Early Micropaleontology

Naturalists struggled to understand microorganisms

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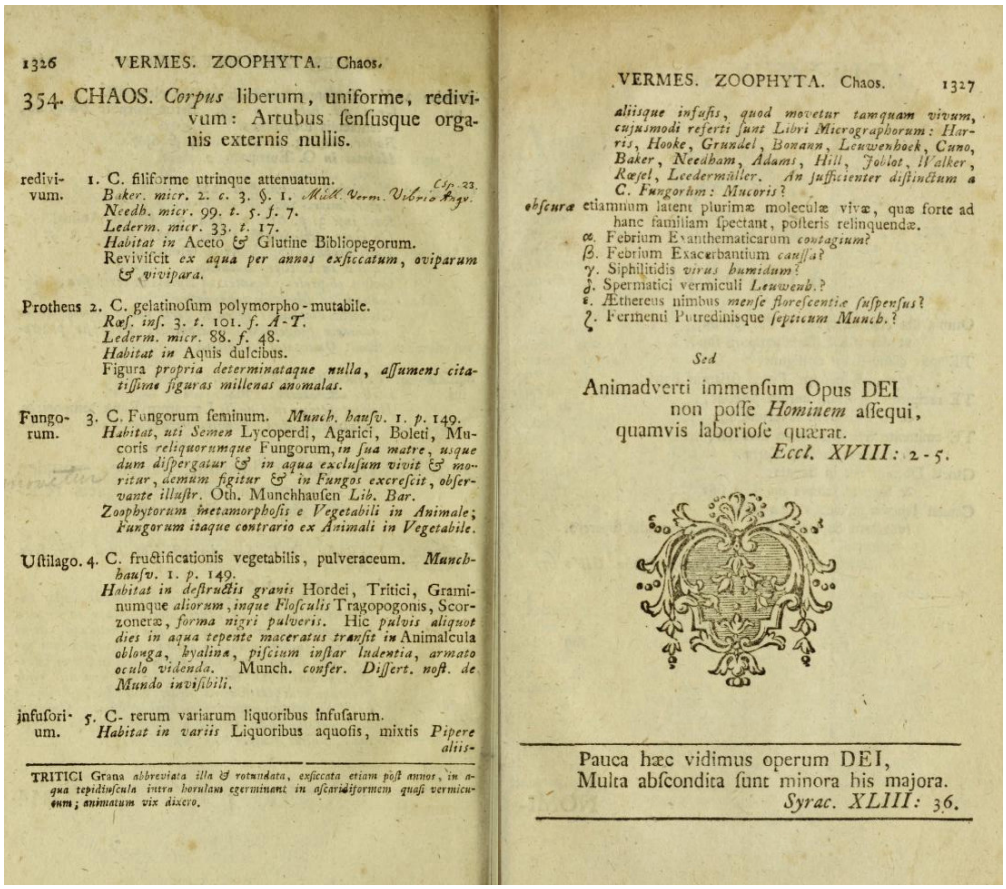

1326 VERMES. ZOOPHYTA. Chaos.

354. CHAOS. *Corpus* liberum, uniforme, redivivum: Artubus ſenſusque organis externis nullis.

redivivum. 1. C. filiforme utrinque attenuatum. *Baker. micr.* 2. *c.* 3. §. 1. *Müll. Verm. Vibrio Rugv.* Esp. 23. *Needh. micr.* 99. *t.* 5. *f.* 7. *Lederm. micr.* 33. *t.* 17. *Habitat in* Aceto & Glutine Bibliopegorum. Reviviſcit *ex aqua per annos exſiccatum, oviparum & vivipara.*

Proteus 2. C. gelatinoſum polymorpho-mutabile. *Røſ. inſ.* 3. *t.* 101. *f. A-T.* *Lederm. micr.* 88. *f.* 48. *Habitat in* Aquis dulcibus. Figura *propria determinataque nulla, aſſumens citatiſſime figuras millenas anomalas.*

Fungorum. 3. C. Fungorum ſeminum. *Munch. hauſv.* 1. *p.* 149. *Habitat, uti Semen* Lycoperdi, Agarici, Boleti, Mucoris *reliquorumque* Fungorum, *in ſua matre, usque dum diſpergatur & in aqua excluſum vivit & moritur, demum figitur & in Fungos excreſcit, obſervante illuſtr.* Oth. Munchhauſen *Lib. Bar. Zoophytorum metamorphoſis e Vegetabili in Animale; Fungorum itaque contrario ex Animali in Vegetabile.*

Uſtilago. 4. C. fructificationis vegetabilis, pulveraceum. *Munch-hauſv.* 1. *p.* 149. *Habitat in deſtructis gravis* Hordei, Tritici, Graminumque *aliorum, inque Floſculis* Tragopogonis, Scorzoneræ, *forma nigri pulveris.* Hic *pulvis aliquot dies in aqua tepente maceratus tranſit in* Animalcula *oblonga, hyalina, piſcium inſtar ludentia, armato oculo videnda.* Munch. *confer. Diſſert. noſt. de Mundo inviſibili.*

Infuſorium. 5. C. rerum variarum liquoribus infuſarum. *Habitat in variis* Liquoribus aquoſis, mixtis *Pipere aliis-*

TRITICI Grana *abbreviata illa & rotundata, exſiccata etiam poſt annos, in aqua tepidiuſcula intra horulam egerminant in aſcaridiformem quaſi vermiculum; animatum vix dixero.*

VERMES. ZOOPHYTA. Chaos. 1327

aliisque infuſis, quod movetur tamquam vivum, cujusmodi referti ſunt Libri Micrographorum: Harris, Hooke, Grundel, Bonann. Leuwenhoek, Cuno, Baker, Needham, Adams, Hill, Joblot, Walker, Røſel, Leedermüller. An ſufficienter diſtinctum a C. Fungorum: Mucoris?

obſcuræ etiamnum latent plurimæ moleculæ vivæ, quæ forte ad hanc familiam ſpectant, poſteris relinquendæ.
α. Febrium Exanthematicarum *contagium?*
β. Febrium Exacerbantium *cauſſa?*
γ. Siphilitidis *virus humidum?*
δ. Spermatici vermiculi *Leuwenh.?*
ε. Æthereus nimbus *menſe floreſcentiæ ſuſpenſus?*
ζ. Fermenti Putredinisque *ſeptícum Munch.?*

Sed

Animadverti immenſum Opus DEI
non poſſe *Hominem* aſſequi,
quamvis laborioſe quærat.
Eccl. XVIII: 2-5.

Pauca hæc vidimus operum DEI,
Multa abſcondita ſunt minora his majora.
Syrac. XLIII: 36.

The final page of Linnaeus' 12th edition of the Systema Naturae, *published in 1766, presenting the official description of the "chaos infusorium", placed in the class Vermes, "worms".*[1]

Ever since the earliest microscopic observations in the 17th and 18th centuries, novel instruments and techniques enabled glimpses of unexpected and complex microbial worlds. At first, the diversity of microbial life appeared chaotic and undefined, so much so that in 1766 Swedish botanist Carl Linnaeus, the founder of modern biological systematics, authoritatively classified all microscopic organisms as belonging to the *chaos infusorium*, a wastebasket category if there ever was one.[2] But as the taxonomic ordering of the natural world proceeded, especially during the 19th century, naturalists attempted to make sense of this difficult-to-see and surprising diversity. By the end of the century, the incredible variety of microscopic forms no longer appeared to be so chaotic: as microscopic media improved, the recurring structures that could be observed stimulated the imagination of scientists and suggested an order to these microorganisms. In this period, many attempted to describe and classify microbial organisms, collectively known as Infusoria, in ways that ran parallel to

the taxonomic ordering of larger and more familiar life forms. Yet, the tools and frameworks of early taxonomy proved ill-suited for the task: as our understanding of the nature of microorganisms underwent significant transformations, most early classifications were rapidly replaced and overturned. To this day, microorganisms continue to surprise and confound us.

These early transformations in the understanding of microbial life had a deep impact on what was to become micropaleontology. Naturalists described impressive numbers of organisms, and gave them [Latin names]. These names are still in use according to the rules of binomial nomenclature and its [taxonomic orders].[3] But, while the traces of these early works are still prominent in species names, like in the case of (Cycladophora davisiana), their organisations, classifications, and understandings of microbial life were often already discredited during their own lifetimes. This is the case of two figures often remembered as the so-called 'fathers' of micropaleontology: Alcide d'Orbigny and Christian Gottfried Ehrenberg. Alcide d'Orbigny is credited with the first systematisation and classification, in the 1820s, of (Foraminifera) (which were later to become central to micropaleontology). However, his interpretations were not as successful as his descriptive work. He believed them to be cephalopods, and despite revising his interpretation later on, he continued to argue controversially that their diverse forms were the result of 27 separate creation events.[4] Unlike d'Orbigny, Ehrenberg did not focus on a specific group; instead, he attended to the broader diversity of infusoria. In 1838 he published his successful monograph *Die Infusionsthierchen als vollkommene Organismen*. In it, with the aid of detailed illustrations, he opposed the predominant hierarchical vision of taxonomy championed by Cuvier, the leading French paleontologist of the time. Cuvier had placed humans at the top of a so called *scala naturae*, a natural, progressive, and hierarchical 'chain of beings', culminating in 'man'. Thanks to his early study of the formation of fungi from spores, Ehrenberg resisted the widespread idea that 'lower animals' would originate spontaneously from inorganic matter, a theory known as spontaneous generation.

In his desire to refute these dominant understandings of life, which were common at the beginning of the 19th century, Ehrenberg argued that all infusoria were in fact complete animals. In his microscopic observations he identified stomachs and other organs within microorganisms and claimed they proved his view correct. This interpretation tainted his reputation, especially as he stubbornly refused to accept the piling evidence that disproved this observation for the rest of his life. Thus, although his second monograph, published in 1854, laid out much of the subject matter of micropaleontology under the name of *Mikrogeologie*, his work wasn't as successful as it could have been until the following century. Despite the international fame their detailed and rigorous descriptions won them, both d'Orbigny's and Ehrenberg's interpretations of microorganisms had received much criticism already during their lifetime. By the 1850s, the (nature) of microbial organisms had profoundly changed.[5]

Footnotes

1. Carl Linnaeus. *Systema Naturae, editio 12, reformata*. Holmiae: Laurentii Salvii, 1766. https://www.biodiversitylibrary.org/item/137240#page/800/mode/1up (03.01.2022).↩
2. To learn more on another 'wastebucket' class of Linnaeus' Vermes, see Stephen Jay Gould. *The Lying Stones of Marrakech*. Cambridge: Harvard University Press, 2000. http://www.jstor.org/stable/j.ctt2jbrgf↩
3. The impact of these early descriptions is quantified in David Lazarus. "The Legacy of Early Radiolarian Taxonomists, with a Focus on the Species Published by Early German Workers". *Journal of Micropalaeontology* 33, no. 1 (2014): 3-19.↩

4. This argument is clearly laid out in Alcide Dessalines d'Orbigny. *Foraminifères fossiles du bassin tertiaire de Vienne (Autriche)*. Paris: Gide et Compe, 1846. https://doi.org/10.5962/bhl.title.145432.↩

5. See, for instance, Frederick B. Churchill "The Guts of the Matter: Infusoria from Ehrenberg to Bütschli, 1838-1876". *Journal of the History of Biology* 22, no. 2 (1989): 189-213. https://doi.org/10.1007/BF00139512.↩