advances in taxonomy at the time.

Although Baker's studies on microscopic organisms have been emphasized above, apparently he himself and the Royal Society were more pleased with his studies, presented at length in this volume, which he had been making

for above ten Years past, on a great variety of Saline Bodies, Mineral, Vegetable and Animal, as well as many other Substances, both simple and compound, whose Parts can be dissolved in Fluids, after a Method which has never hitherto been described by any Author, or practised before myself by any body that I have heard of. And tho' I have found their original Particles undiscoverable by any Microscope, the Time I hope has not been wholly misemployed; since I have been enabled, by the help of that

Instrument, to behold the amazing Order and Regularity, wherewith, after being separated by Dissolution, they come together and re-unite under the Eye, when put in Action by certain Degrees of Heat, in Configurations appropriated to each of them respectively, and with a Constancy that is surprising.³

The Experiments here described, and which the Reader is instructed to make, must I think generally entertain; but merely to entertain, is, I hope, the least of their Worth. They may possibly lead to the Knowledge of what passes in the Formation of Gems, and the most beautiful mineral Productions: And as every new Discovery is an Encouragement to farther Disquisition, the Hints here given may perhaps set abler Heads at Work to improve Art on the Principles of Nature. Examinations by the Microscope, in the Manner here directed, may likewise be employed to ascertain the Truth and Purity of many simple Substances and Compositions made use of in Medicine, and detect Fraud and Imposition.⁴

For this work Baker received the Copley Medal of the Royal Society for 1774 which was awarded "to whomsoever of the members shall be deemed to have produced the most extraordinary Discovery during the whole year."

The volume concludes with a chapter on "Miscellaneous Observations" which includes a section on the microscopes of Leeuwenhoek.

Though Mr. Leeuwenhoek's Microscopes are much talked of, very few People are acquainted with their Structure and Apparatus, no Figure of them that I remember having ever been made publick: 'tis therefore hoped the Curious will be pleased to see a Drawing of them, taken with great Exactness from those in the Repository of the *Royal Society*. . . .

Baker was apparently a congenial spirit and "Societarian," being for nearly thirty years one of the most active Fellows and frequent members of the Council of the Royal Society, a Fellow of the Antiquarian Society of London, and a founder and secretary of the Society for the Encouragement of Arts, Manufactures and Commerce. Martin Folkes, during his eleven-year presidency of the Royal Society, was on terms of considerable intimacy with Baker, being one of a small group of the Fellows who met now and then at Baker's home to consider matters philosophical. Folkes apparently had great confidence in Baker's skill with the microscope and frequently asked him to verify observations communicated to the Royal Society through the president.

It was in this capacity, for example, that Baker made his observations on the origin of "Eels in blighted wheat" (which Needham had communicated in his "New Microscopical Discoveries," London, 1745, and later advanced as support of the

³ "Employment for the Microscope," Chapter I.

⁴ *Ibid.*, Dedication.

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

DESCRIBING

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 quàm in Minimis tota est.
 PLIN. Nat. Hist. Lib. xi. c. 2.

L O N D O N:

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 Shillings.

FIG. 3.

well-known "Buffon-Needham Theory") as well as his study of *Hydra* which he published in a volume of 222 pages under the title of "An Attempt towards a Natural History of the Polype: In a Letter to Martin Folkes, Esq; President of the Royal Society," London, 1743 (*cf.* Fig. 3).

That curious Observer of Nature, Mr. LEEUWENHOEK, first took notice of this Animal, and the uncommon Way its young ones are produced, in the Year 1703 . . . but its more amazing Properties were reserved for the Inquisitive and happy Genius of Mr. TREMBLEY to discover, in the Year 1739 . . . observing it in some Respects to bear the Resemblance of a Plant, and in others of an Animal, he resolved, by cutting it in pieces, to satisfy himself, whether of the two it really was; and found, by this Trial, that, after a few Days, each Piece became a perfect Body, of the same Form exactly as *That* of which it had been only a Part: which Appearance would have determin'd him to conclude it to be a Vegetable, had he not discovered in it at the same time, a frequent Change of Figure, a Motion from place to place, a greedy and voracious Appetite, and a singular Dexterity in catching, mastering and devouring Insects and Worms. . . .

In consequence of these Discoveries, he, ever since, has been making a Variety of such Experiments as none but his own fertile Invention would, probably, have contrived. These Experiments were performed in Sight of many of the Curious. . . . Some of these Creatures were likewise sent both to Mons. REAUMUR and YOU, lest any Difficulty of finding them, might prevent, discourage, or delay making the same Trials in *France*, or *England*, as himself had done at the *Hague*.⁵

When Accounts of the extraordinary Properties of this Creature were communicated to you . . . it was never expected we should rest contented with their Accounts without making Experiments ourselves: *Nul- lius in Verba* being the wise Motto and establish'd Maxim of the ROYAL SOCIETY. But in respect to the Reputation of the ROYAL SOCIETY as well as to the Gentlemen who communicated these Discoveries, it became incumbent on us, as soon as they had sent the Insects over hither, to put them to a severe but speedy Trial, and from the Issue of our own Experience, either convince the World that these Gentlemen had been mistaken, or give our Testimony that what they affirm is true. This, SIR, was your opinion. . . .⁶

YOU was, likewise, so obliging to favour me with three of your *Polypes*, very soon after their Arrival, with Intent that I should put them to the severest Test; and, to encourage and assist me in so doing, have frequently honoured me with your Company, and been yourself a Witness of my Proceedings.

With these three *Polypes* I began my Experiments. . . . And I have gone on till this very Day repeating most of them several Times over, without finding any considerable Difference, but that of a much quicker Growth and Separation of the Parts cut to Pieces as the Weather became warmer. . . . Though it may not be improper to remark, that what by Divisions, Subdivisions, and the Creature's natural Increase, several hundreds have been produced by my first three, between *March* the twenty fifth, and the present fourth Day of *August*.

⁵ "Natural History of the Polype," pp. 4-5.

⁶ *Ibid.*, p. 201.

These, however, were not all the Polype I have had under my daily Care and Inspection: for . . . Mr. ELLICOTT, F.R.S. gave me six *English* Ones, and . . . seven or eight green Ones, . . . which have also increased considerably. And, in *July* last, you favoured me farther with some of the longarm'd Sort, just then arriv'd from Mons. TREMBLEY.

You, SIR, who know my Way of thinking, will not I am persuaded so far mistake me, as to imagine I am attempting, by this Essay, to vie either with yourself, or Mr. TREMBLEY; but it may not be improper to assure that Gentleman and the World, who are not so well acquainted with me, that I am as far from, as unequal to, such a Design; and that my real and only Motive to the many Experiments I have made, to the Care I have taken in propagating these Creatures, to the Readiness wherewith I have sent Numbers of them to *Oxford* and *Cambridge*, and dispersed them, as much as I have been able, amongst the Curious, and to this present Undertaking, has been to vindicate the Truth: which suffers sometimes for want of proper Means to prove it: and to display before Mankind, a new Instance of the amazing Power of the Creator.⁷

Thus the first book devoted to regeneration in animals appeared in England in 1743 and in a French translation in Paris in 1744, the same year that Trembley's famous "*Mémoires pour servir à l'histoire d'un genre de Polypes d'eau douce*" was issued at Leyden.

In view of the fact that Baker's work is not discussed in any, and the title of his book appears in the bibliography of only one of the recent volumes on regeneration, as a matter of record it seems worth while to give his list of experiments:

Experiment I. Cutting off a Polype's Head; II. Cutting a Polype in two Pieces, transversly; III. A Polype cut in three Pieces transversly; IV. Cutting the Head of a Polype in four Pieces; V. Cutting a Polype in two Parts, lengthways; VI. Cutting a young Polype in two Pieces whilst still hanging to its Parent; VII. Cutting a Polype lengthways through the Body, without dividing the Head; VIII. A Repetition of the foregoing Experiment, with different Success; IX. Cutting a Polype in two Places through the Head and Body, without dividing the Tail; X. Cutting off half a Polype's Tail; XI. Cutting a Polype transversely, not quite through; XII. Cutting a Polype obliquely not quite through; XIII. Slitting a Polype open, and cutting off the End of its Tail; XIV. Cutting a Polype with four young Ones hanging to it; XV. Quartering a Polype; XVI. Cutting a Polype in three Pieces the long way; XVII. An Attempt to turn a Polype, and the Event; XVIII. Turning a Polype inside out; XIX. An Attempt to make the divided Parts of different Polypes unite; XX. A speedy Reproduction of a new Head; XXI. A young Polype becoming its Parent's Head; XXII. A cut Polype producing a young One, but not repairing itself.

In regard to Experiment XVIII., a repetition of Trembley's famous one in which he believed that he had permanently turned a Polype inside out, Baker says:

Though I made several Trials before and since, I could never succeed

⁷ *Ibid.*, pp. 6-10.

in turning *Polypes*, so well as in the above Experiment: which I impute to my Want of the Means Mr. TREMBLEY uses, as well as the Dexterity whereof he is Master: whose Account of his having turned many, and their living, thriving, and producing young Ones in that inverted State, I don't in the least doubt the Truth of. And when that Gentleman pleases to publish his own Method, which I should think myself unworthy of knowing if I endeavoured to take any of the Honour of it from him, most reasonable People, I believe, will be convinced.

The following extracts are from Baker's concluding remarks:

Having now, SIR, laid before you the most remarkable of my Experiments, in relation to the cutting *Polypes* asunder, and the Re-production of new Parts to make each Piece a perfect *Polype*; I shall entreat your Patience a little longer, whilst I add a few occasional Reflections. . . .

Though real Facts are incontestable Arguments, and no Reasoning seems necessary after so many repeated Experiments, there are certain Prepossessions, Prejudices and Humours among Mankind (arising from early imbibed Theories or Systems, according to which they have accustomed themselves to judge of Things) that make People sometimes disbelieve even what they see, are stronger than Reason, and will hardly be conquer'd even by the plainest Facts.

Hence it is that some have objected to the Reality of the *Polype's* being a living Creature, notwithstanding its moving from Place to Place, seizing its Prey, eating, digesting, and other Animal Functions: because its other Properties happen to be unsuitable to their Hypothesis of Life in general.

If the Animal Soul or Life, say they, be one indivisible Essence, all in all, and all in every Part, how comes it, in this Creature, to endure being divided forty or fifty Times, and still continue to exist and flourish?

Again: If animal Identity, say they, consists in Consciousness; and if every living Creature is sensible of Pleasure and Pain, or in other Words has a Consciousness, which most think a reasonable Supposition; when the *Polype* is divided into several Parts, all soon becoming perfect *Polypes*, where shall we find the Identity of the original *Polype*?

These Queries, I must acknowledge, I am wholly incapable of resolving: but let those who tie themselves down to such Theories seriously consider, whether they believe themselves so perfectly acquainted with every living Creature God has made, and with all the Modes and Circumstances of the Life of each, as to be certain their Theories comprehend them all. 'Tis, methinks, a little presuming to restrain the Operations of Nature, or imagine that God has done nothing but according to certain Rules well known to us.

It is one great Part of Wisdom to know what we have Abilities for, and what Things are beyond our Power; that we may apply to the former, and avoid perplexing ourselves about the latter. How much valueable Time has been thrown away in framing whimsical unsatisfactory Schemes to account for the Operations of Nature, which might have furnished a great deal of profitable Knowledge, if spent in real Experiments on those self-same natural Operations?

When a Twig is cut off, and by planting in the Earth becomes a Tree of the Kind whereof it was a Part, can we account for its becoming so, any thing better than we can for the like Effect in a *Polype*? . . . The

whole Difference is, we have known the One a long while, and the other is a late Discovery, which has not yet been noticed in our System of Animal Life. . . .

'Tis no great Wonder that Discoveries contrary to old and established Opinions should not at first be credited; but then, neither should they be absolutely rejected till Experiment has been made whether they are true or false.

Those that know the most, are most sensible how little they know in comparison of what is yet unknown, and therefore consider Things with Modesty and Candour: but Ignorance cries out at once, it cannot be:—inconsiderately measuring the Powers of Nature by the scanty Compass of its own Experience, and more ready to reject the Truth than take the Pains to find it out.—A truly wise Man is so fully sensible how little he knows, and what Things he once was ignorant of, which he is now acquainted with, that he is far enough from supposing his own Judgment a Standard of the Reality of Things.

Trembley's and Baker's demonstrations of the potentialities of the polype, reflected by Linnæus naming it *Hydra*, and Hill, *Biota*, on account of the "strong principle of life with which every part is endued," created considerable excitement in scientific, philosophical and literary circles. They apparently had forgotten that Aristotle observed that there are animals as well as plants which propagate themselves by shoots; and on cutting one of these animals, the pieces which before comprised altogether but one animal become suddenly so many distinct individuals. And further that the soul in animals is in effect but one, though "multiplied in its powers as in plants." Or that St. Augustine relates in his "*De Quantitate Animæ*" that a friend in his presence cut a 'polype' in two, and immediately the two parts betook themselves to flight in opposite directions!⁸

Henry Baker's original observations undoubtedly do not entitle him to a place among the leading pioneers with the microscope—for most of his observations were made apparently at random without any particular purpose in view and none of his discoveries is of great significance—while some of them are not discoveries at all, as Hill,⁹ in his animadversions on the Royal Society, takes especial pleasure in pointing out. But Baker's books, appearing at a time when the effects of the first glimpses into the "world of the infinitely little" were slowly permeating into general culture, had a considerable influence on the popularization of microscopic work and the general recognition of its practical value, as well as in stimulating microscopic research.

⁸ Adams, "Essays on the Microscope," 2d edition, London, 1798.

⁹ *Review of the Royal Society*, London, 1751.

"Baker on the Microscope" was something new—a product of the time—though, in a way, a descendant, with modifications, of Joblot's work on animalcules and microscopes¹⁰ first published during the Leeuwenhoek period, and later reprinted with but slight change in 1754, when Baker's works were among the "best sellers." "Baker" was the humble forerunner within the limits of less than 800 octavo pages of our present-day manuals on bacteriology, protozoology and microbiology in general as well as of manuals on the microscope. Its success soon brought many competitors into the field, both in England and on the Continent—competitors such as the works by Adams which increased in bulk with each edition—but none of them approached it in originality of treatment, quaintness of expression, philosophical insight or the contagious enthusiasm of its author for things that are small.

"Baker on the Polype," the first volume ever devoted to regeneration in animals, gradually sank into oblivion on account of Trembley's classic memoir, but not without having exerted a considerable influence in England in stimulating experiments and speculations on life phenomena as "exhibited by that wonderful fresh-water insect the Polype."

It has been said of Mr. Baker, that he was a Philosopher in little things. If it was intended by this language to lessen his reputation, there is no propriety in the stricture. . . . He was an intelligent, upright, benevolent man much respected by those who knew him best. His friends were the friends of Science and Virtue: and it will always be remembered by his contemporaries, that no one was more ready than himself to assist those with whom he was conversant, in their various researches and endeavors for the advancement of knowledge, and the benefit of Society.¹¹

¹⁰ "Descriptions et usages de plusieurs nouveaux microscopes, tant simples que composez; avec de nouvelles observations faites sur une multitude innombrable d'insectes, & d'autres animaux de diverses especes, qui naissent dans des liqueurs préparées, & dans celles que ne le sont point." Paris, 1718.

¹¹ *Biographia Britanica*, 2d edition, London, 1778.



