

The “Microcosm Archive” at the Upper Austrian Museum in Linz (Austria): Microscopic Specimens, Protist Library, Profiles of Main Contributors and Educational Activities concerning Unicellulars

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Abstract: The Upper Austrian Museum in Linz has a relatively long tradition concerning unicellular organisms. Since 1992 the microscopic slide collection of the Biology Centre of the Upper Austrian Museum is managed professionally by a scientific curator, beside also being responsible for all invertebrates except insects. A singular cooperative endeavour to concentrate “microscopic collections” leads to the specific term “Microcosm Archive Linz”. It harbours not only organisms on about 27,500 permanent slides collected in at least 80 countries worldwide, but also an almost complete collection of protozoological journals and periodicals, general textbooks and monographs on protistology as well as general zoology. As regards the scientifically most important type material, 1,118 refer to holo-, syn- or hapantotypes, 512 to neotypes and 1,833 to paratypes. Moreover, about 60,000 reprints mirror specialised fields such as systematics including identification keys and guides, cell biology, history of natural sciences, morphology, physiology, behavior, ecology of protists and further zoological groups. Unpublished material, such as original manuscripts, correspondences, lectures, routine paperwork (administrative efforts), diploma and doctoral thesis could be relevant for the history of science. Therefore, this collection is likely the most comprehensive one worldwide and thus a unique training possibility for beginners to become familiar with microscopic organisms. Short biographies, informations about their collections, and bibliographies are presented of 13 persons, including two women. After each biography a chronological list of the taxa introduced by each author (alone or as first author together with other authors) and dedicated in honour for it follows.

Key words: Unicellulars, Ciliophora, phytoplankton, phytobenthos, diatoms, testate amoebae, diverse protists, collection-based research, autodidacts, curators, history.

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Introduction

Natural science collections are the “libraries” of life, they are unique and obviously irreplaceable. The value of preserved specimens is very poorly understood by society. Moreover, the pervasive denigration of natural history museums by many academic biologists, particularly taxonomists responsible for recognising, diagnosing and classifying organisms, is disastrous in this context. Therefore, the former principal curator of vertebrates in the Natural History Museum of Zimbabwe, Fenton P. D. COTTERILL revived “natural history”, meant as responsibility for the material basis, as a scientific discipline. His writings highlight the **tentelic** (meaning “to hold together a web”) role of preserved specimens in the epistemology of the life sciences, and emphasise the impacts of the Second Alexandrian Tragedy, which ignores the value of gatherings of vouchered organisms on the state of knowledge (COTTERILL 1997, 1999, 2002; COTTERILL & FOISSNER 2010; DUBOIS 2010, 2017; SCHMINKE 2003). Unfortunately, even in museums, this singular corporate strength of natural history museums is not sufficiently appreciated.

The Upper Austrian Museum has a relatively long tradition compared to most other European museums, with regard to microscopic organisms, particularly unicellular. The importance of auto- and heterotrophic microorganisms can hardly be overestimated, just think of their role in the maintenance of water and soil ecosystems as well as on the veterinary and human-medical importance of many unicellular parasites. With the attitude of a trained protistologist (ciliates and testate amoebae) since 1992, Linz has a special position worldwide, since the custodians for microscopic organisms are countable on one hand.

The term “**Microcosm Archive Linz**” has been chosen (1) to fasciliate associations of the interested public, e.g. questions like is this a little

world within itself, are there microorganisms or does it refer to the microcosmic human body. This aims to invite people to have a particular experience for themselves with the formerly unknown; (2) to emphasise the ambireginal nature, viz. beyond the plant and animal dichotomy, of many microscopic organisms; (3) to highlight the fruitful contributions of amateurs (sometimes becoming renowned professionalists) to increasingly specialised disciplines and (4) to remind life scientists on a historical perspective requiring an **archive**, viz. a Greek word meaning ‘public office’ and having a double content, i.e. either the repository of public records, or the documents themselves. Particularly taxonomic papers are not outdated within two years and our inventory of life needs to be based on collections of all material traces left behind allowing reproducible research.

The alternative “Protist Archive Linz” has been withdrawn because (1) it excludes too many people unacquainted with this concept having a vague content at its coinage in 1866 by Ernst HAECKEL and currently is a collective term representing paraphyletic groups; (2) it lays too much weight on “objects” excluding subjects, which may be engaged or indifferent, restricted to his or her mother language, a prolific or seldom publisher and moreover a vivid or scarce collector of material “things” and/or contemporary proofs or even historical papers and or books; (3) it underestimates the diverse perspectives possible on description of and/or experiments with microorganisms. The scope may be narrow or wide, so the ‘results’/‘stories’ associated to them are more or less easily communicable. There are different forms of knowledge, not only scientific ones. This is better reflected in the word “microcosm“, a world in miniature, however open instead closed and implying an interrelated macrocosm, which we should not forget.

Short history of the institution focused on its responsible custodes for invertebrates

The historical landmarks, former spatial conditions and responsible custodes relevant to the natural history collection are listed chronologically in the following overview (keywords are in **bold**, own annotations in square brackets). Precisely because these statements are often very general, the marginal position of the naturalists, and especially of the invertebrates in Upper Austria, becomes clear (for details see AESCHT 2003). The history of the all-purpose museum has been described on several occasions, mostly restricted to culture and art (KOHL 1983; PROKISCH & DIMT 1995; RIDLER 2016).

The origin of the scientific collections of the museum can be traced back to the year **1833**, when the “Verein des vaterländischen Museums für Österreich ob der Enns mit Inbegriff des Herzogtums Salzburg”, which means Association of the National Museum for Austria above [the river] Enns including the duchy of Salzburg, was founded. Today this organisation as “Oberösterreichischer Musealverein”, called for short **Museum Association**, is restricted to Upper Austria and still exists. At that time the president

of these now two provinces, count Alys UGARTE (1784–1845) dedicated that “natural production” and “industry” were grouped together as a task circle (ULM 1983; own translation), anticipating the term “applied” natural science. Thus, during the beginnings practical aspects like pest species, weeds, abnormalities and the collection of single specimens or couples like for “Noah’s arc” were of interest. During the 19th century members of the Museum Association, viz. honorary curators, looked for the enlargement and conservation of the collections.

Since **1835** annual reports and statutes of the Museum Association were published and objects were stored in a house in the centre of Linz (“Ständisches Expeditiorhaus” at the street “Promenade”). As early as **1841** herein “...14 genera of radiolaria and protozoa”, among them are mainly silicious, and calcareous shells, which were formerly classified as microscopic “conchylia” (molluscs), are mentioned.

Contacts to a famous natural history dealer, namely Václav FRIČ (1839–1916) of Prague, are very probable, because in **1863** at a “Volksfest”, a kind of fair, in Linz a silver medal was awarded to “Wenzel Fric, Naturalienhändler in Prag für geognostische Sammlung” (‘...for a geognostic collection’ means pertaining to materials and structure of the earth), his contribution to the category ‘fishing tools and forestry’, focusing on agricultural economy [Linzer Zeitung, 15 September 1863, archive of the municipality Linz; cited after REILING & SPUNAROVA 2005). At that time this was a category in which natural history objects were commonly to be found. A model of the foraminifer titled “Peneroplis planatus” made by FRIČ is still present, although without inventory number. In **1884** the construction of the museum started, after a basic decision for such house



Fig. 1: The Francisco-Carolinum in Linz in the 21st century harbours the library, the administration and the Gallery of the Federal State of Upper Austria. By courtesy of the museum.

has already been stated in 1875.

On 29 May **1895** the building Franciscocarolinum in the Museumstrasse 14 (Fig. 1), named after its first protector Franz Karl (since 1839), the father of Emperor Franz Josef I, has been opened by the latter. From **1893** until 1902, the collector and taxidermist Andreas REISCHEK was the first “professional”, who took care of the collection when he arranged it for presentation in the new museum.

In **1914** the first scientifically educated curator Dr. Theodor KERSCHNER (1914–1945) was employed and thus collection management improved (see also p. 317) and a first exhibition of lepidoperan insects and a set of antlers was shown from 19 June–6 July **1919**.

In **1920** the museum was handed over to the Federal State of Upper Austria. Already in 1931 there existed a basic statement to construct a new building for the natural history collections due to space restrictions (LIPP & DIMT 1978). It was fulfilled at the beginning of the 1990s, although by a reconstruction of the then home for the blind from 1991 till 1992 (see p. 300). In **1943** the Real Councilor DI Carl MAYER, chairman of the **Micrological Association in Linz**, deposited 19 specimens of foraminifera and 7 of radiolarians. In addition 21 object carriers with foraminifers from the Monastery Schlägl were reported.

The curator (**1952–1954**, **1962–1970**) and entomologist Helmut Heinrich Franz HAMANN initiated meetings of a hydrobiological working group, attended by seven persons on average.

The botanist Univ.-Doz. Dr. phil. Franz SPETA (22 December 1941–5 December 2015), employed as a scientific holder of office at the Upper Austrian Museum since **1970**, started a one-man department of botany in **1974**. Between 1970 and 1974 as well as 1979 and 1981 he was provisional custos of the invertebrate collection, in between the entomologist Günther THEISCHINGER cared for it. From 1993 to March 2003 he was divisional



Fig. 2: Franz SPETA and Wilhelm FOISSNER in September 2004, thirty years after the endowment of the type slide collection of ciliates (from right to left).

head of the “natural sciences” section of the Upper Austrian Museum until his retirement in 2003. He founded several biological journals (Linzer biologische Beiträge, Stapfia, Beiträge zur Naturkunde Oberösterreichs and Denisia), where many protistological papers could be published since 1974 (see p. 304).

Franz SPETA initiated Wilhelm FOISSNER’s (Fig. 2; see p. 378 chapter on biographical sketches) further education as non-resident pupil to reach the Higher School Certificate and animated the deposition of type material in the museum since 1974. FOISSNER dedicated one genus (*Spetazon* in 1994), one subgenus (*Spetastyla* in 2002) and two species (*Coleps spetai* in 1984 and *Urotricha spetai* in 2012 on the occasion of SPETA’s 70th birthday) to Franz SPETA. Pictures and documents on SPETA’s biography and bibliography can be found at <http://www.zobodat.at/personen.php?id=277&bio=full>.

On March 2, **1981**, the entomologist Mag. Friedrich („Fritz”) GUSENLEITNER followed THEISCHINGER, who emigrated to Australia. The former started to take an specific inventory of invertebrate objects and a detailed bibliography of natural science topics and first records related to Upper Austria (GUSENLEITNER & GUSENLEITNER 1983, 1992).

In 1992 the entomological collection became separated from the invertebrate collection (formerly called “Evertabrata varia” collection). Date of the beginning of my curatorship was 2 January in the Francisco-Carolinum in an office located in the first floor, shared with the curator of the vertebrates Dr. Gerhard AUBRECHT (see p. 378) and his secretary. Few words on my background: I was born on 13 March 1958 in Ostermiething 35 kilometres away from the town of Salzburg. After working in the Kodak Company internally trained four years long, I studied zoology and botany at the University of Salzburg since 1979 and received my Ph. D. in 1985. I earned my doctoral thesis on “taxonomic and ultrastructural investigations of the ontogenesis and phylogenesis of hypotrich and colpodid ciliates” under the guidance of the enthusiast of microscopic organisms and outstanding protistologist Wilhelm FOISSNER, who laid the ground for being fascinated by taxonomy and nomenclature as well as the principles and methods of biological systematics. At that time, I had to translate my publications into German language for my doctoral thesis, which was by the way performed on an electric typewriter. After a postdoctoral DAAD (“Deutscher Akademischer Austauschdienst”, German Academic Exchange Service) scholarship at the University of Berlin (1985–1986, in total 15 months) in the newly established working group of Klaus HAUSMANN, I investigated ciliates of sewage treatment plants and soils on project basis at the Zoological Institute in Salzburg (1987–1991). In 1987, it was a great surprise to find a new generic name *Erniella* dedicated by FOISSNER to me.

At that time I (co-)authored 27 scientific, technical, and popular articles on ciliates and testaceans (under the name of my former husband WIRNSBERGER or WIRNSBERGER-AESCHT, since 1989 under my birth name AESCHT; see p. 478), so I convinced the commission for “objectivation” of this curatorship. 360 slides of these studies have been deposited in Linz.

In December 1992 the complete natural science section moved to the “Biology Centre”, a term chosen by the administration, because in Upper Austria there exists no biological faculty.

A singular joint effort for enlarging microscopic collections and resources on protistology in Linz

The infrastructure within the institution, the impressive number of exhibitions (more than 40), publications and further activities has only been possible with a lot of helping “hands” and initiatives of many people (academic or not). This cooperative endeavour will become evident on the following pages. The financial support and/or generosity in diverse aspects (e.g. gifts or devoted working time) of several regional authorities of the Federal State of Upper Austria (the Biology Centre belongs to cultural department since 1987) and private sponsors alike (see p. 327) is greatly acknowledged. The development profited (sadly in some way) by the unwillingness of universities in general to care for the future of the collections built by their renowned professors, which is often argued by spatial and financial restrictions, in fact an unhistorical position, too fascinated by “modernisation”.

From the beginning the “invertebrate” (except insects) curator was and is additionally responsible for the exchange of publications and as editor of the respective articles of the Biology Centre’s journals (Linzer biologische Beiträge, Beiträge zur Naturkunde Oberösterreichs and Denisia; until 2000 also Stapfia). For the former I am actively supported by Mrs Waltraud STANDHARTINGER, who took on this task at the end of 2003 (22 hours per week). As regards personal support of the collection responsibilities (apart from temporal projects on molluscs), I worked alone for 16 years. On 12 February 2008 Walter DONAUBAUER was assigned to me in-house as a technical employee. In 2014 Wolfgang SCHWARZ



Fig. 3, 4: The Castle Museum, which harbours the collections of cultural history since the 1960s, might be considered as the largest universal museum of Austria on a single place having around 3500 m² for exhibitions. Its south wing was destroyed in a fire around 1800; a decision to rebuild it was felt in 2006 and the modern "reconstruction" (4) was finished in 2009. By courtesy of the museum.



Fig. 5, 6: The Biology Centre is not a new building, but a reconstruction of the former home for the blind from 1991 till 1992. About 155 m² can be used for exhibitions; mainly school classes take the guided tours. The house is surrounded by an 1,2 hectare large "Ökopark", i.e. an ecological parc with diverse biotopes including an artificial pond. Therefore, a place for teaching and recreation, which is visited by about 18,000 people per year. The entrance (6) was modernised in 2014.

and on 1 November 2015 Erzsebet BODNAR relieved each other in this post.

Current localities and spatial conditions

At present, apart from some contributions to the permanent and temporary exhibitions in the Castle Museum (Fig. 3, 4), the invertebrate collection is housed at six **locations** in two buildings, viz. the Biology Centre (Johann-Wilhelm-Klein-Str. 73, Fig. 5, 6) and the depository in the street Lindengasse 7 (Fig. 7):

1. laboratory of microscopy in the 2nd floor (microscopic slides, TEM- and REM-preparations);
2. loft in the 2nd floor (microscopic slides, dry

material of corals, echinoderms and non-insect arthropods, journals, separates and books);

3. my office (inserenda, small permanent collection of invertebrate "ground plans", reprints and books);
4. basement (wet material in formol or alcohol);
5. half-floor (below the 1st one) in the depository Lindengasse (models, microscopic slides, TEM- and REM-pictures, scientific reprints, journals and books on protists and cell biology, archival material);
6. half of the 3rd floor of the depository Lindengasse (mollusc shells, journals, reprints and books related to them).



Fig. 7, 8: The depository “Lindengasse” is called according to the street where it is situated. At special occasions guided tours present the usually hidden background. – **8:** The “Microcosm Archive” in the narrower sense occupies a part of the depository Lindengasse.

The three-storied “depository Lindengasse”, about 3 kilometers away from the Biology Centre, houses since 1983 the large preparations of the vertebrates, since 2003 the second largest mollusc collection in Austria and since 2016 the “**Microcosm Archive**” in the narrower sense (Fig. 8; see p. 337). Capacities for further collections are only available through compression, which in turn costs a lot of working time.

The optical equipment has been significantly improved since 1992 by the procurement of an interference contrast microscope with a video device and monitors for demonstrations and several incident light microscopes (Fig. 9).

Modes of documentation

In 1993, when a computer for each curator became available, I started a **collection database** with an inventory of individual slides (not specimens) and the basic data fields (genus, species, original designation on label, inventory and storage number, preparation method, sampling site and collection date). Later entries were cross-checked and linked via unique identifiers with the relevant publications (see below).

The previous and incoming slides largely remain in their original boxes (Fig. 10–11), because a systematic storage by taxonomic classification is

impossible since numerous different species are usually included on one slide and in any case a storage number is necessary for retrieval (Fig. 12–13). Moreover, lists have been fixed in the boxes mainly between 1975 and 1988 or were supplemented freely, enlightening the status of the slides sometimes not exactly stated on the labels. Single or few incoming slides are collected in boxes registered per year. Thus, the collection including type and non-name-bearing voucher material is arranged in chronological order and stored in a lockable metallic cabinet (Fig. 11, 12). Solely historical voucher material without types is stored in another system and room, namely the loft (Fig. 13).



Fig. 9: Polyvar microscope used by curator AESCHT in the laboratory of microscopy in the 2nd floor of the Biology Centre.



Fig. 10–13: Original boxes, which may include 12–100 microscopic slides each, are stored in a lockable metallic cabinet (11, 12) or on shelves movable by star-type reel stands (10, 13).

The usual curatorial practice to store name-bearers preferably separate from general collections (vouchers) is at present not followed exactly, because of the uncertain status of numerous types and now coherent populations can be retrieved for checking with minimum fuss and maximum efficiency. As, yet no remounting – in case of air intrusion – was performed, because this may destroy the black ink or felt tip pen circle(s) of relevant specimens on the cover glass or on the back of the slide. This problem has to be solved in future, a possible step would

be the photographic digitalization of the most important slides. Moreover, it requires that fixation and preparation methods are described in more detail by the depositor if differing from standard procedures.

The main collection database (in access format) is termed “Evertebrata varia Kollektion” (for short EvarKoll) according to the dichotomy invertebrates (in German “Wirbellose (ohne Insekten)”) and insects. It is linked (1) to the

literature database (“BIB_all”) via a six-digit (specific collections, viz. HK and MR, now have even a seven-digit code) alphanumeric reference code or signature field (e.g [FOI599]; given in square brackets below), where the first three digits refer to a special separate collection, here FOISSNER, or with [CI1001] to ciliate taxonomy, while the last three digits are consecutive numbers. If no physical reprint or pdf is available the signature field starts with “E” (for external) or has less than six-digits. At present, it contains 50,683 references regarding biology including its popularisation.

It is further linked (2) to a **taxa database** via a unique numerical species field revealing the nomenclatural author(s) and year of publication as well as subsequent new combinations with another genus. Currently, the species file amounts to 20,086 scientific names including spelling variants, the generic file 3,861 and those of the family to the class level 1,714. Linkages via a genus, family, order, class and phylum field yield the classification.

Overview of the contents of collections

The following scheme for Series descriptions also applies to specific collectors introduced in the biographic section below (see p. 378). At first the time period embraced, viz. beginning and end of collecting year, and the total number of boxes and/or slides available is given. Then,

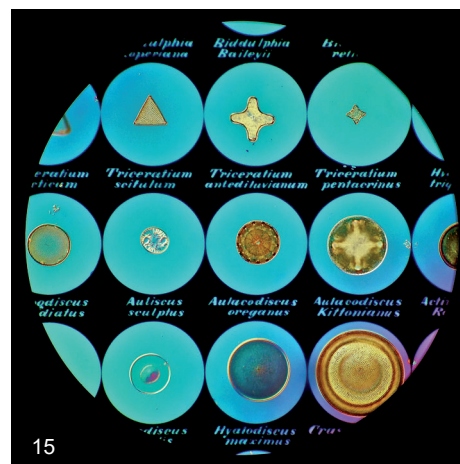
four series are distinguished: (1) holdings of prepared organisms (specimens); (2) publications, namely of a specific author and his separate collection to a particular discipline; (3) unpublished material sorts; (4) documentation as regards the taxonomic and geographical informations associated to the collection(s).

Series 1 Prepared organisms (specimens)

Microscopic slides, undyed or treated with various dyes, of my colleagues on plants (e.g. mosses, woods, stems and leaf cross sections) and multicellular animals, i.e. non-protists, are without the scope of this paper. It is not reasonable to give exact numbers, because quite a lot of the in total roughly 27,500 slides are unlabelled and devoid of protocols, so they have to be checked for the quality of preparation and redetermined. After labelling if possible, they can be inventorised. 58 slides with prokaryotes and 135 slides with inorganic crystals can also be studied. There exist also serially produced preparations from the companies of SIGMUND (Stuttgart, 103 slides), Eduard THUM (Leipzig, 28 slides), and Johann Diedrich MÖLLER (Wedel/Holstein; cp. BURBA 2007, WALKER 2009, 8 slides) (Fig. 14, 15). In 1943 a legacy from Ing. Carl MAYER in Linz still included about 90 slides of foraminifers, radiolarians and algae,



14



15

Fig. 14, 15: Slides of Eduard THUM (1847–1926) and Johann Diedrich MÖLLER (1844–1907), respectively, stored in representative cases. – 15: Details of a slide of MÖLLER.

among other biological preparations of THUM. Particularly valuable are artful and tedious placed preparations with foraminifers or diatoms, even one with 300 different forms (see cover). They are stored in boxes or “maps” including from 12 to 100 slides each. This collection offers overwhelming training opportunities for people interested in diverse aspects of biology. At present, 9430 data entries concerning protists are recorded to taxa and slide level, whereas 411 collective numbers for boxes regard the MKAL containing about 12,000 slides. Of the singular recordings 81,3 % refer to ciliates, 11,0 % to algae 7,7 % to diverse protist taxa. The amount of collective boxes can be attributed as follows: MEISTERFELD (338), HAUSMANN (50), HECKMANN (14), and MULISCH (9). As regards type material representing approximately 15 % of all vouchers, 1118 refer to holo-, syn- or hapantotypes, 512 to neotypes and 1,833 to paratypes.

Series 2 Publications

The Biology Centre of the Upper Austrian Museums publishes five journals, viz. “**Linzer biologische Beiträge**” (LBB), “**Stapfia**” (including the series “**Stapfia: reports**” founded in 2010), “**Beiträge zur Naturkunde Oberösterreichs**” (BNO), “**Denisia**” and “**Vogelkundliche Nachrichten aus Oberösterreich – Naturschutz aktuell**”, about ornithology with current information concerning nature protection of Upper Austria. These are the basis for an exchange of publications with other institutions revealing an income of about 900 biological series, unfortunately not included into an inter-library loan system, because there is only one librarian for the whole museum. Our publications are largely written in German (including title and abstract in English) and to a small extent in English, French or Spain.

A synopsis on occasion of our 20th anniversary (GUSENLEITNER et al. 2013) revealed that since 1969 214 volumes, including 1 to 3 is-

ues per year, containing about 3,900 papers written by c. 1,940 authors from 102 countries with a total number of 91,305 pages have been published. Focused on the period from 2003 to 2012, 10.1 % concern botanical and 89.9 % zoological topics; the latter comprise 61,9 % papers about insects, 25,6 % about vertebrates (mainly birds), and 12,4 % about diverse invertebrates (mainly spiders, molluscs, and ciliates).

LBB meaning biological contributions from Linz was founded under another title in 1969 and includes predominantly taxonomic contributions. Actually it is on the 5th position in the taxonomic ranking of nearly 5,000 comparable journals by Thomson Reuters: <http://www.organismnames.com/metrics.htm?page=tsj>, because roughly 2,700 species (mostly insects) have been newly described within a decade. More than 40 papers regard algae, myxomycetes, and since 1994 also ciliates (see p. 322).

BNO meaning contributions to natural history of Upper Austria is published since 1993. 17 (co-)authored contributions mostly regarding anniversaries of the Biology Centre, but longer one were dedicated to ciliates (see p. 471) and testate amoebae (see p. 339).

Until 2000 **Stapfia**, which is now restricted to botany, also included original research on ciliates. **Denisia** launched in 2001 embraces voluminous zoological monographs, symposia proceedings, and exhibition catalogues. It has been named after Michael DENIS (1729–1800), a well-known Austrian amateur lepidopterist as well as a distinguished librarian, poet, and bibliographer who died more than 200 years ago. Nearly 50 contributions of protistologists and/or parasitologists have been published there up to now.

We also contribute to the periodicals of the cultural section of the Upper Austrian Museum, namely the “**Catalogues**” (**Kataloge des Oberösterreichischen Landesmuseums**), the “**Journal**” (Oberösterreichisches

Museumsjournal), a short-lived “Muse” popular booklet, and the “Year-book of the Museum Association” (“Jahrbuch des Oberösterreichischen Musealvereines”; often shortened to JOOM). The former was launched in 1948 and includes 124 volumes until 1984, starting a new sequence (N. F. “Neue Folge”) from 1985 (vol. 1) till 2003 (vol. 200) and another series (N. S. “Neue Serie”) in 2003 (vol. 1); the last issues in 2018 are vol. 186a-c [sic]. The immense total volume numbers are partially due to double counting, i.e. monographs related to biological exhibitions are also counted as “Catalogues”. FOISSNER contributed already in 1974 on the silver line system, 1986 on ciliates in lichens, in 1992 together with Otto MOOG on saprobiological relevant ciliates in the river Traun, and 2015 to the exhibition “Myth Beauty”. My volume on “Protozoa – a hidden world” in 1994 (see p. 319) due to colour prints could not be published in Stapfia.

The “Journal” (“**Oberösterreichisches Museumsjournal**”) was founded in 1991 for reports on exhibitions, donations and events related to the Upper Austrian Museum. Since 2006 it is incorporated in the “Culture Report Upper Austria” (“Kulturbericht Oberösterreich”). About 43 popular texts since 1992 are written by or related to me (90 to 10 percent): 13 concern the series “animal of the month” (9 on diverse invertebrates, 5 on protists (AESCHT 2002, 2009, 2012), on sulphur bacteria as “organism of the month”, the other tried to explain actual results on soil biology or introduced exhibitions or events. Several more short article were initiated on molluscs or spiders and one on the testate amoebae *Diffugia rubescens* (PENARD, 1891) written by Bruno ORTNER (see p. 339). More detailed as well as earlier (starting in 2001) posters are available at <http://www.landesmuseum.at/de/standorte/biologiezentrum-linz/oekopark/pflanzen-tiere-oder-mineral-des-monats.html>.

Almost complete series of the five **protozoological**

journals, viz. “Archiv für Protistenkunde” since 1902 (148 vol. until it was renamed “Protist” in 1998); “Journal of Protozoology” since 1954 (renamed “Journal of Eukaryotic Microbiology” in 1993); the Polish journal “Acta Protozoologica” since 1963; the French journal “Protistologica” since 1968 (1987 continued as the German journal “European Journal of Protistology”) are available. Some journals on microscopy and cell biology are also included (see p. 450). In 2017 Prof. Erich STEINER, president of Microscopical Association Vienna, donated several issues of each volume of their “Mitteilungsblatt der Mikroskopischen Gesellschaft Wien”.

Periodicals such as “Proceedings of the International Congress of Protozoology” (since 1963) and “Progress in Protistology”, founded in 1986, classical **books** of all groups of protists, general text books on biology, and a **huge separate and book collection** of about 60,000 originals or inter-loan copies, many with autographs, are part of the Microcosm Archive Linz. Of course, the treatment of duplicates will need much foresight and work. Despite increasing digital versions of many journals and older books, for historians of natural sciences this could be an unsurmountable basis for studying the development of protistology as well as microscopy and (cell) biology.

A kind of **grey zone** as regards durability are internet activities such as personalised web pages of universities or singular persons and digital archives. Nobody can assure that they are still accessible in few or even 50 years. This also applies to the database **ZOBODAT** (Zoological-Botanical Database), founded in 1972 as ZOODAT and taken over by the Federal State of Upper Austria in 1999. It is managed by our bioinformatics DI Michael MALICKY and provides material concerning natural history in 3 domains: Since 1972 biodiversity data (beyond 4 million data sets) of animals and plants including more than hundred thousand pictures,

mainly from Austria. Since 2002 bibliographies of more than 18,000 naturalists including pictures, pdf files and since 2005 natural history literature concerning Upper Austria and since 2007 extended to Austria is digitised by our institute. Up to date more than 4,5 million pages of scientific literature (286,000 referenced scientific articles) have been digitised and read by OCR (Optical Character Recognition). Besides plotting traditional distribution maps, new goals include user friendly analysis (at present only in German language; cp. MALICKY et al. 2013) which enable rapid retrievals of information about certain geographical areas and site-specific conservation matters. Special user accounts provide a differentiated data protection. Pdfs can be found and downloaded without costs at this site. At present, only a portion of the data on invertebrate literature and taxa are included in ZOBODAT due to overwork.

Some 200 scientific and popular films (16 mm light-tone film copies, VHS copies and DVDs) and posters can also be considered as **semi-published**, because of their special purpose production for a restricted audience and non-durable accessibility. For instance, our poster series “animal/plant/mineral of the month” usually includes one print, which in addition was undated at the beginning, since 2001 they can be found online in ZOBODAT.

Series 3 Unpublished material

Correspondence, lectures, routine paperwork (administrative efforts), notes, memos are stored in maps and/or hanging folders, bigger bundles in files. Nondurable posters are kept rolled up in cardboard boxes or framed and presented in the “gallery” (see p. 338). Original card cabinets of scientists are kept to demonstrate the respective working style and for historical reasons to evaluate the contemporary interests. Diploma and doctoral theses usually bear a six-digit alphanumerical signature and are categorised among the literature.

Ten thousands of photographs (positive and/or negative) of the beginnings of light and electron microscopy, dia positives (even old ones of glass) and original line drawings: pencil and/or coloured as well as films are stored in cardboard boxes.

The collection does not only include authentic protist specimens “preserved for eternity”, but also **models** are aimed to put these usually invisible creatures in the right light. This already started in the 19th century, when a foraminifer titled “Peneroplis planatus” made by the natural history dealer Václav FRIČ (1839–1916) of Prague and a historical composition of bacteria had been ordered (Fig. 16, 17), although without inventory year and number. Three dimensional models of organisms and particular aspects, e.g. cilia strokes, extrusomes, are stored in MKAL (see p. 337).

My first instruction to represent the *Großglockneria acuta*, an endemic soil ciliate, was given in 1993 to the Swiss biologist and grammar-school teacher Dr. Pedro GALLIKER. It was used at the “Urtier” exhibition in 1994, in addition to many other loan items made by him from recycled materials (see p. 318). GALLIKER worked not only as a teacher, but also at the Natural Science Museum of the University of Zürich, where he worked as a scientific photographer and film-maker, and later at Swiss Television as department head for science, technology and medicine. His film “Live microorganisms” gives a good introduction to this hidden world. Since 2009, the ciliate model by Pedro GALLIKER is shown in the soil section of the permanent exhibition “Nature Upper Austria” in the Castle Museum (“Schlossmuseum”). The later also applies to some models of myxomycetes (see p. 322).

As part of the miracles of life (“Lebenswunder”) exhibition in 1998, Hans DAPPEN (Mönchengladbach) produced models of a radiolarian and a foraminifer (see p. 328) as



Fig. 16, 17 Models of a foraminifer (16) and some bacterial ground plans, called schizomycetes or split fungi (17), at the turn of the 19th to 20th century.

well as an *Acanthamoeba* cyst, as an important life strategy, and of *Trichomonas vaginalis* and *Giardia lamblia*, exemplifying flagellates (see cover) for the “parasite” exhibition in 2002. Most of them were again shown in the evolution exhibition 2007 and are now located in the Microcosm Archive Linz (see p. 337).

100 different types of foraminifers were ordered from Professor Shouyi ZHENG in 2007, a part of them were also shown in the Myth Beauty exhibition 2015 (see p. 336).

In 2012 the laboratory” pet “*Tetrahymena pyriformis* was prepared by Klaus LEITL in Straßwalchen (Salzburg; see p. 333).

Series 4 Documentation

Every visitor or future curator of the different locations is faced with **abbreviations** or acronyms, which can be pronounced as a word, the most frequent are listed, translated [in square brackets] and explained as follows:

AcPr	Acta Protozoologica
AE(B)	AESCHT work or book
ALG	Algen [algae]
ASP	reference code for publications of Horst ASPÖCK
BAK	Bakterien [bacteria]
BM(K)	Bruno Maria KLEIN Kollektion [Bruno Maria KLEIN collection]
CI(L)	Ciliaten [ciliates]
cl	<u>C</u> I lesen [ciliate pdf for reading]

D(s)	Dia(serie) [transparency (series)]
DGP	<u>D</u> eutsche <u>G</u> esellschaft für <u>P</u> rotozoologie [German Society for Protozoology].
F	Film [film]
FLA	Flagellaten [flagellates]
FOI	Wilhelm FOISSNER Kollektion [reference code for publications of Wilhelm FOISSNER]
FOR	Foraminiferen [foraminifers]
FUN	mikroskopische Pilze [fungal protists]
GP	K.G. <u>G</u> RELL Protisten-Sonderdrucke [separates of protists of K.G. GRELL]
GZ	K.G. <u>G</u> RELL <u>Z</u> oologie-Sonderdrucke [separates regarding general zoology of K.G. GRELL]
Gs	K.G. <u>G</u> RELL <u>S</u> pezialitäten [specialities of the K.G. GRELL collection]
GWS	<u>G</u> ewässers <u>S</u> chutz Abteilung [water pollution controll in Upper Austria]
HDM	R.M. <u>H</u> AND <u>M</u> ANN Kollektion [code for the R.M. HANDMANN collection]
He	Klaus <u>H</u> ECK <u>M</u> ANN Kollektion [code for the Klaus HECKMANN collection]
HK	<u>H</u> AUS <u>M</u> ANN <u>K</u> laus Kollektion [code for the Klaus HAUSMANN collection]
Hs	K. <u>H</u> AUS <u>M</u> ANN <u>S</u> pezialitäten [specialities of the Klaus HAUSMANN collection]
i. s.	incertae sedis
JEM	Journal of Eukaryotic Microbiology
JoPr	Journal of Protozoology
JOOM	Jahrbuch des Oberösterreichischen Musealvereines
KLE	B.M. KLEIN Kollektion [reference code for publications of B.M. KLEIN]

LBB	Linzer biologische Beiträge
MH	<u>M</u> ACHEMER <u>H</u> ans Kollektion [reference code for publications of Hans MACHEMER]
MHS	<u>M</u> ACHEMER <u>H</u> ans <u>S</u> pezialitäten [specialities of the Hans MACHEMER collection]
MKAL	Mikrokosmos Archive Linz [Microcosm Archive Linz]
MM	<u>M</u> aria <u>M</u> ULISCH Kollektion [code for the Maria MULISCH collection]
MP	<u>M</u> ikropräparat [microscopic slide]
MR	<u>M</u> EISTERFELD <u>R</u> alf Kollektion [code for the Ralf MEISTERFELD collection]
NAM	<u>N</u> ackta <u>m</u> öben [naked amoebae]
NP	not printed [long text only as pdf]
OT	<u>O</u> bjektträger-Behälter [microscopic slide box]
PCA	<u>P</u> ro <u>k</u> aryoten [procaryotic unicellulars]
PDF	portable document format [also used as reference code]
pl	PDF for reading, viz. not printed
PP	pdf ungedruckt [used as reference code]
PR(T)	<u>P</u> ro <u>t</u> isten [eukaryotic unicellulars]
SB	<u>S</u> onder <u>b</u> and [unicate of bound volume]
SCH	Ewald <u>S</u> CHILD Kollektion [code for the Ewald SCHILD collection]
SPZ	<u>S</u> pezialität [speciality code for OT]
TE(S)	Testaceen [testate amoebae]
WF	<u>W</u> ilhelm <u>F</u> OISSNER Kollektion [Wilhelm FOISSNER collection]
Z	Artikel in <u>Z</u> eitschrift [reference code for publications in journals]
ZOOT	<u>Z</u> oologie OT [speciality code for zoology OTs]
ZR	<u>Z</u> oological <u>R</u> ecord

Donors and provenance of the collections are given in Table 1. The following main collections are kept aside on special places or different sorts of material can be traced by specific markers, usually abbreviations (in alphabetical order): Josef DIECKMANN (1948–1996, Münster); Univ.-Prof. Dr. Jean DRAGESCO (Saint-Clément de Riviere, France); Univ.-Prof. Dr. Wilhelm FOISSNER (retired from the University of Salzburg); Raoul Heinrich FRANCÉ (1873–1943, Vienna); Annie FRANCÉ-HARRAR (1886–1971, Seewalchen am Attersee and Salzburg); Univ.-Prof. Dr. Karl Gottlieb GRELL (1912–1994, Tübingen, Germany);

Rudolf Michael HANDMANN (1841–1929, Linz); Univ.-Prof. Dr. Klaus HAUSMANN (retired from the University of Berlin, Germany); Univ.-Prof. Dr. Klaus HECKMANN (1934–2002, Münster, Germany); Dr. h. c. Bruno Maria KLEIN (1891–1968, St. Andrä-Wördern and Vienna); Univ.-Prof. Dr. Hans Georg MACHEMER (retired from the University of Münster, Germany); Dr. Ralf MEISTERFELD (retired from the University of Aachen, Germany); Dr. Maria MULISCH (University of Kiel, Germany); Ewald SCHILD (1899–1962, Linz).

Vouchers (typified or not) and further material (e.g. original manuscripts and photographs) of the persons moreover mentioned in Table 1 are stored in the regular collection (details concerning “type material” see AESCHT in this volume p. 483–502).

The **geographic range** of the collection is worldwide, 70 „states“ are represented, where mainly ciliates and to a less extent testate amoebae have been collected (Tab. 2).

The **working classification** provided in Table 3 (see p. 311–316) is neither intended to tackle diverging nomenclatural rules of “botanists”, “bacteriologists” and “zoologists” nor to discuss phylogenetic hypotheses. These puzzles are beyond the scope of this paper. Given is the taxonomic status from generic level upwards restricted to unicellulars of the Microcosm Archive Linz covered by voucher slides, i.e. type and non-name bearing ones), models or taxa mentioned in the results of the monitoring studies (see p. 352–377).

Educational activities (popular and scientific) focusing on unicellulars in Linz

This chapter introduces the persons, their co-operations and activities related to the Biology Centre of the Upper Austrian Museum in Linz-Dornach and beyond, because they were origi-

Table 1: Provenance of the microscopic slide collection in Linz. Listed are persons (in alphabetical order), their home countries, the first year of deposition [marked by an asterisk * if posthumously], the number of slides deposited [small ones concern type material] and other contributions to the Microcosm Archive such as drawings, films, literature or unpublished correspondence, manuscripts or protocols. Note that often slides of members of a working group or colleagues from other institutions (not mentioned here) may be included. Main topics of protistological interest are arranged according the respective bibliography. Abbreviations: cu – culture, popularisation; ec – ecology; mt – morphology and taxonomy; pg – phylogeny; pl – physiology; te – techniques.

Family name	Surname	State	Year	Slide(s)	Archive
AESCHT	Erna	Austria	1993	360	mt cu pg ec te
AMMERMANN	Dieter	Germany	2000	2	–
ASPÖCK	Horst	Austria	2003	9	pl cu mt
BAUMGARTNER	Manuela	Germany	2002	2	–
BERGER	Helmut	Austria	2003	29	–
BLATTERER	Hubert	Austria	1995	19	[+ 3419 GWS]
BOURLAND	William A.	USA, Idaho	2009	64	–
DIECKMANN	Josef	Germany	1993	1035*	te mt pl
DRAGESCO	Jean	France	1997	376	mt te pl ec
DUMACK	Kenneth	Germany	2015	7	–
EIGNER	Peter	Austria	1993	12	–
FOISSNER	Wilhelm	Austria	1974	4792	mt te pg ec pl cu
FRANCÉ	Raoul Heinrich	Austria	2005*	–	cu ec mt
FRANCÉ-HARRAR	Annie	Austria	2005*	–	cu pl ec
GRELL	Karl	Germany	2009*	500	[via HECKMANN] pl mt cu
GROSPIETSCH	Theodor	Germany	2014*	c. 6000	[via MEISTERFELD] ec
HANDMANN	Rudolf	Austria	1933*	658	ec
HAUSMANN	Klaus	Germany	2011	c. 2000	pl mt cu
HECKMANN	Klaus	Germany	2014*	c. 700	pl
HÜLSMANN	Norbert	Germany	2006	1	–
KLEIN	Bruno Maria	Austria	1992*	4287	pl cu te
KRAINER	Karl-Heinz	Austria	1992	28	–
LEIPE	Detlev	Germany	1993	3	–
MACHEMER	Hans	Germany	2014	–	pl
MEISTERFELD	Ralf	Germany	2014	2	pg ec mt
MICHEL	Ralf	Germany	1999	2	–
MULISCH	Maria	Germany	1998	800	pl mt
OBERSCHMIDLEITNER	Roland	Austria	1997	70	–
PETZ	Wolfgang	Austria	2001	205	–
POSCH	Thomas	Switzerland	2016	3	–
RADEK	Renate	Germany	1993	23	–
SCHILD	Ewald	Austria	2002*	1113	te pl cu
SCHMID-HEMPEL	Regula	Switzerland	2010	6	–
SCHÖDEL	Horst	Germany	2005	55	–
SILVA NETO	Inacio Domingos da	Brazil	1998	1	–
SONNTAG	Bettina	Austria	2005	239	–
VOSS	Hans-Jürgen	Germany	1996	9	–
WILBERT	Norbert	Germany	1993	12	–
WYLEZICH	Claudia	Germany	2012	2	–

nally own initiatives or refer to unvouchered “material”. It is likewise a guide to the personalities and literature of this period given in the subsequent biographical chapter. These regional activities are related to Austrian, European and to a small extent international events regarding protistology (cp. HAUSMANN et al. 2003).

in Vienna. Later he returned to Bavaria and became board of the Botanical Garden in Munich; he died in this town in 1835 (for references see AESCHT 1994).

One of his favorite areas were the infusorians, which he never was tired to observe and describe. For example, he discovered and figured the new ciliate species *Cothurnia vaga* near Linz, which he considered to be a polyp. This is

1776 – The first record of a ciliate in Austria happens in Linz and fate of the genus *Linz*

The first reliable proof of a ciliate in Austria can be attributed to SCHRANK as early as 1776. Franz de Paula SCHRANK, born in Vornbach am Inn (Bavaria) in 1747, close to today’s border of Germany to Upper Austria, was a well-known entomologist and botanist; since autumn 1769 he spent some time in Linz and around 1776 he promoted as theologian

Table 2: Continents and countries represented in the Linz collection. Mainly ciliates and to a less extent testate amoebae have been collected there.

Continent	Country	Continent	Country
Europe	Austria	America	Argentina
	Belgium		British Virgin Islands
	Czechoslovakia		Brazil
	Croatia		Canada
	Denmark		Cap Verde
	Finland		Chile
	France		Costa Rica
	Germany		Cuba
	Greece		Dominican Republic
	Hungary		Ecuador
	Iceland		Guam
	Italy		Guyana
	Norway		Jamaica
	Poland		Mexico
	Portugal		Netherland Antilles
	Slovakia		Panama
	Spain		Peru
	Sweden		United States of America
	Switzerland		Venezuela
	Turkey		
Africa	Benin	Asia	China
	Botswana		India
	Burundi		Israel
	Cameroon		Japan
	Cape Verde		Jordan
	Egypt		Korea
	Ethiopia		Maldives
	Kenya		Saudi Arabia
	Lybia		Singapore
	Madagascar		
	Mali		Pacific
	Namibia		Australia
	Rwanda		Fiji
	South Africa		Papua New Guinea
	Tansania		Tasmania
	Tunisia		
	Zanzibar	Antarctica	

SCHRANK in addition introduced the new genus *Linza* in 1802, unfortunately its type species *L. pruniformis* was already described as *Ophrydium versatile*, making the younger name invalid. The generic name was all the more suppressed by the ICZN in 1956 (cp. AESCHT 2001).

1882 – The first water assessment in Linz

Carl SCHIEDERMAYR (1818–1895) was born in Linz and a physician and botanist. Particularly noteworthy are his microscopic investigations of fountains and the stream Danube in 1882, 1887 (for references see AESCHT 1994). He demonstrated unequivocally that the water in the city of Linz was unsuitable for drinking, since he found eggs of tapeworms and further kinds of organisms, including ciliates, suggesting a great organic pollution and possible infection. The citizens of Linz initially thought the water would be good enough, because they feared the high costs of a water pipeline. Finally the proponents of a better water became dominant. After a long search, SCHIEDERMAYR made a positive microscopic report on the water quality in Scharlinz. In any case, the well was dug, and the

understandable because the term **protozoa** was only introduced in 1818 by GOLDFUSS and the Protozoa became separated from Metazoa by Carl Theodor Ernst von SIEBOLD in 1845, who also divided the former into the rhizopods and infusorians. The kingdom **Protista**, introduced in 1866 by Ernst HAECKEL (1834–1919), however, included bacteria, unicellular algae, fungi and protozoans, but excluded his classes Ciliata and Acinetæ (Suctoria) by placing them in the phylum Articulata (segmented animals).

first waterwork and a water supply system for Linz were opened on 6 May 1893 – more than 125 years ago. At the same time (1878–1914) the institutionalisation of the discipline of protozoology took place: 1880–1889 appeared the first standard textbooks on protozoology in three volumes written by Otto BÜTSCHLI (1848–1920) in Heidelberg. Protozoological laboratories were founded at Berlin 1904 and at Hamburg 1906 (cp. HAUSMANN et al. 2003).

Table 3: Working classification of unicellulars represented in the Microcosm Archive Linz differentiated by colours: **green:** class-series, **blue:** possibly orders, **red:** family-series, black: genus, black and **bold:** phylum or domain. Note the divergent traditions of botanists and zoologist in the usage of ending for different ranks. Most people including taxonomists yet do not have the faintest idea about biodiversity and phylogenetic understanding is only at the beginning, also indicated by the numerous uncertain taxonomic positions, viz. incertae sedis (i. s.).

Eucaryota	Trachelocercidae	Bistichella	Lamtostyla
Alveolata	Kovalevaia	Erniella	Nudiampphiella
Apicomplexa	Trachelocerca	Metauroleptus	Paramphiella
Aconoidasida	Trachelolophos	Parabistichella	Uroleptoides
Haemosporida	Tracheloraphis	Pseudohemisincirra	Kahliellidae
Plasmodiidae	Loxodida	Deviatidae	Deviata
Plasmodium	Cryptopharyngidae	Idiodeviata	Engelmanniella
Piroplasmida	Ciliofaurea	Notodeviata	Kahliella
Babesiidae	Loxodidae	Gonostomatidae	Paraholosticha
Babesia	Loxodes	Apogonostomum	Wallackia
Piroplasma	Remanella	Gonostomoides i. s.	Keronidae
Apicomonadea	Protoheterotrichida	Schmidingerotrichidae	Keronopsis
Colpodellida	Aveliidae	Schmidingerotrix	Orthoamphiellidae
Spiromonadidae	Avelia	Sporadotrichida	Circinella
Spiromonas	Parduczia	Oxytrichidae	Cladotricha
Coccidiasina	Geleidae	Anatolociurus	Orthoamphiella
Eucoccidiorida	Geleia	Apourosomoida	Parakahliellidae
Haemogregarinidae	Gellertia	Australociurus	Anatolociurus
Haemogregarina	Heterotrichaea	Coniculostomum	Fragmocirrus
Sarcocystidae	Heterotrichida	Cyrtohymena	Neogeneia
Sarcocystis	Climacostomidae	Gastrostyla	Parakahliella
Conoidasida	Climacostomum	Gigantothrix	Psilotrichidae
Eucoccidiorida	Condylostomatidae	Gonostomum	Psilotricha
Eimeriidae	Condylostoma	Hemiurosoma	Psilotrichides
Coccidium	Condylostomides	Histiculus	i. s.
Eimeria	Folliculinidae	Laurentiella	Afrothrix
Eugregarinorida	Ascobius	Monomicrocaryon	Saudithrix
Gregarinidae	Bickella	Notohymena	Strongylidiidae
Gregarina	Heterostentor	Onychodromopsis	Strongylidium
Myxosporea	Maristentoridae	Onychodromus	Strombidiida
Bivalvulida	Maristentor	Oxytricha	Pelagostrombidiidae
Myxidiidae	Spirostomidae	Parentocirrus	Pelagostrombidium
Myxidium	Anigsteinia	Paragonostomum	Strombidiidae
Sporozoea	Blepharisma	Perisincirra	Rimostrombidium
Eucoccida	Gruberia	Paraurostyla	Spirostrombidium
Sarcocystidae	Spirostomum	Pleurotricha	Strombidium
Toxoplasma	Stentoridae	Pseudouroleptus	Tontoniidae
Dinozoa / -phyta	Heterostentor	Rigidocortex	Tontonia
Gonyaulacales	Stentor	Rubrioxxytricha	Tintinnida
Ceratiaceae	Spirotrichea	Steinia	Codonellopsidae
Ceratium	Choreotrichida	Sterkiella	Codonellopsis
Gymnodiniales	Leegardiellidae	Stylonychia	Dictyocystidae
Coccolithophoridae	Leegaardiella	Tachysoma	Codonella
Amphidinium	Torquatellidae	Tetmemena	Ptychocylididae
Gymnodiniaceae	Strobilidium	Terricirra	Cymatocylis
Cochlodinium	Euplotida	Urosoma	Stenosemellidae
Gymnodinium	Aspidiscidae	Vermioxytricha	Stenosemella
Polykrikaceae	Aspidisca	Urosomoididae	Tintinnidiidae
Polykrikos	Euplotidae	Erimophrya	Membranicola
Peridinales	Euplotes	Hemioxytricha	Tintinnidium
Peridiniaceae	Euplotoides	Oxytrichella	Urostylida
Peridinium	Euplotopsis	Urosomoida	Bakuellidae
Thoracosphaeraceae	Swedmarkiidae	i. s.	Bakuella
Apocalathium	Swedmarkia	Paroxytricha	Neobakuella
Noctiluciphyceae	Uronychiidae	Totothrix	Holostichidae
Noctilucales	Diophrys	Stichotrichida	Holosticha
Noctilucaceae	Uronychia	Amphiellidae	Holostichides
Noctiluca	Halteriida	Afroamphiella	Neokeronopsidae
Ciliophora	Halteriidae	Amphiella	Neokeronopsis
Karyorelictea	Halteria	Amphiellides	Pattersoniella
Protostatidida	Meseres	Apoamphiella	Pseudokeronopsidae
Kentrophoridae	Hypotrichida	Hemiamphiella	Bicoronella
Kentrophoros	i. s.	Hemisincirra	Pseudokeronopsis

Tab. 3: continued

Thigmokeronopsis	Apocoriplites	Epispathidium	Urliella
Uroleptopsis	Dioplitophrya	Semispathidium	Wolffosia
Pseudourostylidae	Fuscheria	Spathidium	Nassulidae
Pseudourostyla	Renoplites	Supraspathidium	Nassula
Triconella	i. s.	Tracheliida	Nassulides
Rigidotrichidae	Suturothrix	Tracheliidae	Naxella
Rigidotrich	Homalozoidae	Trachelius	Obertrumia
Urostylidae	Homalozoon	Vestibuliferida	Synhymeniida
Australothrix	Lacrymariidae	Actinobolinidae	Orthodonellidae
Birojima	Lacrymaria	Actinobolina	Zosterodasys
Caudiholosticha	Pelagolacrymaria	Belonophrya	Scaphidodontidae
Diaxonella	Phialinides	Balantidiidae	Chilodontopsis
Eschaneustyla	Lagynophryidae	Balantidioides	Colpodea
Etoschothrix	Lagynophrya	Phyllopharyngea	Bryometopida
Metaurostylopsis	Myriokaryonidae	Chlamydodontida	Bryometopidae
Notocephalus	Cephalospathula	Chilodonellidae	Bryometopus
Periholosticha	Myriokaryon	Alinostoma	Thylakidium
Uroleptus	Pleuropitidae	Chilodonatella	Jaroschiidae
Armophorea	Pleuropilites	Chilodonella	Dapedophrya
Metopida	Pleuropiltoides	Odontochlamys	Pentahymena
Metopidae	Pseudoholophryidae	Pseudochilodonopsis	Kreyellidae
Heterometopus	Ovalorhabdos	Thigmogaster	Microdiaphanosoma
Metopus	Paraenchelys	Trithigmostoma	Orthokreyella
Apometopidae	Pseudoholophrya	Gastronautidae	Trihymenidae
Apometopus	Trachelophyllidae	Gastronauta	Trihymena
Litostomatea	Actinorhabdos	Gymnozooidae	Bryophryida
Cyclotrichida	Bilamellophrya	Gymnozoum	Bryophryidae
Mesodiniidae	Chaenea	Spiroprorodon	Bryophrya
Rhabdoaskenasia	Enchelyotricha	Lynchellidae	Bryophryoides
Haptorida	Epitholiolus	Chlamydonella	Parabryophrya
Acropisthiidae	Luporinophrys	Chlamydonellopsis	Puytoraciella
Acropisthium	Phialina	Dysteriida	Tectohymenidae
Clavoplites	Sleighophrys	Dysteriidae	Pseudokreyella
Coriplites	Spetazoon	Dysteria	Bursariomorphida
Cranotheridium	Trachelophyllum	Endogenida	Bursariidae
Diplites	Urotrichidae	Tokophryidae	Paracondylostoma
Perispira	Urotricha	Brachyosoma	Colpodida
Sikorops	Pleurostomatida	Evaginogenida	Bardeliellidae
Bryophyllidae	Amphileptidae	Enchelyomorphidae	Bardeliella
Bryophyllum	Amphileptus	Enchelyomorpha	Colpodidae
Didiniidae	Kentrophyllum	Exogenida	Bresslaua
Askenasia	Pseudoamphileptus	Metacinetidae	Colpoda
Cyclotrichium	Litonotidae	Metacineta	Corallocolpoda
Didinium	Litonotus	Paracinetidae	Corticocolpoda
Monodinium	Loxophyllidae	Loricophrya	Idiocolpoda
Dileptidae	Loxophyllum	Podophryida	Krassnigia
Apodileptus	Siroloxophyllum	Podophryidae	Kuehneltiella
Apotrachelius	Spathidiida	Podophrya	Tillina
Dileptus	Apertospathulidae	Sphaerophrya	Exocolpodidae
Monilicaryon	Apertospathula	Nassophorea	Bromeliotrix
Paradileptus	Longispatha	Colpodidiida	Exocolpoda
Pseudomonilicaryon	Arcuospathidiidae	Colpodidiidae	Grossglockneriidae
Dimacrocaryonidae	Arcuospathidium	Apocolpodidium	Fungiphrya
Dimacrocaryon	Armatospathula	Colpodidium	Grossglockneria
Rimaleptus	i. s.	Pedohymena	Nivaliella
Enchelyidae	Enchelariophrya	Microthoracida	Pseudoplatyophrya
Apoenchelys	Lingulotrichidae	Leptopharynidae	Microcolpoda
Chilophrya	Cataphractes	Leptopharynx	Hausmanniellidae
Enchelys	Lingulotrix	Microthoracidae	Avestina
Ileonema	Protospathidiidae	Drepanomonas	Bresslauides
Obliquostoma	Edaphospathula	Microthorax	Emarginatophrya
Papillorhabdos	Protospathidium	Stammeridium	Hausmanniella
Enchelyodontidae	Spathidiidae	Trochiliopsis	Kalometopia
Enchelyodum	Apobryophyllum	Nassulopsida	Apoavestina i. s.
Enchelyodon	Apospathidium	Furgasoniidae	Marynidae
Fuscheriidae	Cultellothrix	Furgasonia	Ilsiella
Aciculoplites	Enchelaria	Parafurgasonia	Maryna

Tab. 3: continued

Sandmanniellidae	Bromeliophryidae	Telotrochidium	Echinamoebidae
Sandmannides	Bromeliophrya	Vaginicolidae	Echinamoeba
Sandmanniella	Glaucomides	Cothurnia	Tubulinida
i. s.	Deltopylidae	Vorticellidae	Amoebidae
Dragescozoon	Agolohymena	Apocarchesium	Trichamoeba
Cyrtolophosidida	Tetrahymenidae	Carchesium	Archamoebae
Cyrtolophosididae	Colpidium	Epicarchesium	Pelobiontea
Cyrtolophosis	Dexiostoma	Pseudocarchesium	Pelobiontida
Plesiocaryon	Tetrahymena	Pseudohaplocaulus	Pelomyxidae
Pseudocyrtolophosis	Turaniellidae	Pseudovorticella	Pelomyxa
Platyophryidae	Paracolpidium	Vorticella	Cercozoa
Cirrophrya	Peniculida	Zoothamniidae	Aconchulinida
Mancothrix	Frontoniidae	Zoothamnioides	Vampyrellida
Platyophrya	Apofrontonia	i. s.	i. s.
Platyophryides	Disematostoma	Benthontophrys	Penardia
Pseudochlamydonellidae	Frontonia	Amoebozoa	Tectofilosida
Hackenbergia	Marituja	Archamoebae	Chlamydoophryidae
Reticulowoodruffiidae	Paraclathrostoma	Amoebida	Lecythium
Semiplatyophrya	Parameciidae	Entamoebidae	Penardeugenia
Sagittariidae	Neobursaridium	Entamoeba	Euglyphida
Apowoodruffia	Paramecium	Gymnamoebia	Cyphoderidae
Sagittaria	Stokesiidae	Leptomyxida	Cyphoderia
Woodruffiidae	Stokesia	Flabellulidae	Euglyphidae
Etoschophrya	Philasterida	Flamella	Assulina
Rostrophrya	Cinetochilidae	Heliozoa	Euglypha
Rostrophryides	Platynematum	Actinophryida	Tracheleuglypha
Woodruffia	Sathrophilus	Actinophryidae	Trinematidae
Woodruffides	Cinetochilides i. s.	Acanthocystis	Corythion
Sorogenida	Loxocephalidae	Lobosea	Trinema
Sorogenidae	Balanonema	Euhyperamoebida	Labyrinthulomycete
Sorogena	Dexiotricha	Hyperamoebidae	Amphitremida
Prostomatea	Loxocephalus	Tubulina	Amphitrematidae
Prorodontida	Myxophyllidae	Physarida	Amphitrema
Colepidae	Myxophthirus	Didymiidae	Phytomyxea
Coleps	Philasteridae	Diachaea	Plasmodiophorida
Levicoleps	Philasterides	Physaraceae	Plasmodiophoridae
Planicoleps	Pseudocohnilembidae	Craterium	Plasmodiophora
Holophryidae	Pseudocohnilembus	Physarum	Sorosphaera
Bursellopsis	Uronematidae	Trichiales	Rhizopoda
Holophrya	Homalogastra	Arcyriaceae	Gromiida
Pelagothrix	Uronema	Arcyria	Cyclopyxidae
Placidae	Pleuronematida	Tubulinea	Pseudawerinzewia
Placus	Cyclidiidae	Arcellinida	Euglyphidae
Plagiocampidae	Apocyclidium	Arcellidae	Sphenoderia
Paraurotracha	Cristigera	Arcella	Thecofilosea
Plagiocampa	Cryptochilum	Centropyxidae	Cryomonadida
Plagiocampides	Cyclidium	Centropyxis	i. s.
Protoplagiocampa	Protocyclidium	Cyclopyxidae	Rhizapis
Prorodontidae	i. s.	Cyclopyxis	Phaeocystida
Prorodon	Larvulina	Pseudawerinzewia	Aulacanthidae
Prostomatida	Pleuronematidae	Trigonopyxis	Aulacantha
Metacystidae	Pleuronema	Diffugiidae	Ventrilosea
Metacystis	Schizocalyptra	Diffugia	i. s.
Metathrix	Sessilida	Schwabia	Kraken
Plagiopylea	Astylozoidae	Heleoperidae	Metamonada
Plagiopylida	Astylozoon	Heleopera	Anaeromonadea
Trimyemidae	Epistylidae	Lesquereusiidae	Oxymonadida
Trimyema	Epistylis	Quadrullella	Polymastigidae
Astomatia	Heteropolaria	Nebelidae	Monocercomonoides
Astomatida	Pseudotelotrochidium	Nebela	Retortamonadea
Mesnilellidae	Operculariidae	Paraquadrulidae	Retortamonadida
Mesnilella	Opercularia	Paraquadrula	Retortamonadidae
Oligohymenophorea	Orbopercularia	Phryganellidae	Chilomastix
Ophryoglenida	Ophryidiidae	Phryganella	Trichomonadea
Ophryoglenidae	Ophryidium	Plagiopyxidae	Spirotrichonymphida
Bursostoma	Opisthonectidae	Bullinularia	Spirotrichonymphidae
Tetrahymenida	Opisthonecta	Plagiopyxis	Spirotrichonympha

Tab. 3: continued

Trichomonadida	Asterigerinatidae	Ornatanomalina	Tubothalamea
Trichomonadidae	Asterigerinata	Stylostomellidae	Miliolida
Trichocovina	Bagginidae	Orthomorphina	Alveolinidae
Trichomonas	Baggina	Uvigerinidae	Alveolina
Diplomonadida	Bolivinitidae	Uvigerina	Alveolinella
Hexamitidae	Hanzawaia	Virgulinelidae	Borelis
Giardia	Virgulina	Virgulinella	Cribrolinoididae
Hypermastigida	Buliminidae	Textulariida	Adelosina
Joeniidae	Bulimina	Eggerellidae	Fischerinidae
Joenia	Praeglobobulimina	Martinottiella	Fischerinella
Euglenozoa / -phyta	Calcerinidae	Tritaxilina	Planispirina
Euglenida	Pararotalia	Kaminskiidae	Planispirinella
Euglenaceae	Cancrisidae	Spirorutilus	Trisegmentina
Euglena	Cancris	Textulariidae	Wiesnerella
Trachelomonas	Gyroidinoides	Bigenerina	Hauerinidae
Eutreptiida	Valvulinera	Haeuslerella	Articulina
Astasiaceae	Caucasinidae	Semivulvulina	Biloculinella
Astasia	Caucasina	Septotextularia	Crenatella
Heteronematales	Chilostomellidae	Siphoscutula	Cruciloculina
Heteronematidae	Allomorphina	Spiroplectammina	Cycloforina
Entosiphon	Cibicididae	Textularia	Flintinoides
Kinetoplastea	Dyocibicides	Foraminifera i. s.	Lachlanella
Trypanosomatida	Lobatula	Lagenida	Longiapertina
Trypanosomatidae	Discorbinellidae	Chrysalogoniidae	Lorettaoides
Crithidia	Biapertorbis	Amphimorphina	Masilina
Trypanosoma	Elphidiidae	Ellipsolagenidae	Polysegmentina
Foraminifera	Elphidium	Fissurina	Ptychomiliola
Globothalamea	Porosonion	Oolina	Pyrgo
Globingerinida	Stomoloculina	Walterparria	Pyrgoella
Globigerinidae	Epistomariidae	Glandulinidae	Quinqueloculina
Globigerina	Pseudoeponides	Glandulina	Sigmamiliolinella
Globigerinoides	Eponidae	Globulotuba	Sigmoilopsis
Globingerinidae	Eponides	Ichthyolariidae	Spirosigmoilina
Globingerina	Fursenkoinidae	Grillina	Tortonella
Globorotaliidae	Fursenkoina	Nodosariidae	Triloculina
Globorotalia	Glaboratellidae	Botuloides	Triloculinellus
Lituolida	Conorbella	Laevidentalina	Triloculinoides
Ammosphaeroidinidae	Glaboratella	Lingulina	Varidentella
Recurvoides	Globorotaliidae	Nodosaria	Lagenidae
Haplophragmoididae	Globorotalites	Rimulina	Lagena
Buzasina	Hantkeninidae	Plectofrondiculariidae	Neugeborina
Haplophragmella	Cribrorhantkenina	Plectofrondicularia	Miliamminidae
Labrospira	Hantkenina	Polymorphinidae	Miliamina
Hormosinidae	Heterolepidae	Globulina	Miliolidae
Hormosina	Heterolepa	Guttulina	Miliola
Spiroplectamminidae	Nonionidae	Polymorphina	Nubeculariidae
Orectostomina	Melonis	Pseudopolymorphina	Nodophthalmidium
Spirotextularia	Nonion	Vaginulinidae	Stellarticulina
Trochamminidae	Nonionella	Amphycoryna	Ophthalmidiidae
Arenoparrella	Nonionoides	Dimorphina	Edentostomina
Nummulitida	Pullenia	Ellipsocristellaria	Peneroplidae
Nummulitidae	Nummulitidae	Lenticulina	Dendritina
Planostegina	Heterostegina	Saracenaria	Monalysidium
Robertinida	Orbitoididae	Spirolingulina	Peneroplis
Ceratobuliminidae	Orbitoides	Vaginulinopsis	Puteolina
Ceratobulimina	Pannellainidae	Valvulinidae	Renulina
Ceratocancris	Pannellaina	Siphobigenerina	Spirolina
Robertinidae	Parelloididae	Monothalamea	Soritidae
Geminospira	Cibicidoides	Allogromiida	Orbiculina
Robertinoides	Planorbulinidae	Allogromiidae	Spiroloculinidae
Rotaliida	Planorbulina	Edaphoallogromia	Inaequalina
Acervulinidae	Reusselidae	Astrorhizida	Neospiroloculina
Sphaerogypsina	Reussella	Rhabdamminidae	Spiroloculina
Alabaminidae	Rosalinidae	Rhabdammina	Spirillinida
Alabamina	Rosalina	i. s.	Ammodiscidae
Amphisteginidae	Rotaliidae	Reticulomyxidae	Glomospira
Amphistegina	Ammonia	Dracomyxa	Repmanina

Tab. 3: continued

Hemimastigophora	Pyxidiophorales	Chytridiopsidae i. s.	Staurosiraceae
Hemimastigida	Pyxidiophoraceae	Acarispora	Opephora
Spiroemidae	Acarinicola	Encephalitozoonidae	Pseudostaurosira
Hemimastix	Laboulbeniomyces	Ciliatosporidium i. s.	Staurosirella
Spiroema	Pyxidiophorales	Nosematidae	Licnophorales
Heterokontophyta	Pyxidiophoraceae	Nosema	Ulnariaceae
Actinochrysophyceae	Pyxidiophora	Chlorobionta	Hannaea
Actinophryida	Lecanoromycetes	Bacillariophyta / -phyceae	Ulnaria
Actinophryidae	Peltigerales	Achnanthes	Mastogloiales
Actinophrys	Collemataceae	Platessa	Mastogloiaceae
Actinosphaerium	Collema	Bacillariales	Aneumastus
Coscinodiscophyceae	Basidiomycota	Bacillariaceae	Mastogloia
Coscinodiscales	Pucciniomycetes	Denticula	Melosirales
Aulacodiscaceae	Pucciniales	Grunowia	Melosiraceae
Aulacodiscus	Coleosporiaceae	Hantzschia	Melosira
Aulacoseiraceae	Coleosporium	Nitzschia	Naviculales
Aulacoseira	Cronartiaceae	Simonsenia	Achnanthesiaceae
Coscinodoscaceae	Cronartium	Tryblionella	Achnantheidium
Coscinodiscus	Melampsoraceae	Biddulphiales	Eucocconeis
Lindavia	Melampsora	Biddulphiaceae	Karayevia
Triceratiales	Phragmidiaceae	Biddulphia	Lemnicola
Triceratiaceae	Phragmidium	Isthmia	Planothidium
Cerataulus	Pucciniaceae	Cocconeidales	Psammothidium
Fragilariophyceae	Puccina	Cocconeidaceae	Amphipleuraceae
Fragilariales	Pucciniastrum	Cocconeis	Amphipleura
Fragilariaceae	Uromyces	Cymbellales	Frustulia
Asterionella	Ustilaginomycetes	Anomoeoneidaceae	Halamphora
Diatoma	Urocystidiales	Adlafia	Vanheurckia
Rhabdonematales	Urocystidaceae	Anomoeoneis	Berkeleyaceae
Rhabdonemataceae	Urocystis	Cymbellaceae	Berkeleya
Rhabdonema	Ustilaginales	Brebissonia	Parlibellus
Tabellariales	Anthracoideaceae	Cymbella	Brachysiraceae
Tabellariaceae	Schizonella	Cymbopleura	Brachysira
Tabellaria	Glomosporiaceae	Gomphocymbella	Nupela
Parabasalia	Sorosporium	Gomphocymbellopsis	Cavinulaceae
Trichonympheaea	Ustilaginaceae	Kurtkrammeria	Cavinula
Trichonymphida	Ustilago	Gomphonemataceae	Diadesmidaceae
Spirotrichosomidae	Ustilaginomycotina	Delicata	Diadesmis
Heliconympha	Entylomataceae	Didymosphenia	Humidophila
Lophomonadida	Entyloma	Encyonema	Luticola
Joeniidae	Tilletiaceae	Encyonopsis	Diploneidaceae
Placojoenia	Tillexia	Geissleria	Diploneis
Oxymonadida	Choanozoa / Mesomycetozoa	Gomphoneis	Naviculaceae
Oxymonadidae	Craspedida	Gomphonema	Cocconema
Opisthomitus	Codonosigaceae	Placoneis	Hippodonta
Percolozoa	Codosiga	Reimeria	Navicula
Heterolobosea	Chytridiomycetes	Gomphosphaeriaceae	Neidiaceae
Schizopyrenida	Synchytriales	Gomphosphaeria	Muelleria
Tetramitidae	Synchytriaceae	Rhoicospheniaceae	Neidium
Tetramitus	Synchytrium	Rhoicosphenia	Pinnulariaceae
Radiozoa	Eurotiummycetes	Eunotiales	Pinnularia
Polycystina	Eurotiales	Eunotiaceae	Plagiogrammaceae
Collodaria	Trichocomaceae	Eunotia	Dimeregramma
Sphaerozooidae	Penicillium	Fragilariales	Pleurosigmataceae
Sphaerozoum	Exobasidiomycetes	Fragilariaceae	Gyrosigma
Opalozoa Opalinata	Entylomatales	Asterionella	Pleurosigma
Opalinae	Entylomataceae	Caloneis	Sellaphoraceae
Opalinida	Entyloma	Ceratoneis	Fallacia
Opalinidae	Tilletiales	Diatoma	Sellaphora
Opalina	Tilletiaceae	Fragilaria	Stauroneidaceae
Myxozoa	Tilletia	Fragilariforma	Craticula
Myxosporea	Zygomycota	Grammonema	Fistulifera
Bivalvulida	i. s.	Odontidium	Stauroneis
Myxobolidae	Nephridiophagidae	Staurosira	i. s.
Myxobolus	Nephridiophaga	Synedra	Achnantheiopsis
Fungal' protists	Microsporidia		Discoplea
Ascomycota	Microsporea		Chamaepinnularia

Tab. 3: continued

Eolimna	Staurastrum	Pandorina	Alphaproteobacteria
Himantidium	Stauroidesmus	Volvox	Rhizobiales
Kobayasiella	Chlorophyta	Prasinophyceae	Rhizobiaceae
Mayamaea	Chlorodendrophyceae	Pyramimonadales	Agrobacterium
Microcostatus	Chlorodendrales	Halosphaeraceae	Betaproteobacteria
Pseudofallacia	Chlorodendraceae	Pyramimonas	Rhodocyclales
Paraliales	Tetraselmis	Trebouxiophyceae	Rhodocyclaceae
Paraliaceae	Chlorophyceae	Chlorellales	Quadricoccus
Ellerbeckia	Chaetophorales	Chlorellaceae	Cyanobacteria/-phyceae
Rhopalodiales	Chaetophoraceae	Dictyosphaerium	Achnathales
Rhodolodiaceae	Chlorotylum	Micractinium	Achnathaceae
Epithemia	Draparnaldia	Oocystaceae	Achnathes
Rhopalodia	Chlamydomonadales	Crucigeniella	Chroococcales
Stephanodisciales	Phacotaceae	Lagerheimia	Chroococcaceae
Stephanodiscaceae	Phacotus	Nephrocytium	Chroococcus
Cyclostephanos	Chlorococcales	Oocystis	Microcystaceae
Cyclotella	Characiaceae	Planctonema	Microcystis
Discostella	Korshikoviella	Tetrachlorella	Radiocystis
Handmannia	Chlamydomonadaceae	Trebouxiales	Nostocales
Orthosira	Chlamydomonas	Botryococcaceae	Aphanizomenonaceae
Pantocsekiella	Chlorophyceae	Botryococcus	Aphanizomenon
Stephanodiscus	Willea	Laboulbeniomycetes	Dolichospermum
Surirellales	Treubariaceae	Laboulbeniales	Nostocaceae
Surirellaceae	Treubaria	Laboulbeniaceae	Anabaena
Clypeus	Sphaeroleales	Stigmatomyces	Nostoc
Campylodiscus	Characiaceae	Chrysophyta	Oscillatoriales
Cymatopleura	Ankyra	Chrysophyceae	Microcoleaceae
Iconella	Hydrodictyceae	Chromoulinales	Planktothrix
Stenopterobia	Hydrodictyon	Chrysamoebaceae	Oscillatoriaceae
Surirella	Monactinus	Chrysidiastrum	Oscillatoria
Trinecrio	Pediastrum	Dinobryaceae	Synechococcales
Tabellariales	Pediastrum	Chrysolykos	Coelosphaeriaceae
Tabellariaceae	Pseudopediastrum	Dinobryon	Coelosphaerium
Meridion	Stauridium	Coccolithophyceae	Snowella
Thalassiophysales	Tetraëdron	Isochrysidaceae	Woronichinia
Catenulaceae	Neochloridaceae	Erkenia	Leptolyngbyaceae
Amphora	Golenkinia	Hibberdiales	Planktolynngbya
Thalassiosirales	Radiococcaceae	Stylococcaceae	Merismopediaceae
Thalassiosiraceae	Coenochloris	Bitrichia	Aphanocapsa
Amphitetras	Coenocystis	Hydrurales	Limnococcus
Cerataulus	Eutetramorus	Hydruraceae	Merismopedia
Thalassiosira	Selenastraceae	Hydrurus	Pseudanabaenaceae
Triceratiales	Quadrigula	Synurales	Limnothrix
Triceratiaceae	Scenedesmaceae	Mallomonadaceae	Pseudanabaena
Triceratium	Coelastrum	Mallomonas	Synechococcaceae
Mediophyceae	Crucigenia	Cryptophyta	Anathece
Stephanodisciales	Hariotina	Cryptomonadea	Cyanodictyon
Stephanodiscaceae	Scenedesmus	Cryptomonadales	
Cyclotella	Tetradesmus	Campylomonadaceae	
Handmannia	Tetrastrum	Chilomonas	
Orthosira	Verrucodesmus	Cryptomonadaceae	
Charophyta	Schizochlamydeaceae	Cryptomonas	
Conjugatophyceae	Planktosphaeria	Pyrenomonadales	
Zygnematales	Selenastraceae	Geminigeraceae	
Closteriaceae	Ankistrodesmus	Plagioselmis	
Costerium	Kirchneriella	Pyrenomonadaceae	
Zygnemataceae	Monoraphidium	Rhodomonas	
Mougeotia	Ulotrichales	Procaryota	
Spirogyra	Ulvophyceae	Actinobacteria	
Zygnematophyceae	Elakatothrix	Actinomycetales	
Desmidiiales	Volvocales	Corynebacteriaceae	
Desmidiaceae	Chlamydomonadaceae	Corynebacterium	
Closterium	Sphaerella	Frankiaceae	
Cosmarium	Goniaceae	Frankia	
Hyalotheca	Gonium	Promicromonosporaceae	
Micrasterias	Volvocaceae	Proactinomyces	
Pleurotaenium	Eudorina	Proteobacteria	

Chronology of the 20th century

Further details about research on protozoa in Austria can be found in AESCHT (1994, 2003, 2013).

In **1913** likely influenced by foundation of the journal “Mikrokosmos” (see p. 426), a **Micrological Association** was established in Linz, which set itself the special goal to explore the diatoms of Upper Austria (SCHIEDER 1913). Unfortunately, only a single volume of its reports called “Mitteilungen des Mikrologischen Vereins Linz” was published (for more details see p. 343).

As regards the Francisco-Carolinum, KERSCHNER (1920) reported that from October to the end of December **1919** he held a course of lectures on general zoology and **microscopic techniques** with 50 participants: “A microscope could be made available to each participant. The success was quite satisfying. This course took place on three evenings each week, with a total of around 100 hours“ [translation mine]. Despite all optimism, KERSCHNER (**1924**) emphasised: “Of course, we must not forget that large orders of invertebrate animals are simply understudied in Upper Austria. I recall, in this respect, only the plankton of our Alps, which is so very important for fisheries, and generally to hydrobiology” [translation mine]. Likely due to these initiatives, it was a pleasure for me to find in the museum’s library the first protozoological journal “Archiv für Protistenkunde”, founded by F.R. SCHAUDINN in 1902, and the popular journal “Mikrokosmos” from the beginning as well as the classical works of BÜTSCHLI on Protozoa (1880–1889) and monographies on ciliates of KAHL (1930–1935).

In the 19th century **malaria** was endemic in the Danube valley east of Upper Austria, around Vienna, and in today’s Burgenland; likely caused by *Plasmodium vivax* and *P. malariae*, the less dangerous pathogens (WERNSDORFER 2002). The attention for this protozoan disease

and its carriers, the *Anopheles* mosquitoes, was accordingly great in Upper Austria (KERSCHNER & PRIESNER 1922). KERSCHNER was appointed zoologist of the “State Office for National Health” to the Upper Austrian Malaria Commission (KERSCHNER 1920). A note on malaria in Upper Austria was published by SEIDL in 1948. The collection contains 19 specimens of *Plasmodium* species collected by Bruno Maria KLEIN, Ewald SCHILD and Horst ASPÖCK’s Institute of Hygiene in Vienna. It should also be mentioned that in **1922** the famous Upper Austrian painter Klemens BROSCHE (1894–1926) donated so-called Miescher’s tubes from smoked pork; these are caused by parasitic protozoa (sarcosporidians) indicative for the hygienic situation at that time.

Institutionalisation of protozoology at the international level was marked by founding of the Society of Protozoologists **1947** in USA, which edited the “Journal of Protozoology” since 1954.

On 7 May **1954**, the “Microbiological Station of the City of Linz” was opened, in a new building at Roseggerstrasse 22 next to the Botanical Garden [today’s Natural Science Station]. On the initiative of Mayor Ernst KOREF, docent Ewald SCHILD (see p. 414) was conveyed to Linz, who had already set up a “Research Laboratory for Scientific and Applied Microscopy, Microphotography and Microkinematics” in his hometown Vienna in 1921, without state or municipal support. According to the mayor’s decision, from 1955 the laboratory was run as a cultural administration facility, serving as the basis for scientific research in the field of microbiology and adult education. In three laboratory rooms and one darkroom, there were now eleven microscopes of various types, as well as all auxiliary apparatuses for microscopy (microtome, dark field, polarized light, fluorescence device, and aids for microphotography and microcinematography, etc. SCHILD worked closely with the school management and organized many lectures



Fig. 18–22: Poster of the exhibition “The Protozoa – a hidden world” (18) and insights to the presentation (20– 22). – 19: Visitors at the opening 10 January 1994 in the room for lectures and workshops; – 20, 21: Due to the low budget, many handwork and analogue means prevailed; – 22: Pedro GALLIKER before the instalation “Small becoming great” with his models made from recycling material.

and courses, which were continued after his retirement by members of the renamed “Natural History Station” (cp. LAISTER et al. 2003).

Wilhelm FOISSNER was one of the microscopists of this institution and published under its address from 1970 till 1976, due to the initiative of Franz SPETA he hold lectures already in 1972 and prepared an exhibition of the silverline system in the Francisco-Carolinum associated by a small catalogue (FOISSNER 1974; some original plates are figured in AESCHT & BERGER 2008). Since the place was not needed for a further exhibition, his one could be visited five years long (SPETA 1994).

In 1975, Austria became the first nation in the world to introduce obligatory toxoplasmosis

monitoring during pregnancy mainly due to the physician Otto THALHAMMER (1922–1994) and the hygienists Heinz FLAMM (born in 1929) and Horst ASPÖCK (for references see AESCHT 1994). Horst ASPÖCK, born in Budweis in 1939 and a student of FLAMM, has been head of the Department of Medical Parasitology at the Hygiene Institute of the University of Vienna since 1966 and is a well-known virologist and entomologist. His protozoological investigations mainly concern the diagnosis of toxoplasmosis and since 1985 parasitic diseases in AIDS patients (all separates are collected under the signature ASP). The polyhistor Horst ASPÖCK has strong affiliations to the Upper Austrian Museum (see detailed lists of his publications GUSENLEITNER 2004 and KNAPP 2004 for a biography) and insurmountably contributed to our exhibitions, publications and provided support in many ways.

Between 1984 and 1992 Wilhelm FOISSNER published five papers in our journals including many new species (see p. 386) and contributions to exhibitions on lichens and the river Traun. Protozoa, especially the ciliates, have proved their value as saprobiological bioindicators. In Austria, since the 1950s, they have been used in a number of federal states to assess the quality of the water (for references see AESCHT 1994). Since 1992 Hubert BLATTERER (born on 1 July 1964), a student of FOISSNER, who made his doctoral thesis on “Ecological and taxonomic studies on ciliates (Protozoa: Ciliophora) from running waters and soils with special consideration of bioindicators of the system of saprobity”, is involved in the routine investigations of the river waters, specifically of ciliates until 2006 (see p. 346).

The Biology Centre of the Upper Austrian Museum in Linz-Dornach was officially opened on 26 June 1993. Dr. Gunter DIMT, the director of the institution at that time, and Univ.-Prof. Dr. Ernst Rudolf REICHL, founder of the ZOBODAT, provided introduction words. Franz SPETA spoke to the history of the house and

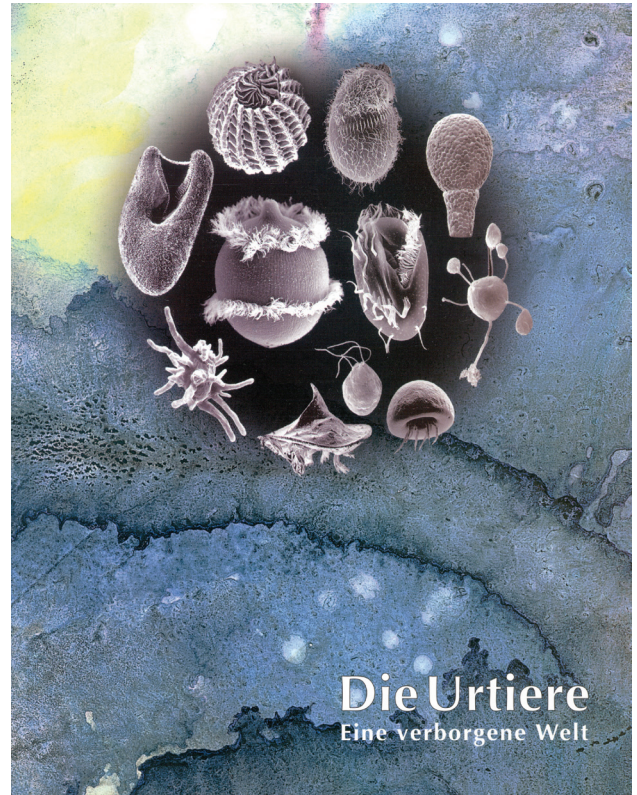


Fig. 23: Cover of the catalogue “The Protozoa – a hidden world”: the composition of the scanning electron micrographs, its original is recognisable to the right of the models in Fig. 22 was made by Wilhelm FOISSNER. The background was an aquarell of the artist and layouter Mag. Christoph LUCKENEDER.

the prominent, retired soil biologist Prof. DDr. Friedrich SCHALLER from Vienna reflected on biology and museum (SCHALLER 1993), which was so impressive that the politician Dr. Josef PÜHRINGER, the later prime minister of the province, promised to support the expansion, which is still urgently needed today. On this occasion an appointment concerning the Bruno Maria KLEIN collection was made (p. 409).

On 22/23 October 1993, Univ.-Prof. Dr. Franz PICHLER (born 1936), originally a telecommunications technician, then Ph.D. and professor for cryptography and system theory at the KEPLER University Linz from the University of Linz and I organized a symposium on the 50th anniversary of the death of Raoul Heinrich FRANCÉ in Salzburg. FRANCÉ (1874–1943) was born in Vienna, coined the term “Edaphon” for the biocoenosis in the soil in 1911 and laid the

foundations for today's bionics (see p. 423). Wilhelm FOISSNER told me that he was also influenced by his writings.

The exhibition "Die Urtiere – eine verborgene Welt" (Fig. 18) was shown from 11 January–5 May 1994 in the Biology Centre, which was the 4th [sic] one after the opening of the building in 1993. Three accompanying events, namely evening lectures with transparencies, of the exhibition were held by myself on biology of protozoans (February 7), by Horst ASPÖCK (see Fig. 20 1st row beside the woman) on protozoans as pathogens: actual problems in Middle Europe (March 7), and Wilhelm FOISSNER on systematic and ecology of ciliates (April 19). Apart from me, Pedro GALLIKER introduced his fantastic microworld in film and plastic models (Fig. 22) in the "Journal" of the museum.

Rigth in time an accompanying catalogue was published in the museum's series "Catalogues, new series") volume 71 embracing 278 pages (Fig. 23). Ten contributions (all in German language without English abstract), which have been initiated by me roughly a year before, provided a mainly popular introduction, albeit including also original research, to the protist domain, because it does not mirror the presentation shown to the visitors of the exhibition:

Franz SPETA wrote the forward;

AESCHT about history of studies on protozoans in Austria;

Hartmut ARNDT (at that time director of the Limnological Institute in Mondsee) on protozoa as an essential component of pelagic lakes ecosystems;

Horst ASPÖCK on protozoa as a pathogen of human diseases: overview and current problems in Central Europe;

Hubert BLATTERER about the ciliates of Upper Austrian running waters with special consideration of the southern Inn feeder;

Angela ENTZEROTH (see Fig. 20 the woman in the 1st row) introduced the history of German-speaking protozoan research;

FOISSNER established *Spetazon australiense* nov. gen., nov. spec., a new ciliate (Protozoa, Ciliophora) of Australia; introduced protozoa of soil and with support of PETZ W., UNTERWEGER A., HERZOG E., SIMONSBERGER P., KRAUTGARTNER W.-D. & ZANKL, the miracle of the microcosm; Wolfgang PETZ considered life below zero, viz. Antarctic sea ice as habitat for ciliates, which was backed up by a 223 – pages monograph in Stapfia in 1995.

Within four months over 50 guided tours for school classes were given by myself due to the absence of museum pedagogic guides at that time.

In 1994, Peter PAVLICEK from Vienna handed over fossils (sand with foraminifers, marl with amphistegins and nannofossils) from the famous palaeontological sites Nussdorf near Vienna and Baden-Soos, later prepared and determined in a project by the paleontologist Katharina SCHÜTZ (taxa are included in Tab. 3, see p. 314).

In the frame of a symposium on the "Importance, state and current development of the classification of soil animals" in the State Museum of Natural History Görlitz I gave a lecture on "Critical remarks on the species neutral minimal ecology exemplified with soil protozoa" on 18 September 1995, which was published later (AESCHT 1997). Here I stated that the classical period of biology investigating the diversity of organisms, should apparently be superseded by the more important investigation of functional parameters of ecosystems, such as energy transfer and nutrient flow. However, generalisations, like "the role of protozoa is negligible" or "protozoa are bacterivores" and simplifications, e. g. "amoebae are the most important protozoan group in the soil" hamper our understanding of the processes in soil. The "species neutral" ecology at high taxa level results in a distorted view of reality, if our knowledge on the biology of the diverse species is not adequately integrated. Therefore, the selection of important ecosystem components

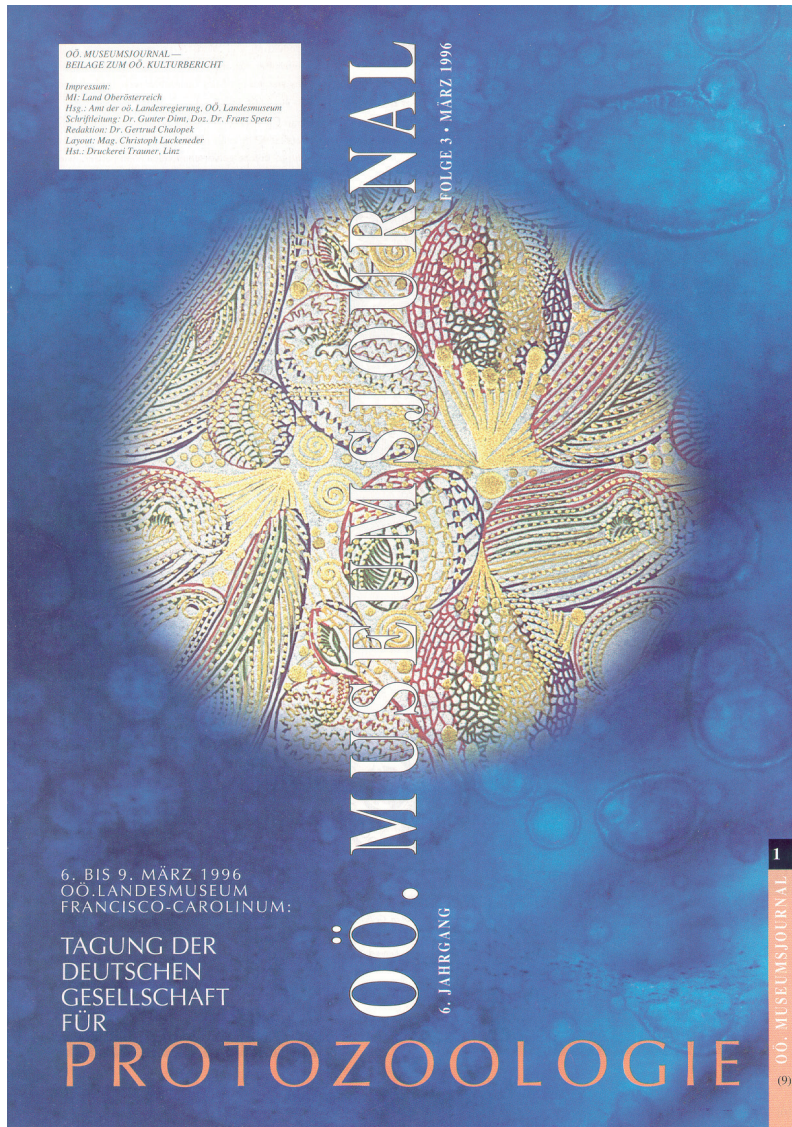


Fig. 24: Cover of the publication almost entirely dedicated to the meeting of the German Society for Protozoology in Linz 1996.



Fig. 25: *Avestina ludwigi*, a colpodid, which has been discovered in the Bohemian forest of Upper Austria (AESCHT & FOISSNER 1990), has been accomplished by Christian THANHÄUSER, a publisher, artist and close friend in Ottensheim near Linz, as a woodcut enriching the scientific programm.

and appropriate bioindicators needs a qualitative (taxonomic) as well as a functional approach and a more intense cooperation of taxonomists and ecologists, which are both indispensable in modern biological studies.

In the German-speaking countries alone, around 200 people spend their free time and/or as an employee on the fascinating unicellular eukaryotes. Therefore the association “German Society for Protozoology” (DGP “Deutsche Gesellschaft für Protozoologie”) including Austrian, Swiss, and Dutch scientists was founded in 1981. Once a year, they meet and exchange the latest findings, this occurred in

Rauischholzhausen (1982), Erlangen (1983), Bonn (1984), Heidelberg (1985), Münster (1986), Blaubeuren (1987), Salzburg (1988), Iserlohn (1989), Helgoland (1990), Giessen (1991), Osnabrück (1992), Berlin (1993), Norderney (1994) and Delitzsch (1995). The 15th meeting was held in Linz, from 6–9 March 1996 in the Museum Francisco-Carolinum; guided tours in the Biology Center were offered as a framework event; the evening festivity took place in the Castle Museum.

The complete program with an introduction termed “Neues aus dem Reich der Einzeller” (News from the kingdom of unicellulars) was



Fig. 26, 27: Lecture of Jean DRAGESCO in the banqueting hall (26) and coffee break in the colonade of the Museum Francisco-Carolinum (27), where the posters were presented.



Stand und Perspektiven”).

- Modes of life, behaviour, physiology: Univ.-Doz. Dr. Maria MULISCH of the University of Cologne showed in her lecture on the life cycle of folliculinids (“Der Lebenszyklus der Follikulinen”) how complicated the reproduction, fine structure, and physiology of the apparently primitive unicellulars is, and how many questions of general biological importance arise in the course of the examinations, using the example of *Eufolliculina uhligi*, a case-building ciliate (Fig. 54, see p. 338).

- Life forms and biocoenoses (two parts): Dr. Ing. Manfred WANNER from the Technical University of Aachen, in his lecture on testate amoebae and indication: ecological, morphological and molecularbiological aspects (“Thekamöben und Bioindikation: ökologische, morphologische und molekularbiologische Aspekte”) highlighted new methods and difficulties in quantifying environmental changes.

reproduced on five pages in an issue of the “journal” of the Upper Austrian Museum (AESCHT 1996; Fig. 24). As a further novelty an art work enriched the scientific programm (Fig. 25).

Major areas of protozoan research were covered in five plenary lectures introducing the sections:

- Parasitology: Univ.-Prof. Dr. Horst ASPÖCK from the hygiene institute in Vienna spoke about unicellulars as disease-causing agents (“Einzeller als Krankheitserreger”).
- Biotechnology, cell biology, genetics: Dr. Thomas KIV from the research department of Hoechst AG in Frankfurt spoke about protozoa in biotechnology – state of knowledge and perspectives (“Biotechnologie der Protozoen – Aktueller

ökologische, morphologische und molekularbiologische Aspekte”) highlighted new methods and difficulties in quantifying environmental changes.

- Prof. Jean DRAGESCO (Fig. 26) from St. Clément de Riviere in France gave the lecture “50 years of study in Protozoa – personal experiences” and talked about the variability of species. He also showed two historical films produced in 1963 and 1966, each lasting about 10 min, about *Neobursaridium gigas* (Ciliata, Peniculinida) and “Food behaviour of the heliozoan *Actinosphaerium eichhorni*”.

The further 42 short lectures and 41 poster contributions (Fig. 27) showed how inexhaustible the unicellular organisms and wide-ranging the questions they arise are. For the first time during the

meetings of the DGP, the presenters of posters could verbally introduce their work and themselves for three minutes. 125 participants from 44 cities attended the meeting.

Ingrid LAUS (Linz), Karina PFEFFER (Enns) and Sandra PLÖCHL (St. Valentin) did some computer-aided recording of data on the labels of microscopic slides during their holiday jobs 1996–1997. FOISSNER contributed to the catalogue and exhibition “Urzeitkrebse” (Crustacea: Branchiopoda excl. Cladocera) on symphoriont ciliates.

Roland OBERSCHMIDLEITNER, now employed as military general, undertook his diploma thesis in Salzburg and Linz, intensely using the laboratory of black and white photography. He investigated by means of life observation, protargol impregnation and morphometrical analysis the ciliated protozoa occurring in two sewage treatment plants (Asten near Linz and Offenhausen near Wels, Upper Austria). Fifty taxa have been found, six of them were new for the activated sludge. From the sewage treatment plant Asten near Linz seven samples were taken in which 37 taxa could be proved, 12 of them were found in freshly sampled activated sludge. One sample of activated sludge and one of periphyton of the settling tank wall was taken from the sewage treatment plant Offenhausen near Wels. Nineteen ciliate species, including typical indicators of a high sludge loading and oxygen deficiency could be proved. One new species (*Gastronauta aloisi* OBERSCHMIDLEITNER & AESCHT, 1996) was described from the activated sludge plant Asten near Linz (Fig. 28). The following species were redescribed: *Pseudourostyla cristata* (JERKA-DZIADOSZ 1964) BORROR 1972 and *Diaxonella trimarginata* JANKOWSKI 1979.

The photographer and artist Anita GRATZER took a look at the micro-preparations and made large-format gelatin-silver prints from photographs mainly of diatoms, which were presented to a

larger public during their exhibition at the Stifterhaus in Linz from 5 to 30 August 1997. For her catalogue “Human time anatomy”, I wrote an essay on persiting forms (i.e. ex- and encystation).

In 1998, I was heavily involved in the preparation of an exhibition in the Castle Museum (13 October 1998–6 April 1999) and a catalogue on Ernst HAECKEL work, effect and consequences (Fig. 29, 30).

John O. CORLISS (Pennsylvania), President of the International Society of Protistologists 1964–1965, and Martin SCHLEGEL (University of Leipzig) could be won for contributions on “HAECKEL’s kingdom Protista and current concepts in systematic protistology” and on classification and phylogeny of protists, respectively, and the director of the Natural History Museum in Vienna at that time, Bernd LÖTSCH about the art forms of nature. I wrote about “Ernst HAECKEL – an appeal for the invertebrates and the biological systematics” noting that at the end of the 20th century it is – like in the middle of the 19th century [and today] – a frequent practice to regard biological systematics as outdated. Ernst HAECKEL (1834–1919) likewise had other priorities, namely



Fig. 28: This hitherto unknown ciliate *Gastronauta aloisi*, dedicated to OBERSCHMIDLEITNER’s father, was chosen for the cover of the published results in Linz.

the search for phylogenetic (genealogical) relationships, however he has created about 2000 genus names and has described more than 3500 species of mainly radiolarians, calcareans, scyphozoans, cubozoans, and siphonophorans. After DARWIN'S "Origin of species" of 1859 he has therefore been one of the first scientists applying the gradual transformation of species and the newly discovered criterion for biological classification, the common ancestry, to various taxa of animals on key positions of the evolution. The paper gave some background information on HAECKEL'S (and others) attempts to dissolve systematics into phylogenetics and shortly described the state of knowledge concerning his preferred groups of single-celled radiolarians, sponges and cnidarians about 100 years later. It was concluded that the inventory and reconstruction of phylogeny of organisms are far from a preliminary end. Biological systematics thus represents an important

research field otherwise evolution and protection of biological diversity remains an unresolved enigma of natural science.

Jean DRAGESCO (see p. 417) submitted a revision of geleid ciliates in 1999 and deposited his slides since then. Initiated by SPETA, Wilhelm FOISSNER was honoured by the Cultural Award of the Federal State of Upper Austria on 19 October 1999 (see p. 378).

Chronology of the 21th century

As a student assisting in Wilhelm FOISSNER'S library, I already felt the urgent need of a comprehensive "dictionary" of ciliate generic names, however for ten year my main scientific interests have been morphological, morphogenetic, and fine structural investigations of ciliates. This desire could be fulfilled in Linz, so after years of collecting my "Catalogue of the generic names of ciliates (Protozoa,

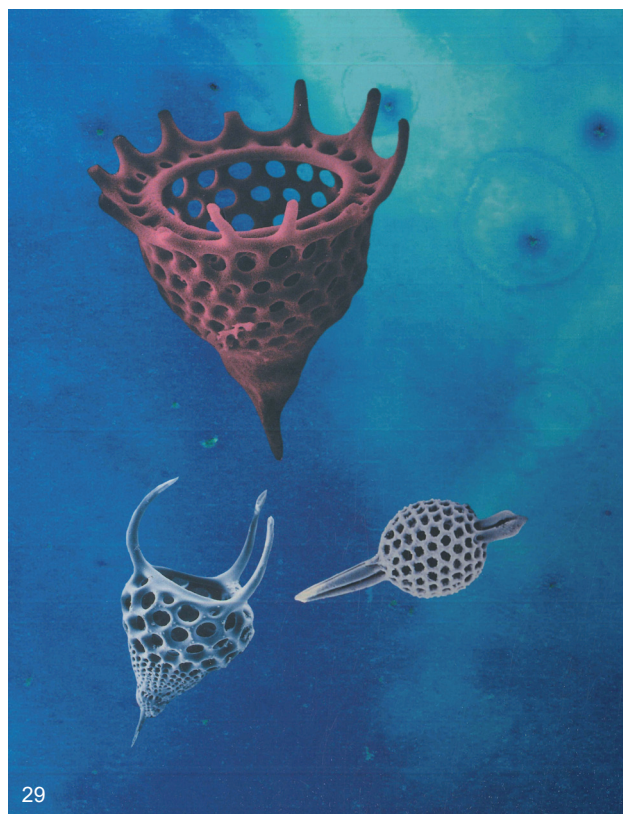


Fig. 29, 30: Backside with radiolarians (29) and header sheet (30) of the catalogue on Ernst HAECKEL filled with radiolarian generic names introduced by him.

Ciliophora)” embracing 350 pages was delivered on 23 February 2001 as first volume of the newly launched journal “Denisia” (Fig. 31). It provides (1) an alphabetical list of more than 2,700 generic names of recent and fossil ciliates appearing in the literature since 1758; (2) the correct citation of the authorships; (3) the reference to the first valid publication of each name; (4) a citation of the type species of each genus, including basionym, eventual incorrect secondary spellings, and kind of typification; (5) data about homonymy and synonymy; (6) information concerning recent genus revisions, key to species, and redescription of type species; and (7) 1,531 references containing the data just listed and, especially, the original descriptions of the generic names.

In the same year two book reviews, one by FOISSNER and the other, quite long by Prof. John O. CORLISS, were published. FOISSNER noticed that “Generally, such nomenclatural work is not

widely acknowledged in modern times, although it is an invaluable working basis for both novices and experienced taxonomists and ecologists, who often have the problem of choosing between different spellings of generic names and/or their authors. Biodiversity researchers will also profit from this catalogue for various reasons, not the least of which is to have now a reliable indication of the numbers of valid/invalid generic names of ciliates... Only those who ever attempted a similar compilation can judge the enormous amount of work needed, and how difficult it is to avoid mistakes, misprints, and inconcistencies. Indeed, it is a never-ending work! ... be congratulated for preparing and publishing such a ‘labour of love’ at a reasonable price... a fundamental work which will not lose its value with time.” CORLISS noted that “we find some 15 pages given to a succinct history of naming ciliates and to the rationale for the catalogue and the format used-important information! Everything is meticulously explained so that no misunderstandings need arise in using material on later pages. The fact that original (as well as relevant subsequent) sources of taxonomic-nomenclatural literature have been exhaustively examined-combined with AESCHT’s comprehension of the rules comprising the most recent edition of the International Code of Zoological Nomenclature can reassure the reader that her conclusions may be taken as authoritative.” Moreover, that it will be “...indispensable to ciliate taxonomists and other biologists beset with concern over proper names to assign to the ciliates involved in their own research, be it ecological or experimental in nature. The painstaking monograph will ever stand as a tribute to the great love and devotion that Erna obviously has for these ‘wee beasties,’ protistan infusorians long known simply as ‘the ciliates.’” He further correctly warned “...that the reader of this review-and purchaser of the volume-will not be misled, two points should immediately be made clear as to what this unique catalogue is NOT [original style]. It is NOT a taxonomic monograph (although obviously taxonomy is

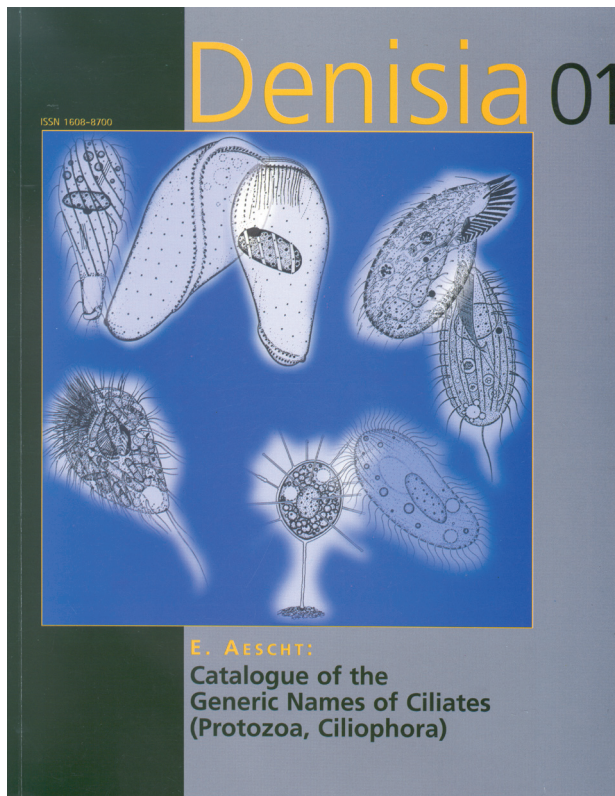


Fig. 31: Title page of my main nomenclatural work in 2001 showing line drawings of species discovered during my investigations on the University of Salzburg.

affected by nomenclatural decisions) and it is NOT directly concerned with the systematic categories or ranks at levels above and below the generic level (although, again, type-species have to be involved; and some genera themselves also serve as types of the families containing them). Ciliate orders, classes, subphyla, etc., are thus, quite understandably and quite rightly, not even mentioned. And species are not switched around, whether or not such taxonomic action might be desirable in the future, amongst the genera whose names (only!) form the principal subject of this detailed nomenclatural work. Yet Erna AESCHT's monumental critical compilation, so conscientiously assembled over a period of years, is an indispensable handmaiden to both such activities (suprageneric classifications and taxonomic revisions)." Finally, during the 11th International Congress of the International Society of Protozoology in Salzburg (15–19 July 2001), the American honorary member of this society, John O. CORLISS, gave me as a mark of honor the "Ciliate Cravat Award for outstanding work in ciliate research".

Matthias WOLF & Klaus HAUSMANN wrote a paper of 27-pages for LBB on "Protozoology from the perspective of science theory: History and concept of a biological discipline in 2001. They took almost 40 protozoologists into consideration and correlated them with distinct phases in the evolution of the discipline. Names, lifespans and events were combined into one picture to identify individuals representative of each step in the genesis of protozoology. On the basis of who could have known whom and who could have known what, their different concepts have been interpreted. The evolving terminology, in particular, has generated a species-concept for taxonomy, systematics and classification which is new for almost all protozoologists and therefore of special interest for modern protozoology. Additionally, by the analysis of protozoological congresses a general – qualitative and quantitative – profile of the

history and concept of traditional and modern protozoology has been developed, presented and discussed.

A **generous donation by Wilhelm FOISSNER** (Fig. 32) as a private sponsor, enabled a considerable extension into the former unused loft of the Biology Centre for the natural sciences collections during 2001. This new expanded loft termed "FOISSNER-KLEIN- Collection" (Fig. 33), because the donor was the single scholar of Bruno Maria KLEIN, was officially opened on 18 June **2002**. Hopefully, future responsible authorities are constantly reminded that this sponsorship is intended to secure a permanent home for FOISSNER's yet famous scientific collection. FOISSNER gave a lecture with transparencies on his Namibian trip (SW Africa; see above).

A further highlight of this year was the huge, viz. 1459-pages volume (in fact two issues) of FOISSNER, Sabine AGATHA & Helmut BERGER on "Soil ciliates (Protozoa, Ciliophora) from Namibia (Southwest Africa), with emphasis on two contrasting environments, the Etosha region and the Namib desert". In this a total of 365 species were identified, of which 128 (35 %) were undescribed, including a new order and suborder, three new families, and 34 new genera and subgenera. These new and many insufficiently known taxa, altogether more than 200 species and subspecies and over 300 populations, were described and 800 type slides have been deposited in Linz.

As editor and contributor Horst ASPÖCK cared for a huge catalogue accompanying the exhibition "Amoebae, tapeworms, ticks ... Parasites and parasitic diseases of humans in Central Europe" in the Biology Centre (25 October 2002 till 30 March 2002). 19 contributions treated protists. Univ.-Prof. Heinz MEHLHORN (University of Bochum) provided micrographs of parasites for the exhibition.

On 1 December **2003**, the Cultural Medal of the Province of Upper Austria was awarded to Dr.

Wilhelm FOISSNER by Angela ORTNER (Fig. 34), 1st Federal State Parliament President, at that time.

For the two-volumed Festschrift on occasion of the decennial anniversary of the Biology Centre I could won Univ.-Prof. Dr. Horst Kurt SCHMINKE (University Oldenburg) to reflect on “The role of natural history museums in times of the biodiversity crisis”. He emphasised a “shift from organismic biology to molecular and cell biology at universities all over the world. Parallel to the discovery in the meantime of the real extent of biodiversity it was realized that most of it was under threat of extinction due to human expansion on the earth, this process having later aptly been called the biodiversity crisis. This crisis entails

new tasks for natural history museums. They will have to educate students in biodiversity science and foster research collections at universities because these are no longer willing to comply with such tasks. Museums will have to initiate comprehensive floral and faunal surveys and monitoring programmes. They will have to apply new tools of information technology to model floral and faunal changes in order to allow a glimpse into the future with changing climatic conditions. Compared with the narrowly specialized work of many other biological disciplines work at museums is very diverse requiring several different skills. These skills are indispensable for the metamorphosis of natural history museums into biodiversity agencies to which conservationists, policy makers and the public will increasingly turn for advice.” These words have not lost their force in recent days.

Univ.-Prof. Dr. Horst ASPÖCK celebrated his 65th birthday in 2004 and the commemorative publication not only covers entomology, but also protistology, mainly parasitological topics (see references p. 477 JANITSCHKE, JOACHIM & DAUGSCHIES, WALOCHNIK). However, FOISSNER dedicated his new free-living species *Cyrtohymena aspoECKi*, to the jubilee as “an outstanding personality and scientist who published significant contributions ranging from parasitic protists to harmless insects



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Fig. 32, 33: Meeting on occasion of the opening of the “FOISSNER-KLEIN-Collection” on 18 June 2002 (32). The honour board (33) was made by our entomological preparator Roland ZARRE for entrance to its main residence.



Fig. 34: Bestowal of the Cultural Medal to Wilhelm FOISSNER in the Biology Centre with Doris EISENRIEGLER and Angela ORTNER, the 3rd and 1st President of the Upper Austrian parliament, as well as Erna AESCHT (left to right) in 2003.

(Neuroptera)”. I reflected on “delight and burden of naming – about names from the microscopic world”, motivated by ASPÖCK’s exemplary attentiveness to history and language. A short history of designating mainly genera and species of ciliates, which are relatively “large” and rich of characters, was given. True vernacular (genuine) names are till now understandably absent; German names have been established from 1755 to 1838 and in the last three decades of the 20th century in scientific and popular literature. A first analysis from a linguistic point of view of about 1400 scientific names of type species shows that frequently metaphoric names have been applied referring to objects of everyday use and somatic characters of well known animals including human beings. A nomenclaturally up-dated list of 271 species including German names was provided, of which numerous synonyms and homonyms had to be clarified; 160 of these species were of saprobiological relevance and 119 referred to type species of genera. Malpractices of amateurs and scientists have been due to a confusion of nomenclature, a formalized exact tool of designation, and taxonomy, the theory and practice of classifying organisms. It was argued that names in national languages may help to popularise the diversity and importance of microscopic organisms; their description and labeling are a particular challenge to creative, recently underestimated linguistic competence (AESCHT 2004a).

On 20 May 2005, 20 boxes of microscopic slides from Jörg DIECKMANN, arrived in Linz kept in the meantime by Dieter GÖRTZ (University Stuttgart; see p. 422). The spider specialist Konrad THALER motivated a study on “Cryoconital ciliates (Ciliophora, Protozoa) from two glaciers in the Ötztal Alps (Tyrol, Austria)” by me: two taxa of ciliated protozoans have been recorded in cryoconital samples of the glaciers Rotmoosferner and Gaisbergferner, viz. *Gastronauta derouxi* BLATTERER & FOISSNER, 1992 (Family Gastronautidae) and

Odontochlamys alpestris alpestris FOISSNER, 1981 (Family Chilodonellidae), both belonging to the order Chilodonellida and occurring in low individual numbers. However, the first species mentioned was more abundant than the second. Both taxa have already been recorded from moss, soil and freshwater samples and are well adapted to harsh environments by easily forming cysts (AESCHT 2005). At the Congress of the International Society for Protozoology in Guangzhou [Kanton], China, I gave a lecture on “Type material of 708 of ciliate species deposited in Linz, Austria (Europe), with proposals for standardising protozoan typification”.

In 2005 (and 2012) the Upper Austrian Museum received the legacy of the research couple Annie FRANCÉ-HARRAR and Raoul Heinrich FRANCÉ from Prof. René Romain ROTH, a biologist born in Roumania on 24 February 1928 and immigrated



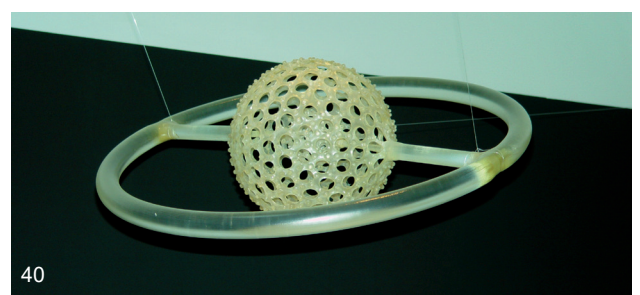
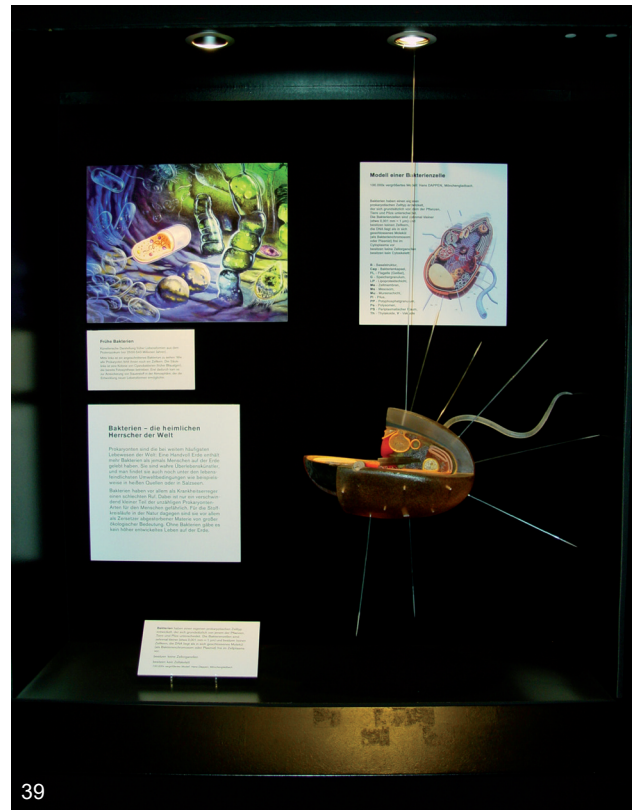
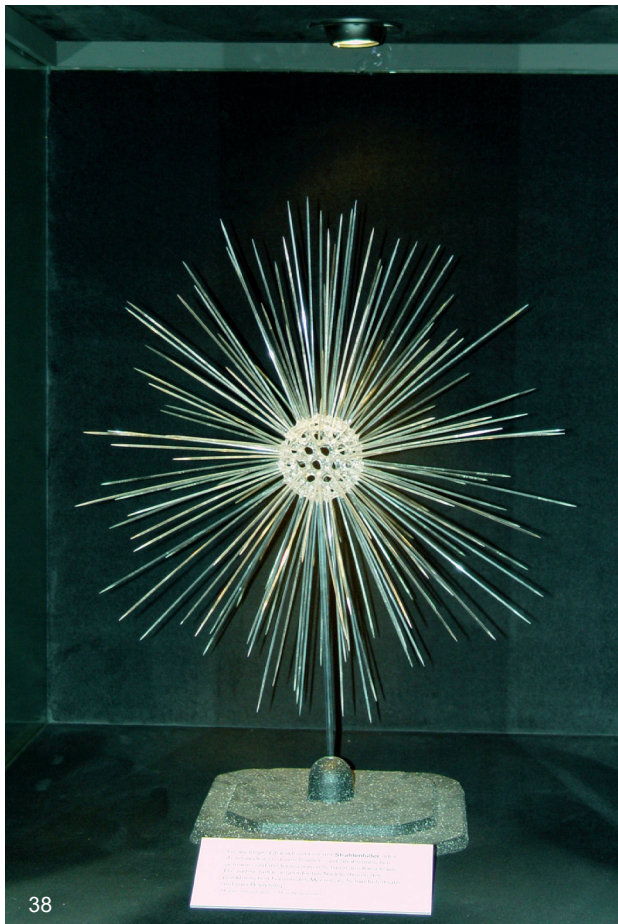
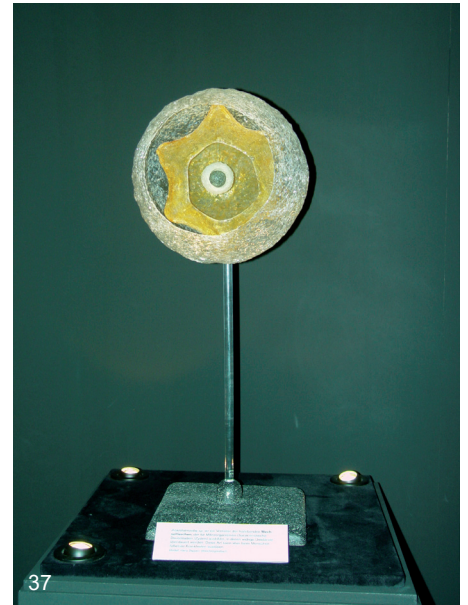


Fig. 35–40: Models of protists in the evolution exhibition in the Castle Museum: the unicellulars, namely foraminifera of Professor Shouyi ZHENG (35 left side), ciliates (36), an *Acanthamoeba* cyst (37) a heliozoan (38), a procaryotic cell (39) and the radiolar *Saturnalis circularis* (40) of Hans DAPPEN, have been shown as examples of the origins of life.

to Canada in 1962, where he was doing research and teaching in biology, physiology and history of science at the University of Western Ontario (London) from 1966 till 1992, where he died on 8 July 2010. He became acquainted with the half-brother of Annie FRANCÉ-HARRAR, an early soil biologist and a successful writer (see p. 430) and in promising to write a biography, he received the estate. This transfer was greatly supported by Univ.-Prof. Dr. Franz PICHLER from the University of Linz (see p. 428).

Among 86 authors Maria HOLZMANN from the Department of Paleontology, University of Vienna, contributed to the “Handbook of Deep-Sea Hydrothermal Vent Fauna” edited by Monika BRIGHT, also University of Vienna, with colleagues from France for Denisia. HOLZMANN added the single two protist species, the foraminifers *Luffammina atlantica* and *Abyssotherma pacifica*, beside more than 500 currently described species belonging to 12 animal phyla discovered in hydrothermal vents. The exhibition was shown in the Biology Centre 7 April–1 October 2006.

A popular 20-minute film with the title (“Ich steh auf Boden”), verbally “I stand on soil” meaning simultaneously to appreciate, including protistological views was produced together with colleagues from other institutions, namely Renate LEITINGER, Hermann OBERNDORFER and Hubert BLATTERER in Linz this year.

During material search for the exhibition on evolution in 2007, I drew attention to a rarity: Professor Shouyi ZHENG (born 20 May 1931 made hundreds different models of foraminifers or “art forms of nature” (cp. HAUSMANN & MACHEMER in this volume p. 22). The exact reproductions of 100 of them (after an adventurous transfer history from Qingdao, China to Linz) were first shown in a European museum. Several of them were also presented in a special arrangement in 2015 as part of mythos beauty exhibition (see p. 336).

At the suggestion of Mag. Peter ASSMANN, the then director of the Upper Austrian Museum, an exhibition “Biofakte – Artefakte” [biofact – artefact] of the artist group “c/o:K – Institute for Art Initiatives” was shown at the Ars Galerie Peuerbach (24 March–30 April 2007). Original watercolors from the Bruno Maria KLEIN collection were included and the small-format accompanying booklet contains in a compact form points of his view and previously unpublished pictures of him (cp. AESCHT 2007a).

It is not without reason that the Biology Centre was included in the circle of the 34 most important natural museums in Europe by the Consortium of European Taxonomic Facilities (CETAF) in 2007. This also formally sealed the international significance of its collections and our in-house publications. In recognition of my “great” contributions to ciliate taxonomy, my colleagues from China named two species for me: *Amphileptus aeschtae* Xiaofeng LIN, Weibo SONG & Jiqu LI, 2007 and *Schizocalyptra aeschtae* Hongan LONG, Weibo SONG, Alan WARREN, Khaled AS AL-RASHEID, Jun Gong and Xiangrui CHEN, 2007.

2008 was marked by the “Wilhelm FOISSNER Festschrift – 60 years: a biographical sketch and bibliography” (Fig. 41), which was editorially supported by Dr. Helmut BERGER (Salzburg). Top secret until delivery of the book, where 45 contributors from China (3), Germany (12), Great Britain (6), Canada (2), Korea (1), Austria (14), Russia (1), Saudi Arabia (1) and the USA. (4 articles). 8 articles refer to FOISSNER’s life and work, including a taxonomic registry with over 6000 entries, to taxonomy and nomenclature (9 articles), to ecology (9 articles), as well as to phylogeny (5 articles). In total we prepared 29 highly interesting contributions to the Festschrift. More than 200 colleagues from 27 countries signed the Tabula Gratulatoria; alone in this volume two species were named in honor of FOISSNER: *Uroleptus willii* by SONNTAG and *Bullinularia foissneri* by MEISTERFELD. The

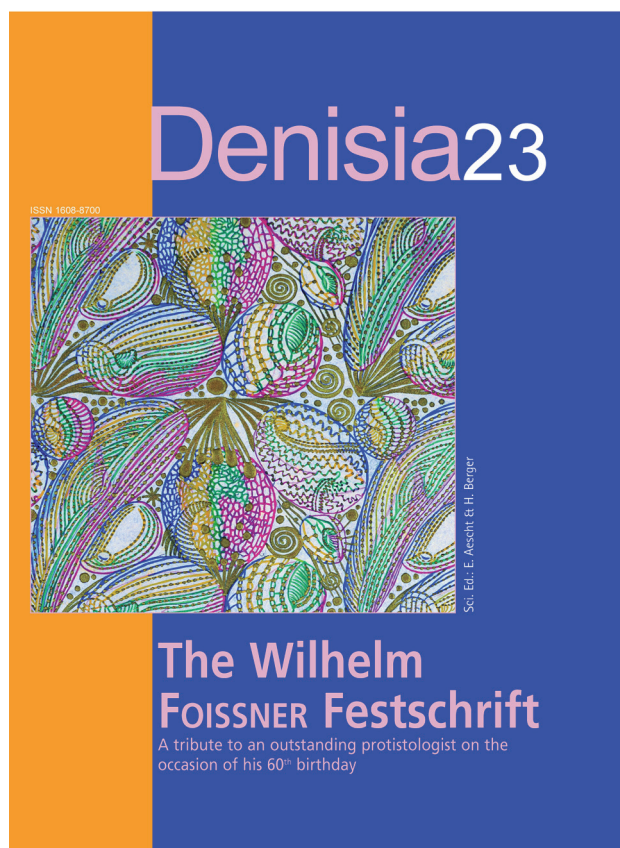


Fig. 41: Cover of the Festschrift 2008 with an original aquarell of Bruno Maria KLEIN, on the inside pages taxa introduced by Wilhelm FOISSNER are listed in an alphabetic sequence.

surprise succeeded and “Willi” was pleased, also because he can now easily find his own descriptions in one work. Excellent book reviews were published by HAUSMANN (2008), who was impressed by FOISSNER’s workload (over 14,000 print pages) and found in the commemorative “All the finest”, and MAUCH (2008), who emphasized the rarely achieved unity of teaching and research and criticized that despite of the exceptional ecological importance of ciliates, the European Water Framework Directive waived its consideration.

In the context of transmissions on life in nature (“Leben in der Natur” by the editor Renate PLIEM) in the nation-wide radio station, called “Ö1”, I reported about the “the hidden world of the ciliates” (five minutes each time on five succesional days) in February 2009. The program received a great response. Via Klaus EISLER from

the University of Tübingen (without financial requirements) in 2009 the scientific literature was taken over of the important German zoologist Prof. Karl Gottlieb GRELL (see p. 433).

The newly constructed south wing of Castle Museum was officially opened on 3 July 2009 on occasion of Linz being one of the European Culture Capitals. A part of it is dedicated to a permanent exhibition on the nature of Upper Austria, protists have also been included (Fig. 42–44). This is accompanied by a popular introduction to the landscapes, plants, animals (as mostly including protists; BENEDETTI-HERRAMHOF 2009).

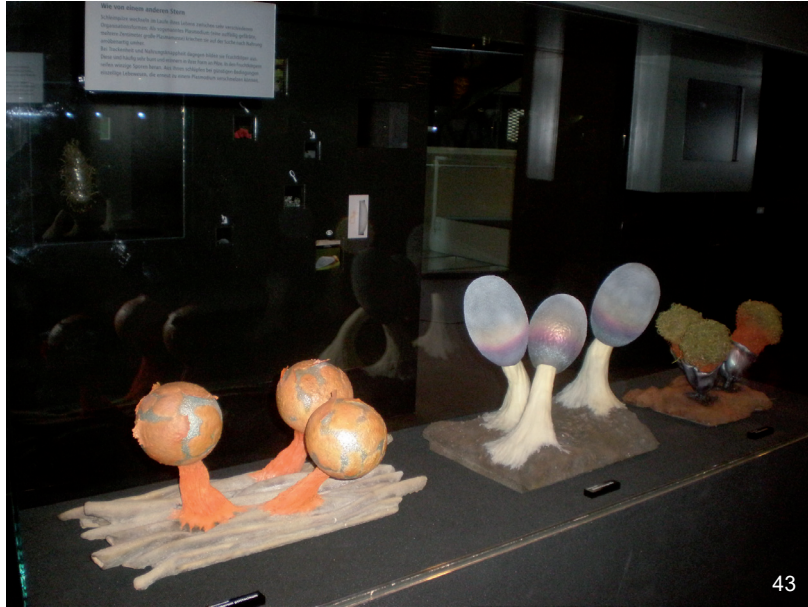
In 2010 extensive bibliographic and bibliographical work on the updating of the ciliate classification on genus and species level for the global taxonomic project “Species 2000” (Catalog of Life) was carried out. More than 3000 valid taxa were put online in 2012 as “CilCat: The World Ciliate Catalog” with reference to our digital archive “ZOBODAT” (<http://www.catalogueoflife.org/annual-checklist/2012/info/special>). The importance of the Linz collection was also appreciated by inclusion in the international Research Coordination Network for Biodiversity of Ciliates (RCN-BC), initiated by Dr. John CLAMP (North Carolina Central University, Durham USA) in 2010.

Dr. Maria MULISCH (see p. 466), a trained ciliatologist and then responsible for the central microscopy institute at the University Kiel, became one of the main editors for actualisation of the classical book of ROMEIS (18th and in 2015 19th edition). She has also a heart for the classical methods, so she invited me write on “Preparation techniques and staining of protozoa and invertebrates for light microscopy”.

Starting in 2011, the immense archive of Prof. Dr. Klaus HAUSMANN (see p. 438), who enjoys a worldwide reputation through his pioneering electron microscopic work, textbooks and films, was transferred from Berlin to Linz...



42



43

Mikroorganismen sind kleiner als 1 Millimeter, ihre "Größe" wird daher in Tausendstel eines Millimeters (0,001 mm = 1 Mikrometer, µm) gemessen und ihre Untersuchung erfordert technische Geräte. Die Einzeller (auch Protisten genannt) sind, ähnlich wie Bakterien, fast überall: im Wasser, im Boden und in der Luft. Man bescheinigt zwar Einzeller und Bakterien jeweils nur aus einer Zelle, doch unterscheiden sie sich in ihrem Aufbau, v.a. dem Zellkern, und ihren Lebensbedingungen, speziell der Ernährung, derart stark, dass sie sogar verschiedenen Reichen von Organismen zugerechnet werden. Protisten sind meist 10-50 größer als Bakterien.

Aspicks Wimpertier (0,35 x 0,14 mm groß) wurde im Aunwaldboden der Einmündung entdeckt. Eine Zeichnung vereint alle wichtigen Merkmale, meist weit besser als ein Foto.

Cyrtolimax aspicus

Zellteilung eines Wimpertiers, lichtmikroskopische Aufnahme nach Silberfärbung.

Rekonstruktion des "Mundaugrobes" von Grossglockneria acuta nach transmissionselektronenmikroskopischen Schnitt. Originalgröße der Mundstruktur 0,0015 x 0,0015 mm.

Gefärbter Blutastrich eines Malaria-kranken, Parasitäre Einzeller erregen das Wechselfieber (Malaria). 1919 gab es auch eine oberösterreichische Malaria-Kommission.

Obwohl die Schalen der Kammerlinge (Foraminifera) über 10 cm Durchmesser erreichen können (hier 1-4 cm), handelt es sich doch um Einzeller aus der Gruppe der Wurzelfüßer.

Amphiblagnum maculatum (Grossk., Flwz.)

Parasitenform (Körpergröße 10 µm) (Körpergröße 10 µm)

Arten (Körpergröße 10 µm) (Körpergröße 10 µm)

Kleinere Arten der Nannuliten, im Tertiärand Murexone oder "Versteinerte Linsen" genannt.

Färbverfahren ermöglichte Dauerpräparate von Mikroorganismen. Bei einem Typuspräparat sind die wichtigsten Individuen mit je einem Tuschkreis gekennzeichnet. Die Arten sind auf einem Durbbart farblich unterschieden.

Kieselalgen gehören zu den pflanzlichen Einzellern. Dieses Präparat enthält 4 Arten aus dem Albussee.

44

Fig. 42–44: Since 2009 the *Grossglockneria acuta model* (42) of Pedro GALLIKER is shown in the soil section of the permanent exhibition "Nature Upper Austria" in the Castle Museum. This also applies to some models of myxomycetes (43), which have been ordered under the slogan "a window to science" for a presentation in the Biology Centre in 2000; one installation in the study collection introduces protists (44).

A poster with the title “Updating the ‘Catalogue of the generic names of ciliates (Protozoa, Ciliophora)’ focused on ‘type’ species and ‘type’ specimens” was presented at the VIth European Congress of Protistology, 24–28 July 2011 Berlin, Germany (AESCHT 2011). It showed that following *Vorticella* in 1767, 3179 generic names have been proposed based on 2129 type species. A slight majority of the 230 genera made available between 2001 and 2011 were based on new species discoveries (viz. 120), while 110 resulted from new combinations of species. Only about 14 % of type species proposed were substantiated by holo-, syn- or neotypes. Consequently, a shift from concepts (diagnoses, though increasingly improved) to the (re-) investigation and deposition of specimens, which are the objective and permanent link between the world of organisms and the world of language, is urgently needed. Taxonomy based on concrete organisms, i.e. material evidence, helps to bind conservation (pivotal role of acknowledged depositories) and science together. Two monographs embracing “all” ciliate taxa were published in Russian by JANKOWSKI in 2007 and in English by LYNN in 2008, however, only 1298 genera (apart from 36 established later) are listed in both, while about 795 genera were inconsistently mentioned.

The artists Walter GSCHWANDTNER and Elke SACKEL from the cultural initiative “Narrenschyff” (an untranslatable term) in Linz came to me in 2011 with their project “GEN 7 Reset / back to the start” to learn more about evolution and a possible life without humans, because GEN 7

refers to the Bible chapter (Genesis 7), which tells us the story of Noah’s Ark. With the involvement of Christian BARDELE (Tübingen) and finally Wilhelm FOISSNER, both artists developed their ideas, which in turn moved to microscopic circles (sh. FOISSNER 2012); see also the large-scale altarpiece of the ciliate *Metopus* installed in a church in Linz in the present volume (page 31).

For the special scientific exhibition “Weiße Mäuse und Mendel’s Erbsen. Tiere und Pflanzen,

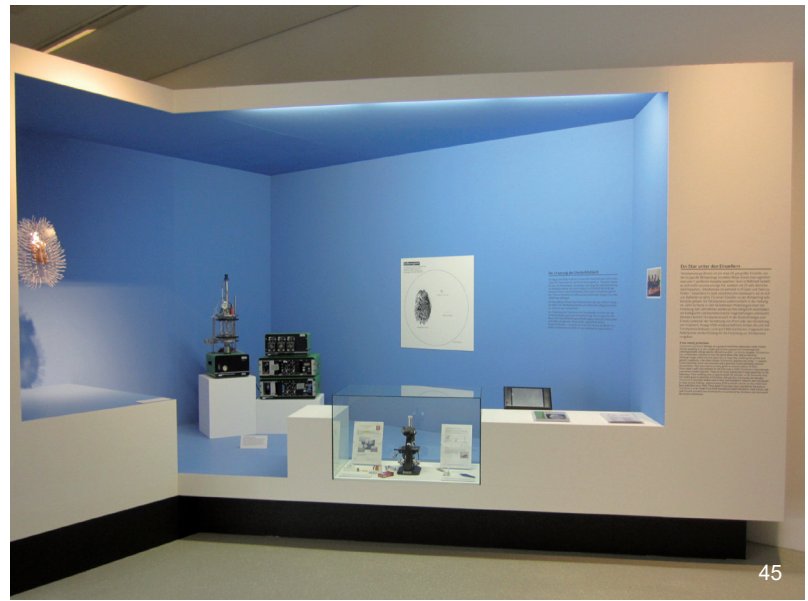


Fig. 45–46: Presentation of the laboratory “pet” *Tetrahymena pyriformis* (45) and a model of a bacteriophage (46) in the exhibition on model organisms in the Castle Museum 2012/13.

die unser Weltbild verändern” („White Mice and Mendel’s Peas. Animals and plants that change our world view; 17 October 2012–24 February 2013) in the Castle Museum, a chapter on the microscopic, eukaryotic laboratory “pet” *Tetrahymena pyriformis* was prepared: the researches yielded about 4,000 scientific articles from hundreds of authors referring to *Tetrahymena* in the title. Since there is a smoking kit developed in Germany, which can be used to demonstrate the effect of nicotine via the ciliate species on the flare hairs in the human lung, attempts were made to win the schools inspector for a financing of courses, which unfortunately was of moderate success. Klaus LEITL at Straßwalchen (Salzburg) was invited to make a model and a bacteriophage was reconstructed by Michaela MINICH and Wolfgang SCHWARZ of the Biology Centre (Fig. 45, 46).

On 9 November 2012, at the suggestion of Hubert RAUSCH, I gave a lecture on „neither animal, nor plant – life in the microcosm, tribute to the 111th birthday of the Lower Austrian biologist Dr. Friederike WAWRIK at the Natural History Society Mostviertel in Scheibbs.

In 2012 there was a focus on ciliates of Upper Austrian municipalities and seven further federal states. My survey compiled the taxonomic and biogeographical (un)published information on ciliates updating the “Catalogus Faunae Austriae Ic” of Wilhelm FOISSNER and Ilse FOISSNER in 1988 (shortly CFA). The number of records increased from about 3500 included in the CFA to actually 74,000, mainly due to huge saprobiological monitoring programs of many rivers in Upper Austria from 1992 to 2006, including about 40,000 unpublished observations of Hubert BLATTERER (St. Valentin/Linz) and 21 from Bruno GANNER (Salzburg). 53 unpublished observations of Wilhelm FOISSNER (Salzburg) were made in Salzburg, Tyrol and Vienna. The nomenclature and taxonomy was actualised, including originally mentioned names for each record.

Concerning Upper Austria the records are allocated to the 18 districts and 215 investigated municipalities (the total amounts to 444!) including detailed sampling dates. Taxonomic, bibliographic, classificatory and faunistic informations are stored and interlinked in the database of Austrian ciliates of the Biology Centre in Linz.

More than 500 references from 1776 to 2012 to papers on Austrian ciliates were analysed and were briefly commented. 1021 valid species classified in 390 genera and 185 families were originally described – 231 of them having been established with the type locality in Austria, which are highlighted for the respective federal state – or reliably recorded from about 700 localities corresponding to about 14 %, 26 % and 61 % of the worldwide known species, genera and families, respectively. Compared to the CFA this corresponded to an increase of about 39 % of valid taxa. The overwhelming proportion of ciliate (sub)species belonged to two families, the Oxytrichidae (60) und Vorticellidae

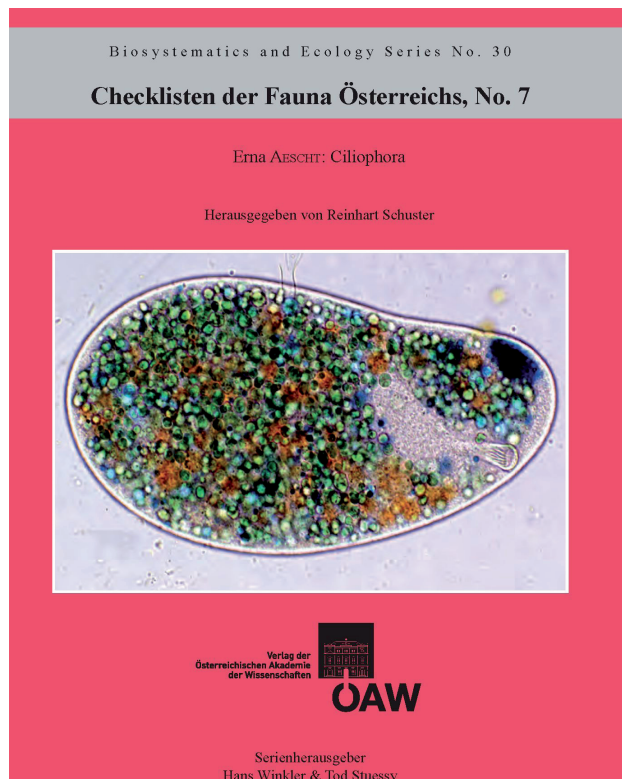


Fig. 47: Title page of the ciliate checklist of Austria in 2013.

(54), however 48 % of the families were only represented by one or two taxa. According to the number of taxa the nine federal states of Austria are ranked as follows: Salzburg (596), Upper Austria (570), Lower Austria (383), Carinthia (229), Tyrol (213), Burgenland (194), Vienna (157) and Styria (139). No record was known for Vorarlberg.

These 749 pages embracing a regionally organised compilation including original locations supplemented my respective paper, which is restricted to classification and a species list, for the series “**Checklists of the Austrian Fauna**” published by the Austrian Academy of Sciences in 2013 (Fig. 47). This warned that the new scenarios are far from approaching completeness as indicated by the 15 species recorded for the first time in Austria since 2012, since in most administrative units the majority of ciliate diversity is still undiscovered.

A new experience was to make the computer layout (supported by Michaela MINICH) for the “Monograph of the Dileptids (Protista, Ciliata) Wilhelm FOISSNER in Denisia (see p. 400).

The first half-year of **2013** was marked by the 20th anniversary of the Biology Centre. Extensive research on the past 10 years has been necessary (see p. 470). Wilhelm FOISSNER was invited to take part in the panel discussion on the general situation of museums at the festive event in the south wing on 15 June (see p. 378). Following the invitation of the philosopher Laurent FEDI, I gave a lecture on “The positive viewpoint and the biocentric worldview of Raoul FRANCÉ” at the symposium of the Auguste COMTE Association in Strasbourg (France) on 22 March 2013. In 2013 Dr. Ralf MEISTERFELD (see p. 461), retired from the Technical University of Aachen, donated his collection to Linz.

The International Code of Zoological Nomenclature (‘the Code’) shows several important weaknesses. For instance, the

responsibility for types on a long-term basis is costly and cannot be provided in private collections and in universities with their temporary staff. Thus, the pivotal role of natural history museums and their core activity should be included in the Code. This is why on 10 July **2014** together with Alain DUBOIS, a french herpetologist and polyhistor in Paris, and I organised an International Meeting on Zoological Nomenclature in Linz, where it was decided to establish the “Linz Zoocode Committee” for short LZC (see DUBOIS, AESCHT & DICKINSON 2016). The main purpose of this Committee is to propose improvements to the Code along the lines developed in the Linz Meeting. In a first step, the LZC worked on formal proposals regarding specific Principles, Rules, Articles and Recommendations of the Code. In the longer run, our plan is to articulate these proposals under the form of a complete document, the Linz Zoocode, which will be submitted to the International Commission on Zoological Nomenclature and to the international community of taxonomists for comparison of its merits with those of the Code.

By invitation of the organizer Dr. Allen WARREN (Life Sciences department Genomics and Microbial Biodiversity Division, Natural History Museum London), I gave a lecture on the topic of “Type slides and other traditional collections” near London on 1 September 2014.

On 25 October 2014 in a solemn ceremony by the Lord Mayor of Dinkelsbühl, Dr. Christoph HAMMER, and Hartmut HEILMANN, the Chairman of the Society for Soil, Technology, Quality (BTQ; Fig. 48), handed over to me the FRANCÉ Medal of Merit given to awarded by the BTQ and the municipality of Dinkelsbühl to persons or institutions who have rendered themselves worthy of the universal naturalist Raoul Heinrich FRANCÉ (see p. 423). The laudatory speech was given by Pierre FRANCÉ (Fig. 48), his grandson living in Paris.



Fig. 48: Hartmut HEILMANN, Erna AESCHT und Pierre FRANCÉ at the ceremony in Dinkelsbühl.

In 2015 the exhibition “Myth Beauty. Facetes of the beautiful in nature, art and society” (6 May 2015–10 January 2016) at the Castle Museum at Linz, I curated the part on nature and wrote an extensive, richly illustrated contribution to

the catalogue. Beside better known organisms, special views on REM-micrographs of radiolarians and artificially arranged models of foraminifers were presented (Fig. 49–50). A particularity was the silver plate showing engraved the radiolar *Heliosphaera actinota* (on loan from DI Dr. Wilhelm von ZITZEWITZ, Linz), which was awarded as a prize for hunters in 1907 (figured in AESCHT 2015).

The exhibition also included guided tours for the mediators of the Upper Austrian Museum (7 May) and the staff of the Culture Directorate (29 September), as well as the accompanying program with lectures, e.g. by Florian HUBER from Vienna on “Glass models between craft, science and art”.

Prof. Dr. Denis LYNN (Fig. 51), President of the International Society of Protistologists 1993–

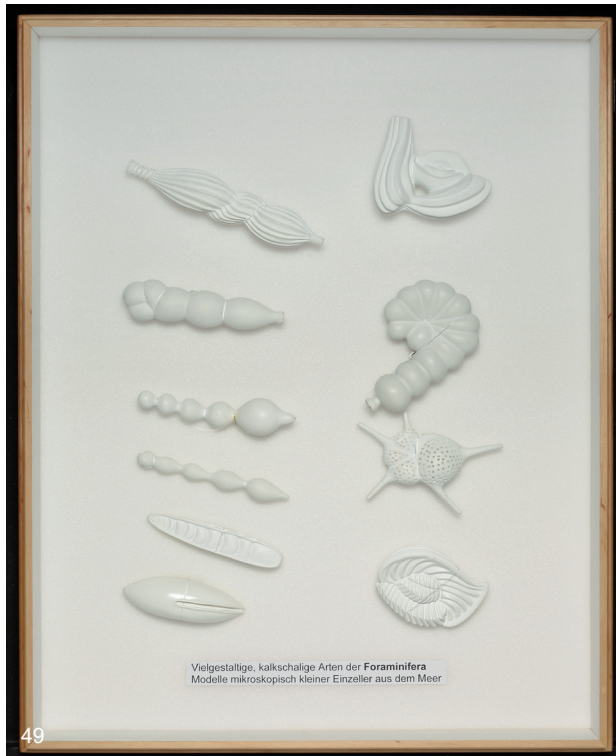


Fig. 49–50: Two of four presentations in 2015 of foraminiferan models made by Professor Shouyi ZHENG.

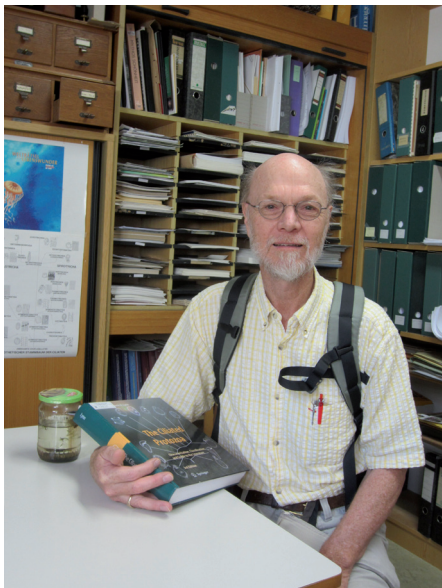
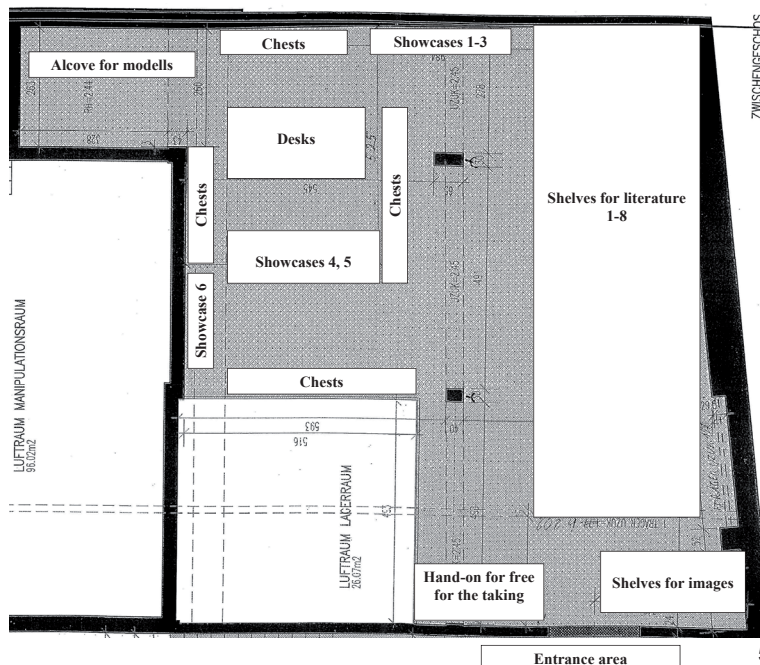


Fig. 51: Denis LYNN in my bureau in the first floor (1947-2018) in my bureau in the first floor holding his classic standard textbook on "The ciliated protozoa" published in 2008, where he wrote that he is deeply grateful to me who reviewed the entire Chapter 17 [on the ciliate taxa] with a degree of care and precision that he could not have expected.

1994, from Vancouver, Canada, visited the protist collection (26–31 July 2015) and we began with OCR scanning of the original taxonomic descriptions of more than 2.000 ciliate type species. These were intended to be made available online in the "International Research Coordination Network for Biodiversity of Ciliates (IRCN-BC)". Shortly before his unforeseen sudden death (26 June 2018), he sent most of his publications.

Initiated by Dipl.-Ing. Renate LEITINGER (Department of Environmental Protection) an exhibition "Bodenleben [Soil Life] Annie FRANCÉ-HARRAR" took place in the Federal State Service Centre (LDZ) near the Linz railway station in the frame of the International Year of the Soil from 7–21 December 2015. The original material and photographs were provided by the Upper



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Fig. 52, 53: Schematic view on the infrastructure (52) of the "Microcosm Archive" (in a narrower sense), which occupies a part of the depository Lindengasse in Linz; it should facilitate the spatial orientation and assignment of the following photos (not to scale). Models of microscopic organisms (53) constantly used in diverse exhibitions are put to "rest" in a niche there (see also text to the title page).

Austrian Provincial Museum.

On 16 December 2015 seven new members joined the International Commission of Zoological Nomenclature, among them myself as third protistologist following John CORLISS and David PATTERSON (for details see AESCHT



Fig. 54–57: Showing-cases with examples of the diverse collections, e. g. models of the life cycle of bottle animals *Eufolliculina uhligi* (54 to the right) made by Maria MULISCH. A series of posters on a shelf for images inviting to DGP meetings (55). Scaled down series of posters on “organisms of the month” (56) and historical object provided by Klaus HAUSMANN (57).

2015).

Since 2013 an extension of space for protist collections was in preparation on the half-floor (below the 1st one) in the depository Lindengasse. As part of a guided tour for the funding association of the Upper Austrian Museum, the newly adapted “**Microcosm Archive Linz**” (Fig. 52–56), named in a wider sense as most people are completely unacquainted with protists, was presented on about 130 m² for the first time on 10 May 2016.

On 14 July 2016, a delegation of 4 people from the National Marine Biodiversity Institute of Korea (MABIK) visited the Biology Center, the depository Lindengasse and the Castle Museum. The reason for the visit was that a collection of

microscopic long-term preparations should be set up at the MABIK. Sun Young KIM wanted to use the long-term experience of mine in an intensive course.

The computer layout (supported by Michaela MINICH) of 912 pages for the monograph of FOISSNER W. on “Terrestrial and semiterrestrial Ciliates (Protozoa, Ciliophora) from Venezuela and Galápagos” in *Denisia 35* (see p. 402) was very demanding. Due to problems during printing, the volume only appeared in 2016 (despite the year inadvertently remaining as 2015 on the backside of the cover).

Jackson BIERFELDT from the University of Chicago visited the Raoul Heinrich FRANCÉ and Annie FRANCÉ-HARRAR collection to

gather material for a dissertation on popular science (18–22 July 2016). In cooperation with Mag. Sandra URBAN, DI Renate LEITINGER (Department of Environmental Protection) and the author, curator and photographer Andreas HIRSCH from Vienna a booklet “Soil lives! Life and work of the Annie FRANCÉ-HARRAR” (in German) appeared on occasion of the respective exhibition in the Federal State Service Centre (LDZ) near the Linz railway station from 5–15 December 2016 (see p. 431).

For the exhibition “We are Upper Austria” (2 April 2017–7 January 2018), in which 26 historical persons were put on focus, two personalities were presented with their works under the topic “composting”: Annie Francé-HARRAR and Karl WESSELY (1861–1946), who founded faunistics and the first collection of lumbricides in Austria.

On the initiative of Dr. Otto MOOG (University of Vienna), the nomenclature and occurrence of the ciliates were updated for the series “Fauna Aquatica Austriaca” of the Federal Ministry of Agriculture, Forestry, Environment and Water Management. This happened in cooperation with Wilhelm FOISSNER, Hubert BLATTERER (Amt der Oö. Landesregierung; Direktion Umwelt und Wasserwirtschaft, Abteilung Oberflächengewässerwirtschaft, Gewässerschutz), Fritz KOHMANN (formally Bayerisches Landesamt für Wasserwirtschaft, currently Brey) and Helmut BERGER (Technisches Büro für Ökologie Salzburg). A version in German and English was delivered.

In 2017, the second report of the LZC (see references p. 473), covering the period from June 2016 to April 2017 was published. The LZC held 8 Sessions of work that led to formal adoption of proposals. The final decisions of these 8 Sessions were reported below in 8 distinct reports, each of which includes a statement of the proposal adopted and an appendix. For financial reason, the histories of these Proposals are not provided here, but can be downloaded from internet



Fig. 58: Bruno ORTNER and Erna AESCHT with the newly printed BNO on testaceans and desmids at Esternberg near the Danube on 20 July 2017.

through the following link: <http://www.zobodat.at/publikation_series.php?id=21003>.

Dr. Allen WARREN (Life Sciences Department of Genomics and Microbial Biodiversity Division, Natural History Museum London) and 54 co-authors (including me) have prepared standardisation proposals for the scientific description of ciliates. The paper reviews issues relating to the taxonomy of ciliates and presents specific recommendations for best practice in the observation and documentation of their biodiversity. This effort stems from a workshop that explored ways to implement six Grand Challenges proposed by the International Research Coordination Network for Biodiversity of Ciliates (IRCN-BC). As part of its commitment to strengthening the knowledge base that supports research on biodiversity of ciliates, the IRCN-BC proposes to populate The Ciliate Guide, an online database, with biodiversity-related data and metadata to create a resource that will facilitate accurate taxonomic identifications and promote sharing of data.

A monograph on “Testate amoebae and desmids (Desmidiaceae) of peat mosses in several austrian moor landscapes” was published by the school teacher, moss specialist and frequent contributor to the journal “Mikrokosmos” Bruno ORTNER in BNO (Fig. 58): The study of 14 *Sphagnum*-

dominated peatlands in Upper Austria (11 sites), Lower Austria (2 sites) and Carinthia (1 site) revealed 131 testate amoebae taxa, documented by 197 lightmicroscopic colour figures, belonging to 29 genera in 17 families.

2018: Comparing two outstanding diatom collections

The life of Rudolf [S. J. P. Michael] HANDMANN (1841–1929)

Rudolf Michael HANDMANN was born on 6. August 1841 in Nußdorf near Vienna as son of Josef HANDMANN, who stems from Villingen in Baden (Germany) and has been regimental physician in Vienna-Kalksburg, and his wife, her

name remains unknown. According to TROLL-OBERGFELL (1932) her father has been Dr. med. Wilhelm WERNECK (?–1840) living in Salzburg and being interested on microscopic organisms, as EHRENBERG (1841) edited some of his species descriptions (see p. 476).

Rudolf HANDMANN, as he is usually called (P. and/or S.J. often attached to a name means ‘Father’ and belonging to the Jesuit Order, respectively), became a novice, viz. a candidate for admission to a religious order (specifically Jesuit), in Tyrnau (Hungary). HANDMANN studied philosophy and theology from 1864 to 1869 at the University of the Jesuit Order in Pressburg and at the University of Innsbruck, respectively. He was consecrated as priest on 25 July 1868 in Brixen- Bressanone (Italy) (Fig. 59).

For his Jesuit order, HANDMANN worked in various places: Mariaschein, Prag



Fig. 59, 60: [S.J. P.] Rudolf Michael HANDMANN (1841–1929) in 1868 (59) and the 1920s (60). By courtesy of the “Archiv der Österreichischen Provinz der Gesellschaft Jesu”

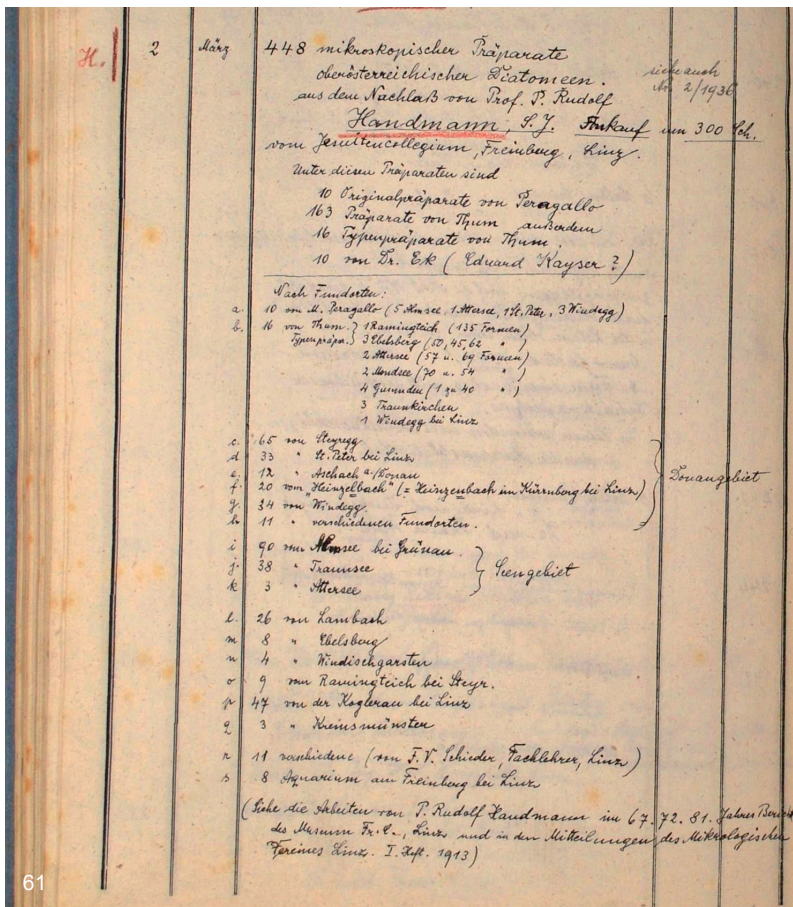


Fig. 61–64: Handwritten inventory in the historical accession book (61) of the legacy of R. M. HANDMANN, seven fiols with diatom material of the Almsee (62) and slides of Maurice PERAGALLO (63) and several of the 16 "type plates" of Eduard THUM (64).

(Czechoslovakia), Travnik (Bosnia), Kalocsa (Hungary), Klagenfurt and in St. Andrä in the Lavanttal (Carinthia), Innsbruck (Tyrol), Stonyhurst (England). The longest periods he lived at the College in Vienna-Kalksburg 1882–1884 and 1886–1889, where he taught mathematics and natural history, and at the College Aloisianum on the Freinberg in Linz 1899–1926 (Fig. 60), as a teacher and custodian of the natural science cabinet (TROLL-OBBERGFELL 1932). He was a member of the Upper Austrian Museum Association and recorded as collector and donator of fossil molluscs and minerals in the year-book of this society (JOOM).



HANDMANN has had various interests, namely

- technical (1875–1883, see references in Anonymous (1929), written likely by Bruno TROLL-OBBERGFELL, who was a priest from Monastery Wilhering near Linz and provided the first biography in 1932);
- physiological and psychological concerning human voice and language (1886–1887);



Table 4: Rivers, lakes and small water-bodies ('Tümpel' means pool, 'Teich' pond) in Upper Austria documented with voucher slides of diatoms from HANDMANN sampled from 1902 until 1923. Min: 1st year of sampling, Max: last year; n: number of permanent slides. Reference: publication year.

Sampling locality	Min	Max	n	Reference
Almsee	1909	1914	208	1913
Attersee	1910	1911	11	1926
Donau near Aschach	1912	1917	16	1926
Gosau (760 m)	–	–	1	undocumented
Gusen	1913	1913	2	1914
Heinzelbach, tributary to Donau	1911	1913	31	1914, 1926
Kellerbach, tributary to Almsee	1911	1911	9	1913
Koglerau Moortümpel	1914	1923	147	1926
Kremsmünster Hofgartenteich	1912	1912	10	undocumented
Lambach old Forellenteiche	1910	1918	34	undocumented
Linz Freinberg Aquarium	1913	1913	8	1914
Linz Margareten Donau	1913	1913	3	1914
Linz St. Peter Donautümpel	1911	1915	47	1914, 1926
OÖ [Upper Austria]	1912	1917	5	undocumented
Pesenbach	1914	1914	3	undocumented
Rodl	1902	1902	14	undocumented
Steyr Ramingteich	1907	1907	9	1909
Steyregg near Linz, Donau	1911	1917	94	1914
Traunauen near Ebelsberg	1910	1912	10	undocumented
Traunsee	1910	1919	50	1909
Windegg Donautümpel	1908	1918	47	1914
Windischgarsten Teich	1914	1914	9	1926
Zaubertalbach	1913	1913	3	1914

- paleontological (fossil molluscs; 1882–1887);
- mineralogical and geological (1902–1910);
- meteorological (1911–1915) and
- botanical (diatoms, 1909–1926).

These resulted in more than 264 publications of scientific and theological topics as well as those on popular science, including translations of books from other languages (e.g. Spanish); for a very likely still incomplete list of references see TROLL-OBBERGELL (1932) and GÖTZENDORFER (1991). HANDMANN, despite being handicapped by lung and eye diseases during his life, described several new taxa of fossil molluscs (e.g. HARZHAUSER & BINDER 2004; see also wikipedia entry concerning downloadable obituaries) and diatoms (see below). During his activities in Linz four publications report on inventoring diatoms of Upper Austria (HANDMANN 1909, 1913, 1914, 1926) and document that beside the Upper Austrian colleagues of the Micrological Society Linz (more on this below), namely F. V. SCHIEDER,

a subject teacher, KLUG and H. RABL (living dates unknown), he was in contact with the diatom specialists Maurice PERAGALLO (living dates unknown) in Sceaux-Robinson near Paris and Prof. J. NUCKOWSKI (living dates unknown) in Chyrów-Galicia as well as the German natural history dealers Eduard KAYSER in Berlin and Eduard THUM (1847–1926) in Leipzig, one of the most talented diatom-mounters of all time, who began his business around 1875, issued his first catalog in 1879, and continued mounting until near the time of his death (STEVENSON 2014: <http://microscopist.net/ThumE.html>). HANDMANN (1909) reports on two samplings in 10 to 20 m depth of the Traunsee by Ed. THUM indicating a visit in Austria.

The Handmann diatom collection

According to the accession book of 1933 (2 March, 4 September, 27 November) and 1936 (23 May October) the legacy of Rudolf HANDMANN came from the “Collegium Aloisianum” to the Upper Austrian Museum. In total it embraced 684 microscopic slides (Fig. 61), two handwritten books, namely a “Catalogus Diatomearum Austriae Superior” and “Diatomistische Studien” [diatom studies] with excerpts and protocols, negative and positive material and seven fiols with diatom material of the Almsee (Fig. 62). The price for one portion, i.e. 448 slides is given with 300 Sch[illinge]. Particularly mentioned are 10 slides of Maurice PERAGALLO, 163 slides (Fig. 63) and 16 type plattes of THUM (Fig. 64), 10 slides of E.K. (very likely Eduard KAYSER) and as item “r” 11 slides of F. V. SCHIEDER. The number of slides per sampling location is also listed in detail. A note to the entry of 4 September 1933 refers to three slides exchanged with Pater Bruno TROLL for the Cistercian monastery Wilhering near Linz. At present, the listed material (except

Year	n	Reference or excel file	PbYr	Signature
1995	72	BUP: el1		
		Gewässerschutz Bericht 18	1997	AEB841
1996	17	BUP: el1		
1997	14	BUP: el1		
1998	10	BUP: el1		
		Gewässerschutz Bericht 24	2001	AEB988
1999	249	BUP: el1		
		Gewässerschutz 1998/1999	2000	pl2202
		Gewässerschutz Bericht 33	2006	NP0411
2000	218	BUP: el1		
		Gewässerschutz Bericht 23	2000	AEB987
		Gewässerschutz Bericht 41	2009	NP0417
2001	239	BUP: el1		
		Gewässerschutz Bericht 25	2001	NP0403
		Gewässerschutz 2000/2001	2002	pl2203
2002	303	BUP: el1		
		Gewässerschutz Bericht 32	2004	NP0410
		Gewässerschutz Bericht 43	2009	NP0419
2003	292	BUP: el1		
		Gewässerschutz Bericht 28	2003	NP0406
		Gewässerschutz Bericht 30	2004	NP0408
		Gewässerschutz 2002/2003	2004	pl2204
2004	279	BUP: el1		
		Gewässerschutz Bericht 37	2007	NP0006
		Gewässerschutz Bericht 42	2009	NP0418
2005	150	BUP: el1		
2006	152	BUP: el1		
2007	232	BUP: el1, el2, ASM: el13, e 16		
		Gewässerschutz Bericht 44	2011	NP0420
2008	176	BUP: el3, ASM: el13, e 16		
2009	186	BUP: el4, ASM: el11, e 16		
		Gewässerschutz Bericht 39	2009	NP0415
		Gewässerschutz Bericht 40	2009	NP0416
2010	180	ASM, BUP: el5, ASM: el11	2010	pl2227
		GZÜV: report, el11	2010	pl2224
		Gewässerschutz Bericht 47	2014	NP0423
2011	–	ASM, BUP: el6, ASM: report, el11	2011	pl2228
		GZÜV: report, el11	2011	pl2225
2012	–	GZÜV: report, el11, BUP: el7, ASM: el11	2012	pl2226
		ASM report	2012	pl2229
2013	81	BUP: el8, ASM: el12, GZÜV: el14		
		Gewässerschutz Bericht 46	2013	NP0422
		WRRL: report	2014	pl2206
2014	282	BUP: el9, ASM: el12, GZÜV: el14		
2015	246	BUP: el10		
		BUP: report 2015	2017	pl2205
		BUP: report	2015	pl2207
		ASM: report	2015	pl2230
2016	40	BUP: el15		

negative material; only one positive exits) and 658 microscopic slides in 45 boxes can be located (see also Fig. 10, 13), so 26 slides are missing. Unfortunately, an excursion journal mentioned in HANDMANN's publications has not been included in the legacy. Missing is also his correspondence.

601 slides bear only a label with the locality, 416 of them also the sampling year (for the rest most

Table 5: Published and “grey” (without ISSN or ISBN number) literature edited by the “Amt der Oberösterreichischen Landesregierung”, therefore anonymous, sorted per year referring to Tab. 6. Signature includes the six-digit reference code to the particular work and the archived pdf, which can be downloaded from <http://www.land-oberoesterreich.gv.at/files/publikationen>. ASM: “landesinternes Amtliches Seen Messnetz” [official inland lake network]; BUP: “Biologische Untersuchungsprogramm” [biological investigation program]; GZÜV: “Gewässerzustandsüberwachungsverordnung” [water status surveillance ordinance]; n: number of permanent slides collected in the respective year building the “GWS diatom (sub)collection” (no slides exist from 2011-2012); PbYr: year of publication (or “grey” report), if empty, the data are included in an excel file (el1-16); WRRL: “EU-Wasserrahmenrichtlinie” [European water framework directive]; Year: year of collection. Note that the reports usually are available one or several years later; they are subordinated to the year of collection.

could be reconstructed according to collective numbers given by THUM or the publications); 190 are labelled with one or more taxon names: 30 to the genus level, 155 to species level. In some boxes handwritten notes list diverse species names partially including very small drawings. The sampling sites are summarised in Table 4.

New taxa and their current taxonomical status

HANDMANN (1909) introduced the new “form” *Navicula ramingensis* with a Latin diagnosis and a detailed comparison with *N. nobilis*, *N. viridis* and *N. macilenta*, but without giving a figure. A discussion of NUCKOWSKI's interpretation as synonym in HANDMANN (1913) strengthens however the species status in his interpretation; two photographs are given on plate II. This taxon is currently regarded as a synonym of *Pinnularia acrosphaeria* var. *sandvicensis* A. SCHMIDT (cp. GUIRY et al. 2017; incorrectly referring the description to the year 1913). In 1913 the first “Mitteilungen des Mikrobiologischen Vereins Linz” [Reports

Table 6: Rivers and lakes in Upper Austria with voucher slides of diatoms from 1995 until 2017. el1-16: in one of the exel-lists; Max: last sampling year vouchered; Min: first sampling year vouchered; n: number of voucher slides; undocumented: not in any exel-list. AEB-, NP-, pl- (with numbers) refer to published or grey literature (cp. Tab. 5).

Sampling locality	Min	Max	n	Reference
Achleitnerbach	2001	2001	2	el1
Ager	1995	2010	66	AEB841 NP0423
Aibach	2003	2003	2	el1 NP0406 NP0408
Aigner Bach	2003	2004	4	el1 NP0406 NP0418
Aist	2000	2015	20	NP0417
Aiterbach	2007	2007	8	el1
Albertsedter Bach	2004	2004	4	el1 NP0006
Albrechtshamer Bach	2004	2004	2	el1 NP0006
Alm	1995	2010	83	NP0423
Almsee	2013	2016	5	pl2230
Altbach	1999	2014	5	el9 NP0423
Ampfelwangerbach	2007	2010	4	NP0423
Antiesen	1999	2014	70	el1 NP0006
Asbach	2000	2000	2	el1
Asböckbach	2004	2004	2	el1 NP0006
Aschach	1996	2014	71	el1 NP0411
Aschbach	2004	2004	2	el1
Attersee	2013	2015	11	pl2230
Aubach	2003	2004	6	el1 NP0006
Auerbach	2002	2002	2	el1
Auleitenbach	2004	2004	4	el1 NP0006
Aurach	2001	2010	44	el1 NP0423
Autobahnbach	2004	2004	2	el1
Bach aus Schönering	2003	2003	2	el1
Bach aus Erb	2002	2002	2	el1
Bach aus Statzing	2001	2001	2	undocumented
Baslingerbach	2000	2000	2	el1
Baumbach	2004	2004	2	el1
Baumörtlbach	2003	2003	2	el1
Beutelbach	2003	2003	2	el1
Biberbach	2000	2000	2	el1
Bierbach	2001	2001	2	el1
Bogenmüllerbach	2002	2002	2	undocumented
Boxleitenbach	2002	2002	2	NP0410
Braunsbergerbach	2002	2002	2	el1
Breitenauerbach	2002	2002	2	el1
Breitsach	2004	2004	2	el1 NP0006
Brenntbach	2002	2002	2	el1
Brunnbach	2002	2002	2	el1
Dachsbergerbach	1999	1999	2	el1
Daglesbach	2009	2015	4	el4 el10 NP0423
Dambach	2002	2002	2	el1
Dambergerbach	1999	1999	2	el1
Diesenleitenbach	2009	2015	4	el4 el10 NP0423
Dimbach	2009	2015	6	el4 el10 NP0423 pl2205
Dingbach	2003	2003	2	el1
Distelbach	2009	2015	4	el4 el10 NP0423 pl2205
Doblbach	2000	2000	2	el1 AEB987
Dornleitenbach	2002	2002	2	el1
Dürre Ager	2007	2010	4	NP0423
Dürre Aschach	1996	2014	52	el1 NP0411
Egl-Sittingerbach	1999	1999	2	undocumented
Eibach	1999	1999	2	el1

of the Micrological Society Linz], edited by the chairmen F. V. SCHIEDER and embracing a foreword, two contributions and club notices by himself, two contributions of HANDMANN, which are situated before those of SCHIEDER, and an appendix “Text zu den Analysen der oberösterreichischen Alpenseen” by Dr. Johann WITTMANN. The club notices speak of courses on plant histology with 20 lectures introducing three staining methods and permanent microslide mounts (there wherabout is unknown). Professor KLUG and the society member H. RABL, who found the rare *Cymbella tumidula* in a small pool near the Pöstlingberg in Linz, are particularly mentioned. A new variety *Fragilaria (Staurosira) harrissonii* (W. SM.) GRÜN. var. *almensis* is introduced by HANDMANN without latin diagnosis in his first contribution; a figure is given by SCHIEDER in his contributions. The variety name refers to the Almsee in HANDMANN (1913). The first contribution also includes a new genus and species, viz. *Handmannia austriaca* ascribed to “M. PER.”, i.e. Maurice PERAGALLO, who discovered it in a mud sample of *Chara* collected and sent by HANDMANN. The characteristic properties given in French language were obviously written by PERAGALLO, while SCHIEDER provided two drawings. So it was a genuine cooperative work leading to the conflicting authorship until now: “M. PERAGALLO”, “M. PERAGALLO in

Tab. 6: continued

Einbach	2000	2000	2	el1 AEB987
Ellersbach	2002	2002	2	el1 NP0410
Emprechtinger Bach	2004	2004	2	el1 NP0006
Enknach	1999	2014	54	el1 NP0410 NP0411 pl2204
Enterbach	2003	2003	2	el1
Erleinsbach	1999	1999	2	el1 NP0411
Eschlbach	2009	2015	4	el4 el10 NP0423 pl2205
Eselsbach	2004	2004	2	el1 NP0006
Etzelsdorferbach	2000	2000	2	el1
Faule Aschach	1999	2014	10	NP0411
Felberbach	2009	2015	4	el4 el10 NP0423 pl2205
Feldaist	2000	2015	70	NP0417
Fischbach	2002	2002	2	el1
Fischelhamerbach	2007	2007	2	el1
Flambach	2009	2015	6	NP0423
Flohleitenbach	2000	2000	2	el1 AEB987
Fornacher Redl	1999	2010	8	NP0423
Frankenburger Redl	2007	2010	6	NP0423
Furthbach	2000	2003	4	el1 AEB987
Fuschler Ache	2007	2010	4	NP0420 NP0423
Gaflenzbach	2007	2010	4	el5 NP0423
Gaisbach	2004	2004	2	el1 NP0006
Gamsbach	2002	2002	2	el1
Gebersdorfer Bach	2003	2003	2	el1 NP0406
Gehnbach	2004	2004	4	el1 NP0006
Gießenbach	2009	2015	4	el4 el5 NP0423 pl2205
Gleinkersee	2013	2016	3	NP0422 pl2230
Gollnbach	2000	2000	2	el1 AEB987
Grabenbach	2001	2001	2	el1 NP0403
Grasbach-Wahlmühle	2001	2001	2	el1 NP0403
Greifenedter Bach	2004	2004	2	el1
Griesbach	2000	2000	2	el1 AEB987
Grolzhamer Bach	2003	2003	2	el1
Großbach	1999	2014	7	el3 el6 el1 pl2207 NP0423
Große Gusen	2000	2015	43	NP0403
Große Mühl	2000	2015	50	el1
Große Naarn	2000	2015	38	el1
Große Rodl	2000	2015	76	el1
Gruberbach	2002	2002	2	el1 NP0408
Grubinger Bach	2003	2003	2	el1 NP0411
Grünaubach	2002	2002	2	el1
Grünbach	2001	2004	20	undocumented
Gumpoldinger	2003	2003	2	el1
Gurtenbach	2008	2014	14	el3 el6 el9 NP0420
Gusen	2000	2015	36	el1 NP0403
Gusenbach	2001	2001	2	el1 NP0403 pl2203
Gutenshamer Bach	2004	2004	2	el1
Hallstättersee	2013	2015	11	pl2230
Hamelbach	2002	2002	2	el1 NP0410
Harbe Aist	2009	2015	4	el4 el7 el10 NP0417 NP0423
Harter Bach	2004	2004	2	el1
Haselbach	2009	2015	4	el4 el7 el10 pl2205 NP0423
Haselberger Bach	2004	2004	4	el1 NP0006
Hauergraben	2002	2002	2	el1
Haupingbach	2004	2004	4	el1
Hausbach	2004	2004	2	el1 NP0006
Heinbach	1999	1999	2	undocumented
Heratinger See	2013	2016	9	pl2230 NP0419

HANDMANN” (e.g. HÅKANSSON 2002) or “M. PERAGALLO, HANDMANN & SCHIEDLER” [the latter misspelled in algaebase]. Two new varieties, *Handmannia austriaca* var. *radiata* PERAGALLO and “*Navicula gendrei* F. HER. M. PER. var. *pantocsekii* M. PER.” [sic!] remained unfigured. The latter is listed as *Nitzschia pantocsekii* M. PERAGALLO without further details, but with the entry “This name is of an entity that is currently accepted taxonomically.” (GUIRY & GUIRY 2018). Neither a variety *almensis* nor *almense* is listed in AlgaeBase. *Handmannia austriaca* with the type locality: Almsee, Austria and the lectotype “PERAGALLO collection, Talence, France slide no 901” is currently regarded as synonym of *Puncticulata a.* by HÅKANSSON (2002: 117) or of *Lindavia a.* by NAKOV et al. (2015). *Handmannia austriaca* var. *radiata* is listed as synonym of *Puncticulata austriaca* (HÅKANSSON 2002: 117) [= *Lindavia austriaca*?]. The publications of HANDMANN (1914, 1926) focus on the distribution of diatoms of Upper Austria, without mentioning new taxa. It is worth to emphasise that the 17 paralectotypes of *Handmannia austriaca* or even the syntypes (three slides clearly labeled with 1909, five possible earlier) of *Staurosira harissonii* “var. *almensis*” available in Linz might be decisive to clarify the unresolved taxonomy of the taxa concerned. In the third contribution of the

Tab. 6: continued

Hinterburgerbach	2002	2002	2	el1
Hinterer Langbathsee	2013	2016	17	pl2230
Hinterrinnbach	2002	2002	2	el1
Hoisenbach	2002	2002	2	el1 NP0410
Höllbach	2002	2002	2	el1 NP0410
Hollerbach	2002	2002	2	el1 NP0418
Höllernersee	2013	2015	6	el11 el12 pl2230
Holzbach	2003	2003	2	el1
Holzöstersee	2013	2016	15	el11 el12 el13 pl2230
Hörschinger Bach	2007	2010	6	NP0423
Hötzlarnbach	2004	2004	2	el1
Imsee	2013	2017	11	el11 el12 el13 pl2230
In der Lahn	2002	2002	2	el1
Inn	2009	2009	2	undocumented
Innbach	1999	2014	106	el1 NP0406
Ipfbach	1998	1998	2	el1 AEB988 pl2202
Irgerbach	2004	2004	2	el1 NP0006
Irrsee	2013	2015	9	el11 el14 el16 NP0422 pl2230
Ischl	2007	2010	6	NP0423
Jagerbachl	2002	2002	2	el1 NP0410
Jebingerbach	2000	2000	2	el1
Kaltbach	2004	2004	2	el1
Kaltenbach	2003	2003	2	el1 NP0406 pl2204
Karbach	2002	2002	2	el1
Kasernenbach	2002	2002	2	el1
Katzbach	2003	2003	2	el1
Katzenbach	2007	2007	6	el1
Kehrbach	1999	1999	2	el1 NP0411
Kembbach	2009	2015	4	NP0423
Kesselbach	2008	2014	4	el3 el6 el9 NP0423 pl2207
Kettenbach	2009	2015	8	el4 el7 el10 NP0417 NP0423 pl2205
Kimplingerbach	1999	1999	2	el1
Kirchdorfer Marktbach	2002	2002	2	el1
Klafferbach	1999	2015	8	el4 el7 el10 NP0423 pl2205
Klambach	2009	2015	4	el4 el7 el10 NP0423 pl2205
Klamleitenbach	1999	1999	2	undocumented
Klausbach	1999	1999	2	undocumented
Kleine Gusen	2000	2015	50	NP0403
Kleine Mühl	2000	2015	54	el1
Kleine Naarn	2000	2015	40	el1
Kleine Rodl	2009	2015	4	el1
Klenbach	2001	2001	2	el1
Kohlbach	2002	2002	2	el1
Kösslbach	2008	2014	4	el3 el6 el9 NP0423 pl2207
Krems	1995	2010	95	el1 AEB841 NP0423
Kremseggerbach	2002	2002	2	el1 NP0410
Krenbach	2001	2001	2	el1 NP0403
Krenglbach	2003	2003	2	el1 NP0406
Kretschbach	2004	2004	2	el1 NP0006
Kristeinerbach	1998	1998	3	el1 AEB988
Kroisbach	2003	2003	2	el1
Kronawittbach	2004	2004	2	el1 NP0006
Kruckenbach	2001	2001	2	el1
Krumme Steyrling	1995	2010	56	el1 AEB841 NP0423
Kutschermüllerbach	1999	1999	2	el1 NP0411
KW-Lambach	1999	1999	6	undocumented

issue, SCHIEDER mentions a “*Cocconeis*-Form (nov. spec.)” without nomenclatural status, because it is unnamed and remained undescribed, although it is figured in his second (countable as fourth of the issue) contribution. Some taxa have been named after HANDMANN: Eric WASMANN (1857–1931), was an Austrian Jesuit who became an accomplished entomologist, introduced *Claviger handmanni* in 1898 (family Staphylinidae). The gastropod species *Melanopsis handmanniana* FISCHER, 1996 (family Melanopsidae), honours the paleontologist.

The GWS diatom collection

GWS is an abbreviation for water pollution control (in German “Gewässerschutz”) embracing huge saprobiological monitoring programs in the Federal State of Upper Austria. Beside other microorganisms (e.g. ciliates and macrozoobenthos) phytoplankton (to smaller extent phyto-benthos) has been recorded (unvouchered before 1995) in the “Amtlicher oberösterreichischer Wassergüteatlas” [certified water quality atlas] since 1967 (see also Anonymous 1978, 1982, 1984). Succeeded by the “Gewässerschutz Bericht” (water pollution control report) beginning with 1992 (Anonymous 1992, 1993a-c, 1994a-c, 1995a-e, 1996a-c, 1997a-c, 1998, 2001a, b, 2003a-b). These investigations were based on the “water quality survey ordinance of the federation” (“Wassergüte-Erhebungs-Verord-

Tab. 6: continued

Lammbach	2001	2001	2	NP0403
Langbathsee	2014	2014	1	pl2230
Langstögerbach	1999	1999	2	el1
Laudach	2002	2010	8	el1 NP0423
Laudachsee	2013	2016	11	el11 el12 el13 pl2230 NP0422
Laussabach	1999	2007	4	NP0423
Laussabach in Losenstein	2007	2010	4	NP0423
Laussabach-Platz	2010	2010	2	NP0423
Lauterbach	2002	2002	2	el1 NP0416
Leberbach	2001	2001	2	el1 NP0403
Leitenbach	1999	2014	22	el1 el3 el6 el9 NP0423 pl2207
Leitnerbach	2003	2003	2	el1 NP0408
Lengau Bach	2003	2003	2	undocumented
Lenglachbach	2003	2003	2	el1
Leopoldshofstätter Bach	2004	2004	4	el1 NP0006
Leuganerbach	1997	1997	1	el1
Lichtenbach	2009	2015	4	el4 el7 el10 NP0423 pl2205
Lindengraben	2000	2000	2	el1 AEB987
Lochbach	2014	2014	2	el6 el9 NP0423 pl2207
Maltsch	1999	2015	9	NP0423 pl2205
Sankt Marienkirchner Bach	2004	2004	2	NP0006
Mattig	1999	2014	85	el1 NP0423 pl2207
Matzingerbach	2000	2000	2	el1
Meggenbach	2003	2003	2	el1
Messenbach	2000	2014	6	el1 el3 el6 el9 NP0423 pl2207
Mettmach	2008	2014	12	el3 el6 el9 NP0423 pl2207
Michaelnbach	1999	1999	2	el1
Micheldorfer Marktbach	2002	2002	2	el1
Michlbach	2000	2000	2	el1
Mirellenbach	2001	2001	2	el1 NP0403 pl2203
Mödlbach	2003	2003	2	el1
Mondsee	2013	2016	39	pl2230
Moosach	2008	2008	4	pl2207
Moosbach	1999	2014	14	el1 el3 el6 el9 NP0423 pl2207
Moserbach	2002	2002	2	el1
Moserbach-Diepersdorf	2002	2002	2	el1
Mühlbach	2002	2003	4	el1 ff
Mundorfingerbach	2000	2000	2	el1
Münsteuerbach	2004	2004	2	el1 NP0006
Naarn	2000	2015	48	el1 NP0423 pl2205
Natternbach	2008	2014	4	el3 el6 el9 NP0423 pl2207
Neustiftbach	2007	2010	4	NP0423
Nußbach	2002	2002	2	el1
Nussensee	2013	2015	4	el11 el12 el13 NP0422 pl2230
Oberach	2004	2014	8	el1 el3 el6 el9 NP0006 NP0423 pl2207
Oberach/Grillenau	2008	2008	2	el3 el6 el9 pl2207
Oberhirschgraben	2001	2001	2	el1
Oberndorferbach	1999	1999	2	el1
Ofenschlößlbach	2002	2002	2	el1
Ofenwasser	2003	2003	2	el1 NP0406
Offensee	2013	2016	16	el11 el12 el13 NP0422 pl2230

nung des Bundes” – **WGEV**, 1992–2005; Tab. 5), which was replaced by the “water status surveillance ordinance” “Gewässerzustandsüberwachungsverordnung” – **GZÜV**; Tab. 5) in 2006, aims to provide an overview of the whole of Austria and at least to present the state of the larger water bodies in a federal overview. For this purpose, a permanent rotation of sampling sites and investigation parameters is provided. The rough grid and the current rotation cannot meet the requirements in the state. International reporting obligations at European level and implementation-oriented water management work in the federal state represent two different levels with different demands (Anonymous 2006). This program covers the big pre-Alpine lakes (Attersee, Mondsee, Irrsee, Hallstätter See, Traunsee), while a last program, the “official inland lake network” (“landesinternes Amtliches Seen Messnetz – **ASM**; Tab. 5, 6) covers 15 smaller lakes and additionally the Mondsee and Traunsee).

With the **European Water Framework Directive** (“EU-Wasserrahmenrichtlinie” – **WRRL**), which came into force in 2000, waters are considered as habitats in their entirety and their water is not only regarded as a commodity. Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such. Anonymous (2000). So, the “biological investigation pro-

Tab. 6: continued

Osterbach	2000	2015	30	el1 el3 el7 el10 NP0423 pl2205
Osternach	2004	2014	8	el1 el3 el6 el9 NP0006 NP0415 NP0423 pl2207
Ottenbach	2004	2004	2	el1
Otterbach	2000	2000	2	el1 AEB987
Ottsdorferbach	2002	2002	2	el1
Pattighamer Bach	2004	2004	2	el1 NP0006
Penzendorferbach	2002	2002	2	el1
Penzingerbach	1999	1999	2	undocumented
Pernsteinergraben	2002	2002	2	el1
Perwenderbach	2007	2010	4	NP0423
Pesenbach	2000	2015	50	el1 el4 el7 el10 pl2205
Pettenbach	2007	2007	4	el1
Pfudabach	2000	2014	6	el1 el3 el6 el9 NP0408 NP0423 pl2207
Planbach	1997	2003	3	el1 NP0406
Pollinger Ache	1999	2014	66	el1 NP0423 pl2207
Polsenz	1997	2014	16	el1 el4 el7 el10 pl2205
Ponneredterbach	2004	2004	2	el1
Pragederbach	2002	2002	2	el1
Pram	1999	2014	80	el1
Pramauerbach	2000	2000	2	el1 pl2204
Prambach	1999	1999	2	el1
Pramhoferbach	2000	2000	2	el1
Pramzubringer-Quelle	2000	2000	2	AEB987
Pulvermühlbach	1999	1999	2	el1
Pumberger Bach	2004	2004	2	el1 NP0006 NP0406
Pürstingerbach	2002	2002	2	el1 NP0410
Quelle Possarthaus	2002	2002	2	el1
Raab	2000	2000	2	el1 AEB987
Rainbach	2000	2000	2	el1 AEB987
Ramenaibach	2009	2009	2	el4
Ranitz	2009	2015	4	el4 el7 el10 pl2205
Ranna	2000	2015	20	el4 el7 el10 el1 NP0423 pl2205
Redlbach	2001	2001	2	el1 NP0403
Reichenau-Grasbach	2001	2001	2	el1 NP0403
Reichramingerbach	1999	1999	2	undocumented
Reiflbach	2002	2002	1	el1 NP0410
Reischenbach	2000	2000	2	el1 AEB987
Reisingerbach	2000	2000	2	el1
Reithbach	1999	1999	2	el1
Riedauerbach	2000	2000	2	el1
Riederbach	2001	2014	7	el1 NP0403 NP0006
Rohrbach	2001	2001	2	el1 NP0403
Roithamer Bach	2003	2003	2	el1 NP0406
Roßbach	2000	2003	4	el1 AEB987
Rottenbach	2003	2014	8	el1 el3 el6 el9 NP0423 pl2207
Rühringerbach	2000	2000	2	el1
Salzach	1995	1995	2	undocumented
Sametingbach	1999	1999	2	el1
Sandbach	1999	2014	10	el1 el3 el6 el9 NP0423 pl2205 pl2207
Sarmingbach	2009	2015	4	el4 el7 el10 NP0423 pl2205
Saubach	1999	2002	6	el1 NP0403 pl2203
Schalbach	2003	2003	2	el1
Schedlbach	2002	2002	2	el1

gram” (“Biologische Untersuchungsprogramm” – **BUP**) was developed to ensure long-term monitoring of the ecological status of rivers in Upper Austria. Currently, the BUP comprises a total of 275 sampling sites, which are regularly examined within 3 years. It targets organisms (phytobenthos and macrozoobenthos) in the aquatic environment whose presence or absence is exploited as a long-term indicator of the extent of exposure to readily degradable organic substances (Fig. 68–70). A second program, the “official immission monitoring network” (“Amtliche Immissions-Messnetz” – **AIM**) is to show up-to-date information and data about the physical, chemical and **bacterial** nature of the running waters of the federal state. It provides information on selected water constituents, their indicator function is used as well as on the bacterial load of the main rivers of the country. AIM and BUP complement each other ideally (in spite of partially different job selection and sampling periodicity). Only the results of both programs make a comprehensive statement aimed at the causes of burdens possible.

The awareness on the demand for vouchered monitoring increased since 1995, so Hubert BLATTERER regularly deposited the slides. Further persons involved are Gustav SCHAY (since 1992), Angela PRANDSTÖTTER (since 2007), Markus REICHMANN (since 2007), Ellen SCHAFFERER

Tab. 6: continued

Schildorngraben	2004	2004	4	el1 NP0006
Schleichtenbach	1997	2003	4	el1
Schleißheimerbach	2007	2007	2	el1
Schnozenbach	2003	2003	2	el1
Schönauerbach	2002	2003	4	el1 NP0418
Schwabenbach	2000	2000	2	el1 AEB987
Schwaigbach	2007	2010	4	NP0423
Schwarze Aist	1999	1999	2	undocumented
Schwarzensee	2013	2016	16	el11 el12 el13 NP0422 pl2230
Schweinbach	2001	2001	2	el1 NP0403
Schwemmbach	1999	2014	59	el1 el3 el6 el9 NP0423 pl2207
Seeache	2007	2010	4	NP0423
Seeleitensee	2013	2015	8	el11 el12 el13 NP0422 pl2230
Seezurinn 1-5	2002	2002	10	el1
Seisenbach	2001	2001	2	el1
Seltenbach	2001	2003	4	el1
Senftenbach	2004	2004	4	el1 NP0006
Sipbach	1998	2010	9	el1 AEB988 NP0423
Sprinzenbach	2002	2002	2	el1
St. Thomas Bach	2004	2004	2	el1
Stampfenbach	2009	2015	4	el4 el7 el10 NP0418 NP0423 pl2205
Steegenbach	1999	1999	4	el1
Steinbach	2000	2003	8	el1 el3 el6 el9 NP0423 pl2207
Steinbruckerbach	2000	2000	2	el1
Steinerne Mühl	2000	2015	40	el1 NP0423 pl2205
Steinwendtnerbach	2002	2002	2	el1
Steyr	1995	2010	90	el1 AEB841 NP0423
Steyrling	1995	2010	18	el1 AEB841 NP0423
Stillbach	2003	2003	2	el1 NP0406
Straneggbach	2002	2002	2	el1
Sulzbach	2002	2003	4	el1 NP0406
Teichl	1995	2010	41	el1 el2 el5 el8 el15 NP0423 pl2206
Teufelmühlbach	2001	2001	2	el1
Teufenbach	2000	2000	2	el1 AEB987
Thalbach	2007	2007	2	el1
Thallingerbach	2001	2001	2	el1
Tiefenbach	2002	2002	2	el1
Tissenbach	2002	2002	2	el1
Trambach	2002	2002	2	el1
Trattbach	2003	2003	2	el1 NP0406
Trattenbach	2003	2003	2	el1
Trattnach	1999	2014	78	el1 el3 el6 el9 NP0423 pl2207
Traun	1995	2010	150	el1 AEB841 NP0423
Traunsee	2013	2016	21	el11 el12 el14 NP0422 pl2230
Trebingerbach	2001	2001	2	el1 NP0403 pl2203
Tresleinsbach	2014	2014	2	el1 el3 el6 el9 NP0423 pl2207
Tributary from Bühel	2002	2002	2	el1
Tributary from Radingsdorf	2001	2001	2	el1
Tributary from Ranklleithen	2002	2002	2	el1
Tributary from Bäckerberg	2002	2002	2	el1

(since 2007, Arge Limnologie), Georg WOLFRAM (since 2007). Phytoplankton and phytobenthos, mainly diatoms are determined by external specialists since 2014. The GWS collection (Fig. 65–67) includes 181 boxes with 3419 slides (6 of them devoid of data, insufficient or destroyed) referring to 1995–2015 [except 2011 and 2012].

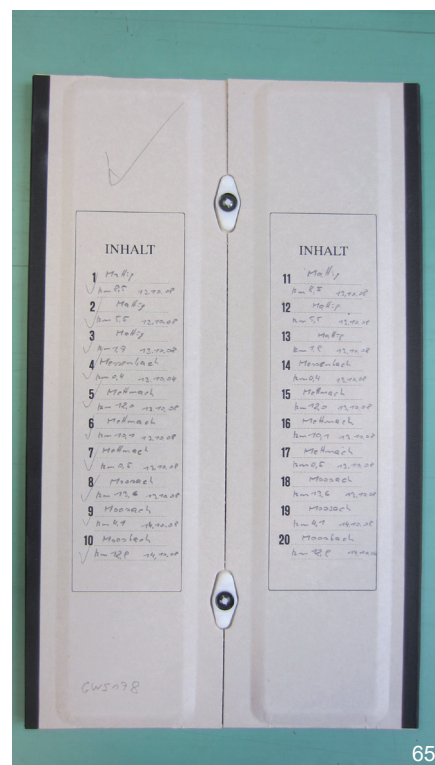
Diatoms in Upper Austria – comparing two turns of a century

The focus lays on a comparison between two turns of a century vouchered by microscopic slides, not to survey the complete literature on algae in Upper Austria. For the latter e.g. the four volumes on desmidiaceans of LENZENWEGER have to be taken into account (see HAUSMANN & MACHEMER in this volume). His big collection is recently hold by himself. The vocabulary of taxa presented in Table 7 embraces more than 1200 variants of scientific names (nomina) assigned to 950 currently valid species-series. At the beginning of the 20th century spellings and allocations have been very unstable, on the one hand since international rules were only established in 1906, on the other hand because of the short-sightedness of HANDMANN (see p. 342) resulting in numerous inadvertent spelling errors. However, many new combinations can also be recorded at the end of the 20th century.

(continued on p. 377)

Tab. 6: continued

Tributary from Brunau	2003	2003	2	el1 NP0406
Tributary from Eitzenberg	2003	2003	2	el1
Tributary from Finkelham	2003	2003	2	el1
Tributary from Fischerbühel	2002	2002	2	el1
Tributary from Fuchshub	2003	2003	2	el1
Tributary from Hofbauer	2002	2002	2	el1
Tributary from Obertrattnach	2003	2003	2	el1 NP0406
Tributary from Riedel	2002	2002	2	el1
Tributary from Sägewerk	2002	2002	2	el1
Tributary from Schnittering	2003	2003	2	el1 NP0406
Tributary from Spielangerthal	2002	2002	2	el1
Tributary from Wiesleithen	2002	2002	2	el1
Tributary from Zwillingkogel	2002	2002	2	el1
Uttenhaler Bach	2003	2003	2	el1 NP0406
Vallabach	2002	2002	2	el1 NP0410
Valtauer Bach	2003	2003	2	el1 NP0410
Visnitzbach	2001	2001	2	el1 NP0403 pl2203
Vockinger Bach	2004	2004	2	el1 NP0006
Vöckla	1995	2010	78	el1 AEB841 NP0423
Vorderer Gosausee	2013	2016	14	pl2230
Vorderer Langbathsee	2013	2016	19	pl2230
Vorderrinnbach	2002	2002	2	el1
Waldaist	2000	2015	60	el1 el4 el7 el10 NP0423 pl2205
Wallibach	2002	2002	2	el1
Wangauer Ache	1999	2010	6	NP0423
Wasenbach	2002	2002	2	el1
Wasserleitenbach	2001	2001	2	el1
Wechselbach	2001	2001	2	el1 NP0403
Wegbach	1999	1999	2	el1
Weilbach	2003	2003	2	el1
Weingraben	2001	2001	1	el1 NP0403 pl2203
Weireithgraben	2000	2000	2	el1
Weißer Aist	2009	2015	6	NP0417
Weißeneggbach	2002	2002	2	el1 NP0419
Welser Grünbach	2007	2010	16	NP0423
Weyerbach 1-3	2007	2010	12	el1 NP0423
Weyreggerbach	1999	1999	2	undocumented
Wilder Innbach	2003	2003	2	el1 NP0406
Wimbach	2002	2010	12	el1 NP0423
Wimbach	2000	2000	2	el1
Windischhuber Bach	2004	2004	2	el1 NP0006
Wolfbach	2003	2003	2	el1
Wolfhartinger Bach	2004	2004	4	el1 NP0006
Wurmmüllerbach	1999	1999	2	el1
Zeller Ache	2007	2010	4	NP0423
Zeurzenbach	2001	2001	2	el1
Ziehbach	1999	2003	4	el1 NP0406 NP0408



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Fig. 65–67: Examples of the phytoplankton and phytobenthos, mainly diatoms, of the GWS collection. – 65, 66: Out- and inside of a cardboard map containing 20 slides labeled with the sampling site and date. – 67 (next page): Piled up maps containing roughly 2800 voucher slides.

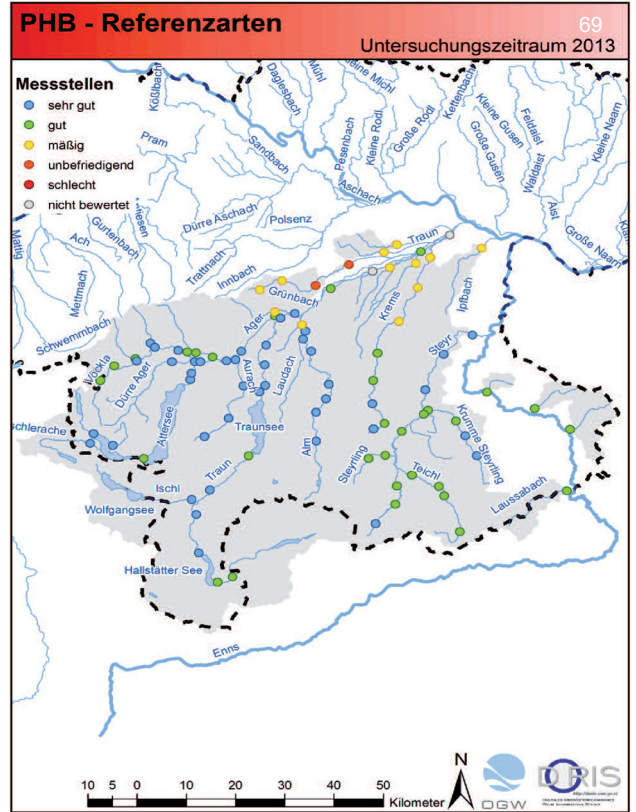


Fig. 68–70: Survey of the results of saprobiological investigations in three different regions of Upper Austria. – 68: Alpine foreland in the south (2013). – 69: Hausruckviertel in the west on the boarder to Bavaria (2014). – 70: Mühlviertel to the north of the Danube (2015).

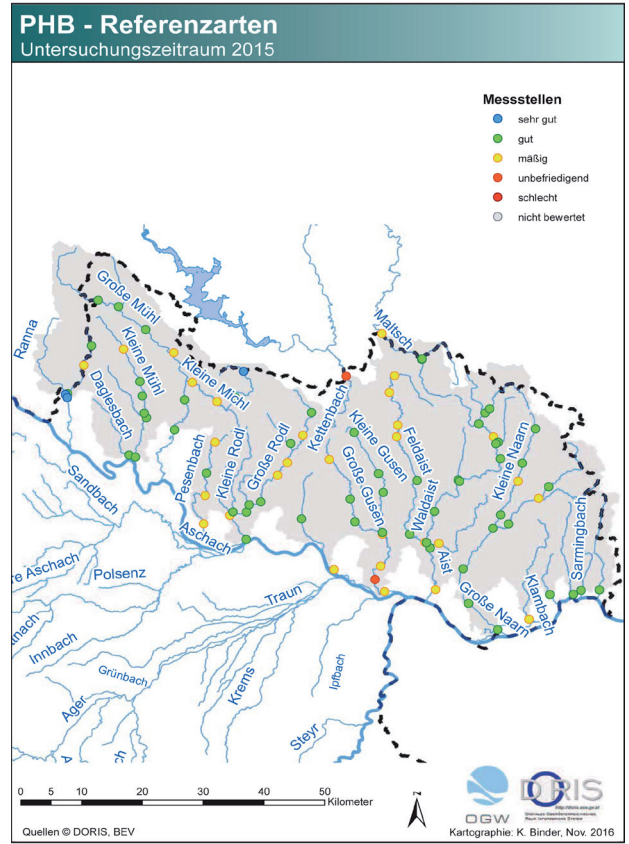
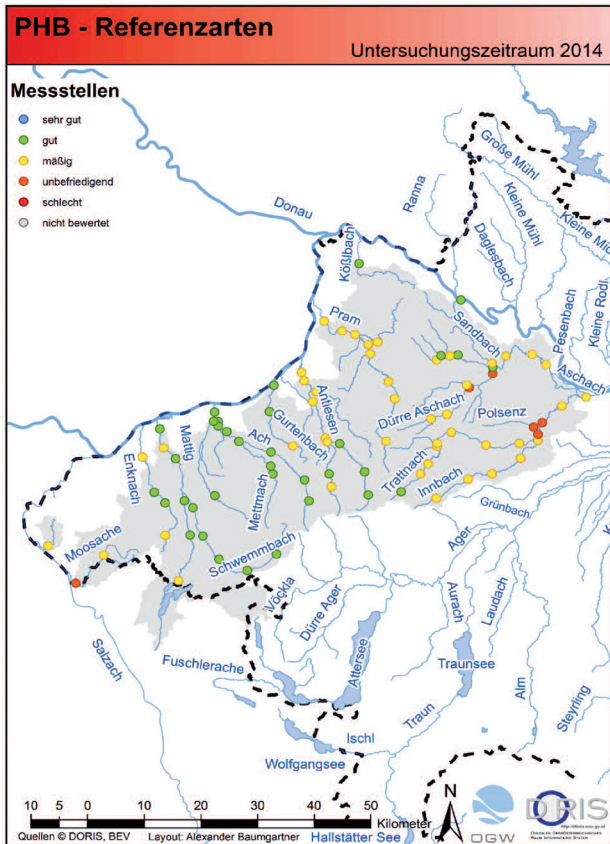


Table 7: Phytoplankton and -benthos determined to the species level in Upper Austrian rivers and lakes at the beginning of the 20th century compared to that of the 21st century. Abbreviations: **Baci** – Bacillariophyta, **Char** – Charophyta, **Chlo** – Chlorophyta, **Chry** – Chrysophyta, **Cryp** – Cryptophyta, **Eugl** – Euglenozoa, **Myzo** – Myzozoa [and Dinoflagellata], **Ochr** – Ochrophyta, **Proc** – Procaryota, i.e. blue green algae. Given are the years of publication (not collecting): HANDMANN (1909, 1913, 1914, 1926; 1872, 1901 and 1906 refer to SCHIEDERMAYR, KEISLER and BREHM & ZEDERBAUER, respectively). The period 1991–2016 is covered by the monitoring of the Upper Austrian Government, which are only published until 2003, however some reports, viz. grey literature, can be traced in the internet (for references see Tab. 5, 6; year-F and -S refer to river [“Fluss”] and lake [“See”], respectively).

Taxon	19/20th century	20/21th century	Phylon
<i>Achnantheiopsis dau</i> (Foged) Lange-Bertalot		2007-9S (as ' <i>Achnanthes</i> d.')	Baci
<i>Achnanthes antiqua</i> Lauby	1913		Baci
<i>Achnanthes brevipes</i> var. <i>intermedia</i> (Kützing) Cleve	1914 (as ' <i>A. subsessilis</i> ')		Baci
<i>Achnanthes exigua</i> Grunow	1926	2007-9S	Baci
<i>Achnanthes lanceolata</i> f. <i>elongata</i> Lauby	1913		Baci
<i>Achnanthes minutissima</i> var. <i>microcephala</i> Mukhamediev	1926		Baci
<i>Achnanthes oblongella</i> Oestrup		2007-9S	Baci
<i>Achnanthes petersenii</i> Hustedt		2007-9S	Baci
<i>Achnanthes pusilla</i> (Grunow) De Toni		2007-9S	Baci
<i>Achnanthes trinodis</i> (W. Smith) Grunow	1872 1909 (as ' <i>Achnantheidium trinode</i> ')		Baci
<i>Achnantheidium affine</i> (Grunow) Czarnecki		1991-2007F-2009S (as ' <i>Achnanthes minutissima affinis</i> ')	Baci
<i>Achnantheidium caledonicum</i> (Lange-Bertalot) Lange-Bertalot		1991-2007F-2009S (as ' <i>Achnanthes minutissima scotica</i> ')	Baci
<i>Achnantheidium eutrophilum</i> (Lange-Bertalot) Lange-Bertalot		1991-2007F-2009S (as ' <i>Achnanthes eutrophila</i> ')	Baci
<i>Achnantheidium exile</i> (Kützing) Heiberg	1872 1909 1913 (as ' <i>Achnanthes exilis</i> '; iss; 1913 as ' <i>Achnanthes exilis</i> ')	1991-2007F-2009S	Baci
<i>Achnantheidium gracillimum</i> (Meister) Lange-Bertalot		2007-9S (as ' <i>Achnanthes minutissima gracillima</i> ')	Baci
<i>Achnantheidium kryophila</i> (J.B.Petersen) Bukhtiyarova		2007-9S (as ' <i>Achnanthes</i> k.')	Baci
<i>Achnantheidium lineare</i> W.Smith	1913 1926 (as ' <i>Achnanthes linearis</i> ')		Baci
<i>Achnantheidium microcephalum</i> Kütz.	1914		Baci
<i>Achnantheidium minutissimum</i> (Kützing) Czarnecky var. <i>minutissimum</i>	1909 1913 1914 1926 (1909 1913 as ' <i>Achnanthes minutissima</i> '; 1914 as ' <i>Fragilaria minutissima</i> '; 1926 as ' <i>Amphora minutissima</i> '; 1926 as ' <i>Amphora minutissima</i> '; 1926 as ' <i>Fragilaria minutissima</i> ') iss	1991-2007F-2009S14ALS	Baci
<i>Achnantheidium minutissimum</i> var. <i>jackii</i> (Rabenh.) Lange-Bertalot et Ruppel		2007-9S (as ' <i>Achnanthes minutissima</i> j.')	Baci
<i>Achnantheidium pfisteri</i> Lange-Bertalot		1991-2007F-2009S (as ' <i>Achnantheidium</i> p.')	Baci
<i>Achnantheidium pyrenaicum</i> (Hustedt) Kobayasi		1991-2007F-2009S (as ' <i>Achnanthes biasoletiana</i> ')	Baci
<i>Achnantheidium straubianum</i> (Lange-Bertalot) Lange-Bertalot		1991-2007F-2009S (as ' <i>Achnanthes straubiana</i> ')	Baci
<i>Achnantheidium subatomus</i> (Hustedt) Lange-Bertalot		2007-9S (as ' <i>Achnanthes biasoletiana subatomus</i> ')	Baci
<i>Achnantheidium subsalsum</i> (J.B.Petersen) Aboal		2007-9S (as ' <i>Achnanthes subsalsa</i> ')	Baci
<i>Adlafia bryophila</i> (Petersen) Lange-Bertalot		1991-2007F-2009S (as ' <i>Navicula</i> b.')	Baci
<i>Adlafia minuscula</i> (Grunow) Lange-Bertalot var. <i>minuscula</i>	1914 (1914 as ' <i>Synedra</i> m.')	1991-2007F 2007-9S (1991-2007F as ' <i>Navicula minuscula</i> '; 2007-9S as ' <i>Navicula</i> m. m.')	Baci
<i>Adlafia minuscula</i> var. <i>muralis</i> (Grunow) Lange-Bertalot		2007-9S (as ' <i>Navicula</i> m. m.')	Baci
<i>Adlafia suchlandtii</i> (Hustedt) Lange-Bertalot		1991-2007F-2009S (as ' <i>Navicula</i> s.')	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Amphipleura pellucida</i> (Kützing) Kützing	1926	2007-9S	Baci
<i>Amphora acutiuscula</i> Kützing	1914		Baci
<i>Amphora balatonis</i> Pantocsek	1926		Baci
<i>Amphora copulata</i> (Kützing) Schoeman & Archibald	1913 1926 (as ' <i>Amphora libyca</i> ')	1991-2007F-2009S	Baci
<i>Amphora enoculata</i> Héribaud	1913 1914 1926		Baci
<i>Amphora exilissima</i> M.H.Giffen	1914 (1914 as ' <i>A. exilis</i> ')		Baci
<i>Amphora eximia</i> J.R.Carter in E.Y.Haworth		2007-9S (as ' <i>A. fagediana</i> ')	Baci
<i>Amphora globosa</i> Schumann	1909 1926		Baci
<i>Amphora inariensis</i> Krammer		1991-2007F-2009S	Baci
<i>Amphora lineolata</i> (Ehrenberg) Kützing	1914		Baci
<i>Amphora ovalis</i> (Kützing) Kützing	1872 1909 1913 1914 (1913 as ' <i>A. o. var. minor</i> '; 1914 as ' <i>A. minor</i> ')	1991-2007F-2009S	Baci
<i>Amphora pediculus</i> (Kützing) Grunow	1909 1913 1926 (1913 as ' <i>A. p. f. major</i> ')	1991-2007F-2009S	Baci
<i>Amphora pediculus var. major</i> Van Heurck	1914		Baci
<i>Anabaena lemmermannii</i> P.G.Richter in Lemmermann		2007-9S (as ' <i>Achnanthes l.</i> ')	Baci
<i>Anabaena minderi</i> Huber-Pestalozzi		2009-14ALS	Proc
<i>Anabaena planctonica</i> Brunthaler		2009-14ALS	Proc
<i>Anathece bachmannii</i> (Komárek & Cronberg) Komárek, Kastovsky & Jezberová		2009-14ALS (as ' <i>Aphanothece b.</i> ')	Proc
<i>Anathece clathrata</i> (W.West & G.S.West) Komárek, Kastovsky & Jezberová		2009-14ALS (as ' <i>Aphanothece c.</i> ')	Proc
<i>Anathece minutissima</i> (West) Komárek, Kastovsky & Jezberová	1909 (as ' <i>Aphanothece m.</i> ')	2007-9S14ALS	Proc
<i>Aneumastus tuscus</i> (Ehrenberg) D.G. Mann & A.J. Stickle	1913 1926 (as ' <i>Navicula tuscula</i> ')	2007-9S	Baci
<i>Ankistrodesmus bibraianus</i> (Reinsch) Korshikov		2009-14ALS	Chlo
<i>Ankistrodesmus fusiformis</i> Corda		2009-14ALS	Chlo
<i>Ankyra judayi</i> (G.M.Smith) Fott (as ' <i>judai</i> ')		2009-14ALS	Chlo
<i>Ankyra lanceolata</i> (Korshikov) Fott		2010 2011ALS	Chlo
<i>Anomoeoneis sphaerophora</i> Pfitzer (as ' <i>Anomoeoneis</i> (<i>Navicula</i>) <i>sphaerophora</i> (Kütz.)	1909 1913 1914 1926 (as ' <i>Navicula s.</i> '; 1926 as ' <i>Navicula sphärophora</i> '; iss)		Baci
<i>Anomoeoneis sphaerophora var. sculpta</i> (Ehrenberg) Otto Müller	1913 1926 (as ' <i>Navicula sculpta</i> ')		Baci
<i>Aphanizomenon gracile</i> Lemmermann		2007-9S	Proc
<i>Aphanocapsa planctonica</i> (G.M.Smith) Komárek & Anagnostidis		2007-9S	Proc
<i>Apocalathium aciculiferum</i> (Lemmermann) Craveiro, Daugbjerg, Moestrup & Calado		2009-14ALS (as ' <i>Peridinium a.</i> ')	Myzo
<i>Asterionella formosa</i> Hassall	1926	2007-9S	Baci
<i>Asterionella formosa var. gracillima</i> (Hantzsch) Grunow in van Heurck	1901 1906 1909		Baci
<i>Asterionella gracillima var. subtilis</i> (Grunow) A.Cleve	1901 1906 1909 (as ' <i>A. formosa s.</i> ')		Baci
<i>Aulacoseira ambigua</i> (Grunow) Simonsen		2007-9S	Baci
<i>Aulacoseira distans</i> (Ehr.) Simons.	1909 (as ' <i>Melosira distans nivalis</i> ')		Baci
<i>Aulacoseira granulata</i> (Ehrenberg) Simonsen	1909 1914 (1914 as ' <i>Melosira g.</i> ')	2007-9S14ALS	Baci
<i>Aulacoseira italica</i> (Ehrenberg) Simonsen		2009-14ALS	Baci
<i>Aulacoseira subarctica</i> (Otto Müller) E.Y.Haworth	1909	2007-9S14ALS	Baci
<i>Berkeleya rutilans</i> (Trentepohl) Grunow		2007-9S (as ' <i>Amphipleura r.</i> ')	Baci
<i>Bitrichia chodatii</i> (Reverdin) Chodat		2009-14ALS	Chry
<i>Botryococcus braunii</i> Kützing	1909	2007-9S14ALS	Chlo
<i>Brachysira aponina</i> Kützing	1926 (as ' <i>Navicula aponina</i> ') iss		Baci
<i>Brachysira brebissonii</i> Ross		2007-9S	Baci
<i>Brachysira intermedia</i> (Oestrup) Lange-Bertalot	1914 1926 (as ' <i>Navicula cryptocephala i.</i> '; 1914 1926 as		Baci

Tab. 7: continued

	' <i>Tabellaria fenestrata</i> i.'; 1926 as ' <i>Nitzschia paleacea</i> i.')		
Taxon	19/20th century	20/21th century	Phylon
<i>Brachysira neglectissima</i> Lange-Bertalot in Werum & Lange-Bertalot		1991-2007F	Baci
<i>Brachysira neoexilis</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Brachysira procera</i> Lange-Bertalot & Moser		2007-9S	Baci
<i>Brachysira styriaca</i> (Grunow) Ross		2007-9S	Baci
<i>Brachysira vitrea</i> (Grunow) Ross	1909 1913 1914 1926 (1909 1913 1926 as ' <i>Nitzschia</i> v.'; 1914 as ' <i>Synedra ulna</i> v.')	2007-9S (2007-9S also as ' <i>Cyclotella</i> v.'; 2007-9S also as ' <i>Anomoeoneis</i> v.')	Baci
<i>Brachysira zellensis</i> (Grunow) Krammer	1914 1926 (1914 as ' <i>Navicula</i> z.'; 1926 as ' <i>Navicula vulpina</i> z.')		Baci
<i>Brebissonia lanceolata</i> (C.Agardh) R.K.Mahoney & Reimer	1872 1909 1913 1914 1926 (1872 1909 as ' <i>Cocconema lanceolatum</i> '; 1914 1926 as ' <i>Navicula</i> l.'; 1926 as ' <i>Cocconema</i> l.'; 1913 1926 as ' <i>C.</i> l.'; 1914 as ' <i>Gomphonema parvum lanceolatum</i> '; 1914 as ' <i>Synedra ulna</i> l.'; 1914 as ' <i>Synedra ulna</i> l.')	1991-2007F-2009S (as <i>Cymbella lanceolata</i> var. <i>lanceolata</i> , also as ' <i>Navicula</i> l.')	Baci
<i>Caloneis alpestris</i> (Grunow) Cleve		2007-9S	Baci
<i>Caloneis amphisbaena</i> (Bory) Cleve f. <i>amphisbaena</i>	1909 1913 1914 1926 (1909 as ' <i>Navicula amphisboena</i> '; iss; 1913 1914 1926 as ' <i>Navicula</i> a.')	2007-9S	Baci
<i>Caloneis bacillaris</i> (Gregory) Cleve	1913 1914 1926 (as ' <i>Navicula</i> b.')		Baci
<i>Caloneis bacillum</i> (Grunow) Cleve		1991-2007F-2009S	Baci
<i>Caloneis dubia</i> Krammer in Lange-Bertalot & Krammer	1872 1909 1914 1926 (1872 1909 as ' <i>Gomphonema intricatum</i> var. <i>sublinearis</i> ')		Baci
<i>Caloneis fasciata</i> (Lagerstedt) Cleve	1913 1926 (as ' <i>Navicula</i> f.')		Baci
<i>Caloneis latiuscula</i> (Kützing) Cleve	1872 1909 1913 1926 (1872 1909 as ' <i>Navicula</i> l. f. <i>major</i> '; 1872 1909 1913 1926 as ' <i>Navicula</i> l.'; 1913 1926 as ' <i>Navicula gastrum</i> l.')		Baci
<i>Caloneis liber</i> (W.Smith) Cleve	1909 1913 1926 (1909 as ' <i>Navicula</i> l.'; 1913 1926 as ' <i>Navicula maxima</i> ')		Baci
<i>Caloneis limosa</i> (Kützing) R.M.Patrick in Patrick & Reimer	1909 1913 1914 1926 (1909 as ' <i>Navicula</i> l. var. <i>longa</i> '; 1909 1913 1914 1926 as ' <i>Navicula</i> l.'; 1914 as ' <i>Navicula</i> l. <i>subundulata</i> '; 1914 1926 as ' <i>Navicula</i> l. <i>gibberula</i> '; 1914 1926 as ' <i>Navicula</i> l. <i>signata</i> ')		Baci
<i>Caloneis molaris</i> (Grunow) Krammer in Krammer & Lange-Bertalot	1926 (as ' <i>Navicula</i> m.')		Baci
<i>Caloneis pulchra</i> Messikommer		2007-9S	Baci
<i>Caloneis schumanniana</i> (Grunow) Cleve		2007-9S	Baci
<i>Caloneis silicula</i> (Ehrenberg) Cleve	1913 1926 (1913 as ' <i>Navicula</i> s. var. <i>genuina</i> '; 1926 as ' <i>Navicula limosa</i> s.')	2007-9S	Baci
<i>Caloneis tenuis</i> (Gregory) Krammer		2007-9S	Baci
<i>Caloneis ventricosa</i> F.Meister	1913 1914 1926 (1913 1914 as ' <i>Navicula leptogongyla</i> '; 1913 1926 as ' <i>Navicula</i> v.'; 1926 as ' <i>Navicula leptogengula</i> ')		Baci
<i>Caloneis ventricosa</i> var. <i>minuta</i> (Grunow) F.W.Mills	1913 (1913 as ' <i>Navicula</i> v. var. <i>m.</i> ')		Baci
<i>Caloneis ventricosa</i> var. <i>truncatula</i> (Grunow) Meister	1913 1926 (1913 1926 as ' <i>Navicula</i> v. t.')		Baci
<i>Campylodiscus balatonis</i> Pantocsek	1926		Baci
<i>Campylodiscus costatus</i> W.Smith	1926		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Campylodiscus hibernicus</i> Ehrenberg	1926		Baci
<i>Campylodiscus hibernicus</i> var. <i>noricus</i> (Ehrenberg) van Heurck	1926 (as ' <i>Campylodiscus noricus</i> ')		Baci
<i>Campylodiscus noricus</i> var. <i>costatus</i> (W. Smith) Grunow	1872 1909		Baci
<i>Campylodiscus noricus</i> var. <i>sublaevis</i> F.Meister	1926		Baci
<i>Campylodiscus punctatus</i> M.Bleisch	1926		Baci
<i>Cavinula cocconeiformis</i> (Gregory) D.G. Mann & A.J. Stickle	1926 (as ' <i>Navicula c.</i> ')		Baci
<i>Cavinula jaernefeltii</i> (Hustedt) D.G. Mann & A.J. Stickle		2007-9S (as ' <i>Navicula j.</i> ')	Baci
<i>Cavinula lapidosa</i> (Krasske) Lange-Bertalot		2007-9S (as ' <i>Achnanthes l.</i> ')	Baci
<i>Cavinula pusio</i> (Cleve) Lange-Bertalot in Werum & Lange-Bertalot		2007-9S (as ' <i>Navicula p.</i> ')	Baci
<i>Cavinula scutelloides</i> (W. Smith) Lange-Bertalot		2007-9S (as ' <i>Navicula s.</i> ')	Baci
<i>Ceratium cornutum</i> (Ehrenberg) Claparède & Lachmann	OT leg. 1910 unpublished	2007-9S	Myzo
<i>Ceratium hirundinella</i> (O.F.Müller) Dujardin	OT leg. 1910, 1916, 1919 unpublished	2007-9S	Myzo
<i>Chamaepinnularia mediocris</i> (Krasske) Lange-Bertalot		2007-9S (as ' <i>Navicula m.</i> ')	Baci
<i>Chroococcus dispersus</i> (Keissler) Lemmermann		2007-9S	Proc
<i>Chroococcus distans</i> (G.M.Smith) Komárková-Legnerová & Cronberg		2007-9S	Proc
<i>Chroococcus minutus</i> (Kützing) Nägeli		2007-9S	Proc
<i>Chrysidiastrum catenatum</i> Lauterborn in Pascher		2009-14ALS	Ochr
<i>Chrysolykos angulatus</i> (Willén) Nauwerck		2009-14ALS	Chry
<i>Chrysolykos planctonicus</i> B.Mack		2009-14ALS (as ' <i>C. planktonicus</i> ') iss	Ochr
<i>Chrysolykos skujae</i> (Nauwerck) Bourrelly (as ' <i>skujai</i> ')		2009-14ALS	Chry
<i>Closterium acutum</i> var. <i>variabile</i> (Lemmermann) Willi Kreiger		2009-14ALS	Char
<i>Closterium limneticum</i> Lemmermann		2009-14ALS	Char
<i>Closterium pritchardianum</i> W.Archer		2009-14ALS	Char
<i>Closterium pseudolunula</i> Borge		2009-14ALS	Char
<i>Cocconeis communis</i> Heiberg	1914		Baci
<i>Cocconeis disculus</i> (Schumann) Cleve in Cleve & Jentzsch	1926 (as ' <i>C. thomasiana</i> ')	1991-2007F-2009S	Baci
<i>Cocconeis linearis</i> (W.Smith) Schonfeldt	1914		Baci
<i>Cocconeis microcephala</i> (Kützing) Schonfeldt	1914		Baci
<i>Cocconeis molesta</i> Kützing	1926		Baci
<i>Cocconeis neodiminuta</i> Krammer		2007-9S	Baci
<i>Cocconeis neothumensis</i> Krammer		2007-9S	Baci
<i>Cocconeis pediculus</i> Ehrenberg	1872 1909 1926	1991-2007F-2009S	Baci
<i>Cocconeis placentula</i> var. <i>euglypta</i> (Ehrenberg) Grunow (as ' <i>Placentula</i> var. <i>euglypta</i> ')	1914 1926 (1914 1926 as ' <i>C. euklypta</i> '; 1926 as ' <i>C. pediculus euglypta</i> ')		Baci
<i>Cocconeis placentula</i> var. <i>intermedia</i> (M.Peragallo & Héribaude-Joseph) Cleve	1914 (as ' <i>C. rouxii</i> ')		Baci
<i>Cocconeis placentula</i> var. <i>lineata</i> (Ehrenberg) Van Heurck	1909 1914 1926 (as ' <i>C. lineata</i> ')		Baci
<i>Cocconeis placentula</i> var. <i>trilineata</i> (M.Peragallo & Héribaude-Joseph) Cleve	1914 (as ' <i>C. trilineata</i> ')		Baci
<i>Cocconeis pseudolineata</i> (Geitler) Lange-Bertalot		2007-9S (as ' <i>C. placentula p.</i> ')	Baci
<i>Cocconeis pseudothumensis</i> Reichardt		2007-9S	Baci
<i>Cocconema maculata</i> Kützing	1914		Baci
<i>Cocconema parva</i> W.Smith	1926		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Cochlodinium constrictum</i> (F.Schütt) Lemmennann	1909 (as ' <i>Gomphonema censtrietum</i> ') iss		Baci
<i>Coelastrum astroideum</i> De Notaris	1909	2007-9S14ALS	Chlo
<i>Coelastrum microporum</i> Nägeli in A.Braun	1909	2007-9S14ALS	Chlo
<i>Coelastrum pseudomicroporum</i> Korshikov		2009-14ALS	Chlo
<i>Coelastrum sphaericum</i> Nägeli		2009-14ALS	Chlo
<i>Coelosphaerium kuetzingianum</i> Nägeli		2009-14ALS	Proc
<i>Coenochloris fottii</i> (Hindák) Tsarenko		2007-9S 2009-14ALS (2007-9S as ' <i>Eutetramorus</i> f.')	Chlo
<i>Coenocystis planktonica</i> Korshikov		2009-14ALS	Chlo
<i>Cosmarium baileyi</i> Wolle		2009-14ALS (as ' <i>C. depressum</i> ')	Char
<i>Cosmarium tenue</i> W.Archer		2009-14ALS	Char
<i>Craticula accomoda</i> (Hustedt) D.G. Mann		2007-9S	Baci
<i>Craticula ambigua</i> (Ehrenberg) D.G.Mann in Round, R.M.Crawford & D.G.Mann	1914 1926 (as ' <i>Navicula</i> a.')		Baci
<i>Craticula cuspidata</i> (Kützing) D.G.Mann	1909 1913 (as ' <i>Navicula</i> c.')	2007-9S	Baci
<i>Craticula halophila</i> (Grunow) D.G. Mann		2007-9S (as ' <i>Navicula</i> h.')	Baci
<i>Craticula minusculoides</i> (Hustedt) Lange-Bertalot		2007-9S (as ' <i>Navicula</i> m.')	Baci
<i>Craticula molestiformis</i> (Hustedt) Lange-Bertalot		1991-2007F-2009S (as ' <i>Navicula</i> m.')	Baci
<i>Crucigenia crucifera</i> (Wolle) O.Kuntze		2007-9S	Chlo
<i>Crucigenia tetrapedia</i> (Kirchner) Kuntze		2009-14ALS	Chlo
<i>Crucigeniella apiculata</i> (Lemmermann) Komárek	1909	2007-9S14ALS	Chlo
<i>Cryptomonas curvata</i> Ehrenberg		2009-14ALS	Cryp
<i>Cryptomonas erosa</i> Ehrenberg	1909	2007-9S14ALS	Cryp
<i>Cryptomonas marssonii</i> Skuja	1909	2007-9S14ALS	Cryp
<i>Cryptomonas obovata</i> Skuja		2009-14ALS	Cryp
<i>Cyclostephanos dubius</i> (Hustedt) Round in Theriot et al.		2007-9S	Baci
<i>Cyclostephanos invisitatus</i> (Hohn & Hellermann) Theriot, Stoermer & Håkansson		2009-14ALS	Baci
<i>Cyclotella antiqua</i> W.Smith	1914		Baci
<i>Cyclotella atomus</i> Hustedt	1909	2007-9S14ALS	Baci
<i>Cyclotella balatonis</i> Pantocsek	1913 1926		Baci
<i>Cyclotella bodanica</i> var. <i>lemanica</i> (Otto Müller ex Schroter) Bachmann		2007-9S	Baci
<i>Cyclotella cretica</i> var. <i>cyclopuncta</i> (H. Hakansson & J.R.Carter) R.Schmidt	1909 (as ' <i>C. cyclopuncta</i> ')	2007-9S14ALS	Baci
<i>Cyclotella distinguenda</i> Hustedt in Gams	1909	2007-9S14ALS	Baci
<i>Cyclotella distinguenda</i> var. <i>unipunctata</i> (Hustedt) Håkansson & J.R.Carter		2007-9S	Baci
<i>Cyclotella lemanensis</i> (Otto Müller) Lemmerman		2007-9S (as ' <i>C. bodanica lemanensis</i> ')	Baci
<i>Cyclotella melosiroides</i> (Kirchner) Lemmermann	1909 1914 (1909 as ' <i>C. comta melosiroides</i> '; 1914 as ' <i>C. meloseia</i> ')		Baci
<i>Cyclotella meneghiniana</i> Kützing		2009-14ALS	Baci
<i>Cyclotella planctonica</i> Brunthaler in Brunthaler, Prowazek & Wettstein	1901 1906 1909 1926 (1926 as ' <i>C. planctonica planctonica</i> ')	2007-9S	Baci
<i>Cyclotella pseudostelligera</i> Hustedt		2007-9S	Baci
<i>Cyclotella radiosa</i> (Grunow) Lemmermann	1914	2007-9S	Baci
<i>Cyclotella striata</i> (Kützing) Grunow in Cleve & Grunow	1926		Baci
<i>Cyclotella striata</i> var. <i>subsalina</i> (Grunow) Hustedt	1914 (as ' <i>C. subsalina</i> ')		Baci
<i>Cymatopleura elliptica</i> (Brébisson) W. Smith	1872 1909 1913 1914 1926 (1913 1926 as ' <i>Navicula divergens elliptica</i> '; 1914 1926 as ' <i>Surirella linearis elliptica</i> '; 1926 also as ' <i>C. e. e.</i> ')	2007-9S	Baci
<i>Cymatopleura elliptica</i> f. <i>subconstricta</i> Grunow	1926		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Cymatopleura elliptica</i> var. <i>constricta</i> Grunow	1872 1909		Baci
<i>Cymatopleura elliptica</i> var. <i>gigantea</i> (Pantocsek) Meister	1926		Baci
<i>Cymatopleura elliptica</i> var. <i>hibernica</i> (W.Smith) Hustedt in Van Heurck	1926 (as ' <i>C. hibernica</i> ')		Baci
<i>Cymatopleura nobilis</i> Hantzsch	1926		Baci
<i>Cymatopleura solea</i> (Brebisson) W. Smith	1872 1909 1926 (1926 as ' <i>C. solea vulgaris</i> ')	1991-2007F-2009S	Baci
<i>Cymatopleura solea</i> var. <i>apiculata</i> (W.Smith) Ralfs in Pritchard	1909 1913 1926 (as ' <i>C. apiculata</i> ')	2007-9S	Baci
<i>Cymbella aequalis</i> W.Smith in Greville	1913 1926 (as ' <i>C. obtusa</i> ')		Baci
<i>Cymbella affinis</i> Kützing	1872 1909 1913 1926 (1909 also as ' <i>Cocconema a.</i> '; 1909 1926 also as ' <i>Amphora a.</i> ')	1991-2007F-2009S	Baci
<i>Cymbella affinis</i> var. <i>leptoceras</i> (Ehrenberg) Brun	1926 (as ' <i>C. leptoceras</i> ')		Baci
<i>Cymbella aspera</i> (Ehrenberg) Cleve	1872 1909 1913 1926 (1872 1909 1913 1926 as ' <i>C. gastroides</i> ')	2007-9S	Baci
<i>Cymbella aspera</i> var. <i>minor</i> (Van Heurck) Cleve	1909 1926 (as ' <i>C. gastroides minor</i> ')		Baci
<i>Cymbella balatonis</i> Grunow in A.Schmidt et al.	1926		Baci
<i>Cymbella bernensis</i> Meister	1926 (as ' <i>C. b. cessatii</i> ')		Baci
<i>Cymbella brehmii</i> Hustedt		2007-9S	Baci
<i>Cymbella cistula</i> var. <i>maculata</i> (Kützing) Van Heurck	1909 1913 1926 (1909 as ' <i>Cocconema maculatum</i> '; 1913 1926 as ' <i>C. m.</i> ')		Baci
<i>Cymbella compacta</i> Østrup		1991-2007F (as ' <i>C. helvetica c.</i> ')	Baci
<i>Cymbella cymbiformis</i> Agardh var. <i>cymbiformis</i>	1872 1909 1913 1926 (1872 1909 as ' <i>Cocconema cymbiforme</i> '; 1913 1926 as ' <i>C. c.</i> '; 1926 as ' <i>Cocconema c.</i> ')		Baci
<i>Cymbella ehrenbergii</i> var. <i>delecta</i> (A.Schmidt) Cleve	1926 (as ' <i>C. e. delecta</i> ')		Baci
<i>Cymbella excisa</i> Kützing	1913 1926 (as ' <i>Eunotia lunaris e.</i> ')		Baci
<i>Cymbella helvetica</i> Kützing	1913 1926 (1926 also as ' <i>C. h. minor</i> '; 1926 also as ' <i>C. h. rostrata</i> ')	1991-2007F-2009S	Baci
<i>Cymbella hustedtii</i> Krasske var. <i>hustedtii</i>		2007-9S	Baci
<i>Cymbella laevis</i> Nägeli	1913 1926	1991-2007F-2009S	Baci
<i>Cymbella lancettula</i> (Krammer) Krammer	1914 1926 (1914 as ' <i>Fragilaria l.</i> '; 1914 as ' <i>Navicula l.</i> '; 1926 as ' <i>Fragilaria lancettula</i> ')jss		Baci
<i>Cymbella mesiana</i> Cholnoky		2007-9S	Baci
<i>Cymbella minuscula</i> Grunow	1926		Baci
<i>Cymbella neocistula</i> Krammer	1872 1909 1913 1926 (1872 1909 1926 as ' <i>Cocconema cistula</i> '; 1909 as ' <i>Cocconema cistula f. minor</i> '; 1913 1926 as ' <i>C. cistula</i> '; 1926 as ' <i>C. balatonis cistula</i> '; 1926 as ' <i>Epithemia cistula</i> ')	2007-9S	Baci
<i>Cymbella neoleptoceros</i> Krammer		2007-9S (as ' <i>C. leptoceros</i> ')	Baci
<i>Cymbella parva</i> (W. Smith) Kirchner	1909 1913 1926 (1909 as ' <i>Cocconema parvum</i> ')		Baci
<i>Cymbella proxima</i> Reimer		2007-9S	Baci
<i>Cymbella scotica</i> W.Smith	1913 1926		Baci
<i>Cymbella simonsenii</i> Krammer		1991-2007F	Baci
<i>Cymbella subalpina</i> Meister	1926		Baci
<i>Cymbella tumida</i> (Brebisson) Van Heurck	1914 1926 (1914 as ' <i>Cocconema t.</i> ')	2007-9S	Baci
<i>Cymbella tumidula</i> Grunow in Schmidt et al.	1926		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Cymbella turgidula</i> Grunow in A.W.F.Schmidt	1926 (as 'C. cistula t.')		Baci
<i>Cymbopleura amphicephala</i> (Nägeli) Krammer	1872 1909 1913 1914 1926 (1872 1909 1913 1926 as 'Cymbella a.')	2007-9S	Baci
<i>Cymbopleura anglica</i> (Lagerstedt) Krammer	1926 (as 'Cymbella a.')		Baci
<i>Cymbopleura cuspidata</i> (Kützing) Krammer	1926 (as 'Cymbella c.')	2007-9S 2009-14ALS (2009-14ALS as 'Staurodesmus cuspidatus')	Baci
<i>Cymbopleura hercynica</i> (A.Schmidt) Krammer		2007-9S (as 'Cymbella amphicephala hercynica')	Baci
<i>Cymbopleura inaequalis</i> (Ehrenberg) Krammer	1913 1926 (as 'Cymbella ehrenbergii minor')		Baci
<i>Cymbopleura incerta</i> (Grunow) Krammer	1909 (as 'Aphanocapsa i.')	2007-9S14ALS	Baci
<i>Cymbopleura naviculiformis</i> (Auerswald) Krammer	1914 (as 'Cymbella n.')	2007-9S	Baci
<i>Cymbopleura subaequalis</i> (Grunow) Krammer	1913 1914 1926 (1913 1926 as 'Cymbella s.'; 1914 as 'Synedra ulna subaequalis') iss (1914 as 'Synedra ulna aequalis'; 1926 as 'Synedra s.')	2007-9S (2007-9S also as 'Amphora aequalis')	Baci
<i>Delicata delicatula</i> (Kützing) Krammer	1913 1914 (as 'Cymbella d.')	1991-2007F-2009S	Baci
<i>Denticula elegans</i> Kützing	1914		Baci
<i>Denticula inflata</i> W.Smith	1913 1914 (as 'D. tenuis i.')		Baci
<i>Denticula tenuis</i> Kützing	1913 1926	1991-2007F-2009S	Baci
<i>Denticula tenuis</i> var. <i>frigida</i> (Kützing) Grunow in van Heurck	1872 1909 1913 1914 1926 (1872 1909 1914 as 'D. f.')		Baci
<i>Diademesmia contenta</i> (Grunow) D.G. Man		1991-2007F-2009S (as 'Navicula c.')	Baci
<i>Diademesmia perpusilla</i> (Grunow) D.G.Mann in Round, Crawford & Mann	1914 1926 (1914 as 'Navicula flotowii'; 1926 as 'Amphora p.')	2007-9S (2007-9S as 'Navicula gallica perpusilla')	Baci
<i>Diatoma ehrenbergii</i> Kützing	1914	1991-2007F-2009S	Baci
<i>Diatoma elongata</i> (Lyngbye) C.Agardh	1872 1909 (as 'D. elongatum') iss		Baci
<i>Diatoma hyemalis</i> (Roth) Heiberg	1914 (1914 as 'D. hiemale') iss	2007-9S	Baci
<i>Diatoma mesodon</i> (Ehrenberg) Kützing	1913 1914 1926 (1913 as 'D. hiemale m.'; 1926 as 'Odontidium m.')	1991-2007F-2009S	Baci
<i>Diatoma moniliformis</i> Kützing subsp. <i>moniliformis</i>	1909	1991-2007F-2009S14ALS	Baci
<i>Diatoma tenue</i> C.Agardh	1926 (as 'D. tenue') iss	2007-9S	Baci
<i>Diatoma tenue</i> var. <i>capitellata</i> (Poretzky) Mitrofanova, Skabitchevskaya, Kim & Romanov (as 'capitellatum')	1914 (as 'D. vulgare capitulum')		Baci
<i>Diatoma vulgare</i> Bory	1872 1909 1926 (as 'D. vulgare') iss (1909 also as 'Diafonia vulgare var. linearis') iss	1991-2007F-2009S	Baci
<i>Diatoma vulgare</i> var. <i>brevis</i> Grunow	1914 (as 'D. vulgare breve')		Baci
<i>Dictyosphaerium ehrenbergianum</i> Nägeli	1909	2007-9S14ALS	Chlo
<i>Didymosphenia geminata</i> (Lyngbye) M.Schmidt		1991-2007F-2009S	Baci
<i>Dimeregramma minus</i> (W.Gregory) Ralfs in Pritchard (as 'minor')	1914 (as 'Denticula minor')		Baci
<i>Dinobryon bavaricum</i> Imhof	1909	2007-9S14ALS	Ochr
<i>Dinobryon crenulatum</i> West & G.S.West		2009-14ALS	Ochr
<i>Dinobryon cylindricum</i> O.E.Imhof		2007-9S	Ochr
<i>Dinobryon divergens</i> O.E.Imhof		2007-9S	Ochr
<i>Dinobryon sertularia</i> Ehrenberg		2007-9S	Ochr
<i>Dinobryon sociale</i> (Ehrenberg) Ehrenberg		2007-9S	Ochr
<i>Diploneis elliptica</i> (Kützing) Cleve	1909 1913 1926 (1909 as 'Navicula e.'; 1913 1926 as 'D. e. minor')		Baci
<i>Diploneis elliptica</i> (Kützing) Cleve var. <i>elliptica</i>	1913 1926 (1913 as 'D. e. puella'; 1913 1926 as 'D. e. grandis', also as 'D. e. ovalis')	1991-2007F-2009S	Baci

Tab. 7: continued

	and as 'D. e.'; 1926 also as 'Cocconeis thomasiana e.')		
Taxon	19/20th century	20/21th century	Phylon
Diploneis fontanella Lange-Bertalot		1991-2007F	Baci
Diploneis krammeri Lange-Bertalot & Reichardt		2007-9S (as 'Cyclotella k.')	Baci
Diploneis ladogensis (Cleve) Lange-Bertalot & Fuhrmann	1913 1926 (as 'D. elliptica l.')		Baci
Diploneis maulerii (Brun) Cleve		2007-9S	Baci
Diploneis minuta J.B.Petersen		2007-9S	Baci
Diploneis oblongella (Nägeli ex Kützing) Cleve-Euler		2007-9S	Baci
Diploneis oculata (Brébisson) Cleve	1926 (1926 also as 'D. mauleri o.')	1991-2007F-2009S	Baci
Diploneis ovalis (Hilse) Cleve	1914	2007-9S	Baci
Diploneis parma sensu Krammer & Lange-Bertalot pro parte		2007-9S	Baci
Diploneis petersenii Hustedt		2007-9S	Baci
Diploneis pseudovalis Hustedt		2007-9S	Baci
Diploneis puella (Schumann) Cleve	1909 1913 1914 1926 (1909 as 'Navicula elliptica var. minutissima'; 1913 1914 1926 also as 'Navicula p.'; 1926 as 'D. elliptica minutissima')		Baci
Diploneis separanda Lange-Bertalot in Werum & Lange-Bertalot	1913 1926 (1913 1926 as 'D. elliptica oblongella'; 1926 as 'Navicula oblongella')		Baci
Diploneis skvortzovii Skabichevsky [Skabichevskii]	1926 (as 'D. elliptica burtigensis')		Baci
Discoplea astrea Ehrenberg	1872 1909 (as 'Cyclotella a.')		Baci
Discoplea kuetzingii Ehrenberg	1926 (as 'Amphora kützingii') iss		Baci
Discostella stelligera (Cleve & Grunow) Houk & Klee		2007-9S 2009-14ALS (2007-9S as 'Cyclotella s.')	Baci
Discostella stelligeroides (Hustedt) Houk & Klee		2009-14ALS	Baci
Dolichospermum flosaquae (Brébisson ex Bornet & Flahault) P.Wacklin, L.Hoffmann & J.Komárek		2009-14ALS (as 'Aphanizomenon flos-aquae')	Proc
Dolichospermum lemmermannii (Richter) P.Wacklin, L.Hoffmann & J.Komárek		2009-14ALS (as 'Anabaena .')	Proc
Elakatothrix gelatinosa Wille		2009-14ALS	Chlo
Elakatothrix viridis (J.W.Snow) Printz		2007-9S	Chlo
Ellerbeckia arenaria (G.Moore ex Ralfs) R.M.Crawford nom. inval.	1909 1913 1926 (1909 1913 1926 as 'Melosira a.')	2007-9S	Baci
Encyonema alpinum (Grunow) D.G. Mann		2007-9S (as 'Cymbella alpina')	Baci
Encyonema auerswaldii Rabenhorst	1926		Baci
Encyonema caespitosum Kützing	1872 1909 1913 1926	1991-2007F-2009S (1991-2007F-2009S as 'Cymbella caespitosa')	Baci
Encyonema gracile Rabenhorst	1926		Baci
Encyonema lunatum (W.Smith) Van Heurck	1926		Baci
Encyonema lunula (Ehrenberg) Grunow in Schmidt et al.	1914		Baci
Encyonema minutum (Hilse) D.G.Mann in Round, R.M.Crawford & D.G.Mann		1991-2007F-2009S (as 'Cymbella minuta')	Baci
Encyonema neogracile Krammer var. neogracile	1909 1913 1926 (1909 1913 1926 as 'Amphora gracilis'; 1926 also as 'Cymbella gracilis')	2007-9S	Baci
Encyonema norvegicum (Grunow) Mills		2007-9S (as 'Cymbella norvegica')	Baci
Encyonema obscurum (Krasske) D.G. Mann		2007-9S (as 'Pinnularia obscura')	Baci
Encyonema perpusillum (A. Cleve) D.G. Mann	1914 (as 'Gomphonema intricatum pusillum')	2007-9S (as 'Cymbella perpusilla')	Baci
Encyonema prostratum (Berkeley) Kützing	1872 1909 1926	2007-9S (as 'Cymbella prostrata')	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Encyonema reichardtii</i> (Krammer) D.G. Mann		1991-2007F-2009S (as 'Cymbella r.')	Baci
<i>Encyonema silesiacum</i> (Bleisch) D.G.Mann in Round, R.M.Crawford & D.G.Mann		1991-2007F-2009S (as 'Cymbella silesiaca')	Baci
<i>Encyonema ventricosum</i> (Agardh) Grunow	1913 1926 (1913 also as 'E. v. f. minuta')		Baci
<i>Encyonopsis cesatii</i> (Rabenhorst) Krammer var. <i>cesatii</i>	1926 (as 'Navicula cessatii') iss	2007-9S (as 'Cymbella cesatii')	Baci
<i>Encyonopsis falaisensis</i> (Grunow) Krammer		1991-2007F-2009S (as 'Cymbella f.')	Baci
<i>Encyonopsis microcephala</i> (Grunow) Krammer	1913 (as 'Navicula m.')		Baci
<i>Eolimna minima</i> (Grunow) Lange-Bertalot	1914 1926 (1914 as 'Campylodiscus hibernicus m.'; 1914 as 'Surirella m.'; 1926 as 'Cymatopleura solea m.')	1991-2007F-2009S (as 'Navicula m.')	Baci
<i>Eolimna subminuscula</i> (Manguin) Lange-Bertalot		1991-2007F-2009S (as 'Navicula s.')	Baci
<i>Eolimna utermoehlii</i> (Hustedt) Lange-Bertalot & Kulikovskiy		2007-9S (2007-9S as 'Navicula u.', 'Navicula rotunda' and 'Navicula subrotundata')	Baci
<i>Epithemia adnata</i> (Kützing) Brébisson	1909 1913 1926 (1909 1913 1926 as 'E. zebra')	1991-2007F-2009S	Baci
<i>Epithemia adnata</i> var. <i>minor</i> (Peragallo & Héribaud-Joseph) R.M.Patrick in Patrick & Reimer	1926 (1926as 'E. zebra m.')		Baci
<i>Epithemia adnata</i> var. <i>porcellus</i> (Kützing) R.Ross	1913 1926 (as 'E. zebra p.')		Baci
<i>Epithemia amphicephala</i> (Østrup) H.Kobayasi & H.Kobayashi	1909 (as 'E. argus var. a.')		Baci
<i>Epithemia argus</i> (Ehrenberg) Kützing	1872 1909 1913 1914 1926 (1872 1909 as 'Synedra a.'; 1926 as 'E. arcus') iss		Baci
<i>Epithemia argus</i> var. <i>alpestris</i> (W.Smith) Grunow	1872 1909		Baci
<i>Epithemia frickei</i> Krammer in Lange-Bertalot & Krammer		2007-9S	Baci
<i>Epithemia gibba</i> Kützing	1872 1909 1914		Baci
<i>Epithemia hyndmannii</i> W.Smith	1872 1909 1914 1926 (1909 1926 as 'E. hyndmannii') iss		Baci
<i>Epithemia muelleri</i> Fricke in Schmidt et al.	1926 (as '. mulleri') iss		Baci
<i>Epithemia operculata</i> (C.Agardh) Ruck & Nakov in Ruck et al.	1872 1909 1926 (as 'Cyclotella o.')		Baci
<i>Epithemia sorex</i> Kützing	1872 1909 1913 1926		Baci
<i>Epithemia turgida</i> (Ehrenberg) Kützing var. <i>turgida</i>	1872 1909 1913 1926 (1872 1909 1913 as 'E. t.'; 1909 1926 as 'Encyonema turgidum'; 1926 as 'Gomphonema turgidum')	2009-14ALS (as 'Chroococcus turgidus minutus')	Baci
<i>Epithemia turgida</i> var. <i>granulata</i> (Ehrenberg) Brun	1909 1913 1926		Baci
<i>Epithemia turgida</i> var. <i>westermanni</i> (Ehrenberg) Grunow	1909 1926		Baci
<i>Erkenia subaequiciliata</i> Skuja		2009-14ALS	Ochr
<i>Eucocconeis alpestris</i> (Brun) Lange-Bertalot in Lange-Bertalot & Genkal	1872 1909 1913 1926 (1872 1909 1913 1926 as 'Achnanidium flexellum')		Baci
<i>Eucocconeis flexella</i> (Kützing) Cleve		2007-9S (as 'Achnanthes f.')	Baci
<i>Eucocconeis laevis</i> (Ostrup) Lange-Bertalot		1991-2007F-2009S (as 'Achnanthes l.')	Baci
<i>Eudorina elegans</i> Ehrenberg		2007-9S	Chlo
<i>Eunotia arcubus</i> var. <i>bidens</i> (Grunow) Lange-Bertalot in Lange-Bertalot et al.	1914 (as 'E. arcus bidens')		Baci
<i>Eunotia arcus</i> Ehrenberg sensu stricto	1913 (as 'E. arcus var. minor')		Baci
<i>Eunotia arcus</i> var. <i>plicata</i> Brun & Héribaud-Joseph	1926		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Eunotia bidentula</i> W.Smith	1913 1926		Baci
<i>Eunotia bilunaris</i> (Ehrenberg) Schaarschmidt	1913 (1913 as 'E. lunaris' var. alpina' and as 'E. lunaris')	2007-9S	Baci
<i>Eunotia diodon</i> Ehrenberg	1913 1914 1926 (1913 1926 as 'E. d. minor')		Baci
<i>Eunotia exigua</i> (Brébisson) Rabenhorst	1926	2007-9S	Baci
<i>Eunotia glacialis</i> Meister		2007-9S	Baci
<i>Eunotia gracilis</i> W.Smith	1909 1913 1926		Baci
<i>Eunotia implicata</i> Nörpel-Schempp, Lange-Bertalot & Alles		2007-9S	Baci
<i>Eunotia incisa</i> Gregory		2007-9S	Baci
<i>Eunotia islandica</i> Oestrup		2007-9S	Baci
<i>Eunotia lunaris</i> var. major (Grunow) Frenguelli	1926		Baci
<i>Eunotia meisteri</i> Hustedt		2007-9S	Baci
<i>Eunotia minor</i> (Kützing) Grunow in Van Heurck	1914 (1914 as 'Stauroneis minot') iss and as 'E. pectinalis m.')	2007-9S	Baci
<i>Eunotia paludosa</i> Grunow	1914 (as 'Synedra p.')		Baci
<i>Eunotia parallela</i> Ehrenberg	1914		Baci
<i>Eunotia paratridentula</i> Lange-Bertalot & Kulikovskiy in Kulikovskiy et al.		2007-9S (as 'E. muscicola tridentula')	Baci
<i>Eunotia pectinalis</i> (Kützing) Rabenhorst	1909 1914 1926 (1914 as 'E. p. stricta')		Baci
<i>Eunotia praerupta</i> Ehrenberg	1926 (as 'E. p. inflata' and as 'E. p. curta')	2007-9S	Baci
<i>Eunotia robusta</i> Ralfs in Pritchard nom. illeg.	1926		Baci
<i>Eunotia serra</i> Ehrenberg		2007-9S	Baci
<i>Eunotia soleirolii</i> (Kützing) Rabenhorst		2007-9S	Baci
<i>Eunotia tenella</i> (Grunow) Hustedt		2007-9S	Baci
<i>Eunotia tenella</i> (Grunow) Hustedt	1913 1914 1926 (1913 1914 1926 as 'Navicula t.a'; 1914 also as 'Gomphonema tenellum')		Baci
<i>Eunotia tetraodon</i> Ehrenberg	1926 (as 'E. robusta t.')		Baci
<i>Eunotia trinacria</i> Krasske		2007-9S (as 'E. paludosa trinacria')	Baci
<i>Eunotia undulata</i> Grunow in Moeller	1926		Baci
<i>Eunotia valida</i> Hustedt	1914 1926 (1914 as 'Denticula v.'; 1926 as 'Surirella v.')		Baci
<i>Eutetramorus plancticus</i> (Korshikov) Bourrelly		2007-14S (also as 'E. planktonicus')iss	Chlo
<i>Fallacia insociabilis</i> (Krasske) D.G.Mann in Round, R.M.Crawford & D.G.Mann		2007-9S (as 'Navicula i.')	Baci
<i>Fallacia lenzii</i> (Hustedt) Lange-Bertalot		1991-2007F-2009S (as 'Navicula l.')	Baci
<i>Fallacia monoculata</i> (Hustedt) D. G. Mann		2007-9S (as 'Navicula m.')	Baci
<i>Fallacia pygmaea</i> (Kützing) A.J. Stickle & D.G. Mann subsp. pygmaea	1913 1914 (1913 1914 as 'Cymatopleura p.'; 1914 also as 'Navicula p.')	1991-2007F-2009S	Baci
<i>Fallacia subhamulata</i> (Grunow) D.G. Mann	1926 (as 'Navicula s.')	1991-2007F-2009S	Baci
<i>Fallacia sublucidula</i> (Hustedt) D.G. Mann		1991-2007F-2009S (as 'Navicula s.')	Baci
<i>Fallacia vitrea</i> (Oestrup) D.G. Mann		2007-9S (as 'Navicula festiva')	Baci
<i>Fistulifera pelliculosa</i> (Brébisson ex Kützing) Lange-Bertalot	1914 (as 'Navicula p.')	2007-9S	Baci
<i>Fistulifera saprophila</i> (Lange-Bertalot & Bonik) Lange-Bertalot		1991-2007F (as 'Navicula s.')	Baci
<i>Fragilaria acus</i> (Kützing) Lange-Bertalot in Krammer & Lange-Bertalot		2007-9S (as 'F. ulna acus')	Baci
<i>Fragilaria amphicephaloides</i> Lange-Bertalot in Hofmann, Werum & Lange-Bertalot	1914 1926 (as 'Synedra amphicephala')	1991-2007F-2009S (as 'F. capucina amphicephala')	Baci
<i>Fragilaria austriaca</i> (Grunow) Lange-Bertalot		1991-2007F-2009S (as 'F. capucina a.')	Baci
<i>Fragilaria bicapitata</i> A. Mayer	1913 (as 'Navicula b. var.	1991-2007F-2009S	Baci

Tab. 7: continued

	hybrida')		
Taxon	19/20th century	20/21th century	Phylon
<i>Fragilaria biceps</i> (Kützing) Lange-Bertalot	1913 (as ' <i>Navicula interrupta</i> var. b.')		Baci
<i>Fragilaria biceps</i> (Kützing) Lange-Bertalot	1913 1914 1926 (1913 1914 1926 as ' <i>Synedra</i> b.'; 1926 also as ' <i>Surirella</i> b.' and as ' <i>Navicula trinodis</i> b.')		Baci
<i>Fragilaria brevistriata</i> Grunow	1909 1913 (1909 as ' <i>Navicula</i> b.')	1991-2007F-2009S	Baci
<i>Fragilaria capucina</i> Desmazières	1872 1909 1913 1926		Baci
<i>Fragilaria capucina</i> var. <i>capitellata</i> (Grunow) Lange-Bertalot in Krammer & Lange-Bertalot		2007-9S	Baci
<i>Fragilaria capucina</i> var. <i>distans</i> (Grunow) Lange-Bertalot in Krammer & Lange-Bertalot		2007-9S	Baci
<i>Fragilaria capucina</i> var. <i>gracilis</i> (Østrup) Hustedt		1991-2007F-2009S	Baci
<i>Fragilaria capucina</i> var. <i>vaucheriae</i> (Kützing) Lange-Bertalot	1872 1909 1926 (1872 1909 as ' <i>F. mutabilis</i> var. <i>intermedia</i> '; 1926 as ' <i>F. intermedia</i> ')		Baci
<i>Fragilaria constricta</i> f. <i>stricta</i> (A.Cleve) Hustedt	1926 (as ' <i>F. undata</i> ')		Baci
<i>Fragilaria construens</i> (Ehrenberg) Grunow f. <i>construens</i>	1913 1926 (as ' <i>F. c.</i> ')	2009-14ALS (as ' <i>Staurosira c.</i> ')	Baci
<i>Fragilaria construens</i> f. <i>binodis</i> (Ehrenberg) Hustedt		2007-9S	Baci
<i>Fragilaria construens</i> f. <i>venter</i> (Ehrenberg) Hustedt		1991-2007F-2009S	Baci
<i>Fragilaria cratonensis</i> Kitton	1909 1926 (1909 as ' <i>F. cratonensis</i> ') iss	2007-9S	Baci
<i>Fragilaria delicatissima</i> (W. Smith) Lange-Bertalot sensu Krammer & Lange-Bertalot	1909 (as ' <i>Aphanocapsa d.</i> ')	2007-9S14ALS	Baci
<i>Fragilaria dilatata</i> (Brébisson) Lange-Bertalot	1909 (as ' <i>Synedra capitata major</i> ')	2009-14ALS	Baci
<i>Fragilaria exigua</i> Grunow in Cleve & Möller	1926	2007-9S	Baci
<i>Fragilaria harrissonii</i> W.Smith	1913 (as ' <i>F. h. f. major</i> ')		Baci
<i>Fragilaria henryi</i> Lange-Bertalot in Lange-Bertalot & Genkal		2007-9S (as ' <i>F. famelica littoralis</i> ')	Baci
<i>Fragilaria incognita</i> Reichardt		2007-9S	Baci
<i>Fragilaria leptostauron</i> (Ehrenberg) Hustedt var. <i>leptostauron</i>		1991-2007F-2009S	Baci
<i>Fragilaria martyi</i> (Héribaud) Lange-Bertalot	1914 1926 (as ' <i>Opephora m.</i> ')		Baci
<i>Fragilaria mesolepta</i> Rabenhorst	1914 1926 (1926 as ' <i>F. capucina m.</i> ')	1991-2007F-2009S (as ' <i>F. capucina m.</i> '; 2007-9S also as ' <i>Pinnularia m.</i> ')	Baci
<i>Fragilaria nitzschioides</i> Grunow in Van Heurck		2007-9S	Baci
<i>Fragilaria parasitica</i> (W.Smith) Grunow		1991-2007F-2009S	Baci
<i>Fragilaria pinnata</i> Ehrenberg var. <i>pinnata</i>	1914 (1914 also as ' <i>Surirella p.</i> ')	1991-2007F-2009S	Baci
<i>Fragilaria pulchella</i> (Ralfs) Lange-Bertalot	1909 (as ' <i>Dictyosphaerium pulchellum</i> ')	2007-9S14ALS	Baci
<i>Fragilaria radians</i> (Kützing) Williams & Round	1872 1909 1914 1926 (as ' <i>Synedra r.</i> ')		Baci
<i>Fragilaria recapitellata</i> Lange-Bertalot & Metzeltin in Metzeltin, Lange-Bertalot & Nergui		1991-2007F-2009S (as ' <i>F. capucina capucina</i> ')	Baci
<i>Fragilaria robusta</i> (Fusey) Manguin		2007-9S (as ' <i>F. r.</i> ')	Baci
<i>Fragilaria rumpens</i> (Kützing) Carlson	1914 (as ' <i>Synedra r.</i> ')	1991-2007F-2009S (as ' <i>F. capucina rumpens</i> ')	Baci
<i>Fragilaria tenera</i> (W. Smith) Lange-Bertalot	1909 1914 1926 (as ' <i>Surirella t.</i> '; 1914 also as ' <i>Synedra t.</i> ')	2007-9S (2007-9S also as ' <i>Navicula t.</i> ')	Baci
<i>Fragilaria tenera</i> var. <i>lemanensis</i> J.C.Druart, S.Lavigne & M.Robert		2009-14ALS	Baci
<i>Fragilaria ulna</i> (Nitzsch) Lange-Bertalot	1872 1909 1913 1914 1926 (as ' <i>Synedra u.</i> ')	1991-2007F-2009S	Baci
<i>Fragilaria vaucheriae</i> (Kützing) Petersen	1914 (as ' <i>Synedra v.</i> ')	1991-2007F-2009S (as ' <i>F.</i> ')	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
		capucina vaucheriae')	
<i>Fragilaria virescens</i> Ralfs	1909 1926	2007-9S	Baci
<i>Fragilariforma virescens</i> (Ralfs) D.M.Williams & Round	1909 1926 (as 'F. producta')		Baci
<i>Frustulia amphipleuroides</i> (Grunow) Cleve- Euler	1914 (as 'Vanheurckia a. rhomboides')	2007-9S (as 'F. rhomboides amphipleuroide')	Baci
<i>Frustulia crassinervia</i> (Brébisson ex W.Smith) Lange-Bertalot & Krammer in Lange-Bertalot & Metzeltin		2007-9S (as 'F. rhomboides crassinervia')	Baci
<i>Frustulia rhomboides</i> (Ehrenberg) De Toni	1926 (as 'Navicula r.')	2007-9S	Baci
<i>Frustulia saxonica</i> Rabenhorst	1913 1914 1926 (1913 as 'Epithemia s.'; 1914 1926 also as 'Suriella s.')		Baci
<i>Frustulia vulgaris</i> (Thwaites) De Toni	1914 1926 (1914 as 'Vanheurckia v.'; 1926 as 'Suriella biseriata v.')	1991-2007F-2009S	Baci
<i>Geissleria acceptata</i> (Hustedt) Lange- Bertalot & Metzeltin		1991-2007F-2009S (as 'Navicula ignota acceptata')	Baci
<i>Geissleria decussis</i> (Hustedt) Lange-Bertalot & Metzeltin		2007-9S (as 'Navicula d.')	Baci
<i>Golenkinia brevispina</i> Korshikov		2009-14ALS	Chlo
<i>Gomphocymbella vulgaris</i> (Kützing) Otto Müller	1914 (as 'Gomphonema olivaceum vulgare')		Baci
<i>Gomphocymbellopsis ancyli</i> (Cleve) Krammer		2007-9S (as 'Cymbella a.')	Baci
<i>Gomphoneis exigua</i> (Kützing) Medlin	1914 (as 'Gomphonema exiguum')		Baci
<i>Gomphonema acuminatum</i> Ehrenberg var. <i>acuminatum</i>	1909 1913 1926 (1909 1913 as 'G. acuminatum intermedia'; 1909 1926 as 'G. a.'; 1926 also as 'Suriella linearis acuminata')	2007-9S	Baci
<i>Gomphonema acuminatum</i> var. <i>clavus</i> (Brébisson) Grunow in van Heurck	1913 1926 (1926 also as 'G. c.')		Baci
<i>Gomphonema aequale</i> W.Gregory	1926 (as 'G. aequalis') iss		Baci
<i>Gomphonema affine</i> Kützing	1914		Baci
<i>Gomphonema angustatum</i> (Kützing) Rabenhorst	1913 1926 (1913 as 'G. a. producta'; 1926 also as 'G. a. dichotoma')	2007-9S	Baci
<i>Gomphonema angustivalva</i> Reichardt		1991-2007F	Baci
<i>Gomphonema angustum</i> Agardh	1914	1991-2007F-2009S	Baci
<i>Gomphonema augur</i> Ehrenberg	1926	2007-9S	Baci
<i>Gomphonema auritum</i> A. Braun	1914	2007-9S	Baci
<i>Gomphonema bavaricum</i> Reichardt & Lange-Bertalot		2007-9S	Baci
<i>Gomphonema calcareum</i> Cleve	1914 (as 'G. olivaceum calcorum')	1991-2007F-2009S (as 'G. olivaceum calcareum')	Baci
<i>Gomphonema calcifugum</i> Lange-Bertalot & Reichardt		1991-2007F-2009S <i>Gomphonema olivaceum</i> var. <i>minutissimum</i> Hustedt chk	Baci
<i>Gomphonema capitatum</i> Ehrenberg	1913 1926 (1913 as 'G. constrictum var. capitata')		Baci
<i>Gomphonema commutatum</i> Grunow in Van Heurck	1914		Baci
<i>Gomphonema coronatum</i> Ehrenberg	1909 1913 1914 1926 (1909 1913 1914 as 'G. acuminatum c.'; 1926 as 'G. acuminatum acronatum') iss		Baci
<i>Gomphonema cymbelliclinum</i> Reichardt & Lange-Bertalot		2007-9S	Baci
<i>Gomphonema dichotomum</i> Kützing	1872 1909 1913 1914 (1872 1909 as 'G. clavatum var. d.'; 1913 as 'G. intricatum var. dichotoma')	2007-9S	Baci
<i>Gomphonema dichotomum</i> var. <i>sessile</i> Kützing	1914 (as 'G. sessilis')		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Gomphonema elongatum</i> W.Smith	1926		Baci
<i>Gomphonema exilissimum</i> (Grunow) Lange-Bertalot & Reichardt	1914 1926 (1914 as ' <i>G. parvum</i> e.'; 1926 as ' <i>G. parvum exilissima</i> ') iss	2007-9S	Baci
<i>Gomphonema gracile</i> Ehrenberg auct.		2007-9S	Baci
<i>Gomphonema hebridense</i> Gregory		2007-9S	Baci
<i>Gomphonema helveticum</i> var. <i>incurvatum</i> J.-J.Brun	1914		Baci
<i>Gomphonema insigne</i> W.Gregory	1914		Baci
<i>Gomphonema intricatum</i> Kützing	1872 1909 1913 1926		Baci
<i>Gomphonema intricatum</i> var. <i>brevistriatum</i> H.Kufferath	1872 1909 (as ' <i>G. intricatum</i> f. <i>brevis</i> ')		Baci
<i>Gomphonema lagenula</i> Kützing	1914		Baci
<i>Gomphonema lateripunctatum</i> Reichardt & Lange-Bertalot		1991-2007F-2009S	Baci
<i>Gomphonema micropus</i> Kützing	1914	1991-2007F-2009S	Baci
<i>Gomphonema minutum</i> (Agardh) Agardh		1991-2007F-2009S	Baci
<i>Gomphonema montanum</i> Schumann	1926		Baci
<i>Gomphonema occultum</i> Reichardt & Lange-Bertalot		2007-9S	Baci
<i>Gomphonema olivaceoides</i> Hustedt		1991-2007F-2009S (as ' <i>G. olivaceum olivaceoides</i> ')	Baci
<i>Gomphonema olivaceolacuum</i> (Lange-Bertalot & Reichardt) Lange-Bertalot & Reichardt		1991-2007F-2009S (as ' <i>G. olivaceum olivaceolacuum</i> ')	Baci
<i>Gomphonema olivaceum</i> (Hornemann) Brébisson	1926 (as ' <i>G. o.</i> ')	2007-9S (as ' <i>G. clavatum</i> ')	Baci
<i>Gomphonema olivaceum</i> (Hornemann) Brébisson var. <i>olivaceum</i>		1991-2007F-2009S 2007-9S	Baci
<i>Gomphonema parallelistriatum</i> Lange-Bertalot & E.Reichardt in Lange-Bertalot		2007-9S	Baci
<i>Gomphonema parvulus</i> (Lange-Bertalot & Reichardt) Lange-Bertalot & Reichardt		2007-9S	Baci
<i>Gomphonema parvulum</i> (Kützing) Kützing	1914 (as ' <i>G. exile</i> ')		Baci
<i>Gomphonema parvulum</i> Kützing var. <i>parvulum</i> f. <i>parvulum</i>	1913 1926 (1913 1926 as ' <i>G. .</i> '; 1913 also as ' <i>G. p. subcapitata</i> ')	1991-2007F-2009S 2007-9S	Baci
<i>Gomphonema parvulum</i> var. <i>parvulum</i> f. <i>saprophilum</i> Lange-Bertalot & Reichardt		2007-9S (as ' <i>Achnanthes minutissima saprophila</i> ')	Baci
<i>Gomphonema parvulum</i> var. <i>subcapitatum</i> Grunow in Van Heurck	1926		Baci
<i>Gomphonema procerum</i> Reichardt & Lange-Bertalot		2007-9S	Baci
<i>Gomphonema productum</i> (Grunow) Lange-Bertalot & Reichardt	1926 (as ' <i>G. angustatum</i> p.')	2007-9S	Baci
<i>Gomphonema pseudoboheemicum</i> Lange-Bertalot & Reichardt		2007-9S (as ' <i>G. boheemicum</i> ')	Baci
<i>Gomphonema pumilum</i> (Grunow) Reichardt & Lange-Bertalot var. <i>pumilum</i>	1913 1914 1926 (1913 1926 as ' <i>Navicula pumila</i> '; 1914 as ' <i>G. pumilum</i> '; 1926 as ' <i>G. angustatum pumila</i> ' and also as ' <i>G. intricatum</i> p.')	1991-2007F-2009S	Baci
<i>Gomphonema rhombicum</i> M. Schmidt		1991-2007F-2009S	Baci
<i>Gomphonema sarcophagum</i> Gregory	1926	1991-2007F-2007-9S (1993 1996 1997 2012 2015 as ' <i>G. sarcophagus</i> ') iss	Baci
<i>Gomphonema stauroneiforme</i> Grunow		1991-2007F-2009S	Baci
<i>Gomphonema subcapitatum</i> (Grunow) E.Reichardt & Levkov in Levkov, Mitic-Kopanja & E.Reichardt	1913 1914 (1913 as ' <i>G. constrictum</i> var. <i>subcapitata</i> '; 1914 as ' <i>G. constrictum</i> s.')		Baci
<i>Gomphonema subclavatum</i> (Grunow) Grunow	1913 1926		Baci
<i>Gomphonema subclavatum</i> var. <i>elongatum</i> Z.X.Shi	1914 (as ' <i>G. elongatum constrictum</i> ')		Baci
<i>Gomphonema subtile</i> Ehrenberg	1913 1914		Baci
<i>Gomphonema subtile</i> var. <i>sagitta</i>	1914 (as ' <i>G. sagitta</i> ')		Baci

Tab. 7: continued

(Schumann) Grunow in Van Heurck			
Taxon	19/20th century	20/21th century	Phylon
Gomphonema tergestinum Fricke		1991-2007F-2009S	Baci
Gomphonema trigonocephalum Ehrenberg	1914		Baci
Gomphonema truncatum Ehrenberg	1872 1909 1913 1926 (as 'G. constrictum')	1991-2007F-2009S	Baci
Gomphonema turris Ehrenberg	1914		Baci
Gomphonema vibrio Ehrenberg	1909 1914 1926 (1926 as 'G. intricatum v.')		Baci
Gomphonema vibrio var. pulvinatum (Braun ex Rabhorst) R.Ross	1913 1926 (1913 as 'G. intricatum var. pulvinata'; 1926 as 'G. intricatum p.')		Baci
Gomphonema vibrio var. pumilum (Grunow) R.Ross in B.Hartley, R.Ross & D.M.Williams	1913 (as 'G. intricatum var. pumila')		Baci
Gomphosphaeria aponina Kützing		2009-14ALS	Baci
Grunowia sinuata (Thwaites) Rabenhorst	1926		Baci
Grunowia solgensis (A.Cleve) Aboal in Aboal, Alvarez-Cobelas, Cambra & Ector		2007-9S (as 'Nitzschia sinuata delognei')	Baci
Grunowia tabellaria (Grunow) Rabenhorst	1914	1991-2007F-2009S (as 'Nitzschia sinuata t.')	Baci
Gymnodinium uberrimum (G.J.Allman) Kofoid & Swezy		2009-14ALS	Myzo
Gyrosigma acuminatum (Kützing) Rabenhorst var. acuminatum	1909 1914 1926 (1909 1914 1926 as 'Pleurosigma a.'; 1914 also as 'Pleurosigma a. lacustrum'; 1914 1926 as 'Pleurosigma spencerii')	1991-2007F-2009S 2009-14ALS (2009-14ALS as 'G. spenceri')	Baci
Gyrosigma acuminatum var. gallicum (Grunow) Cleve	1914 (as 'Pleurosigma a. gallicum')		Baci
Gyrosigma attenuatum (Kützing) Rabenhorst	1872 1909 1913 1914 1926 (as 'Pleurosigma a.')	2007-9S	Baci
Gyrosigma kuetzingii (Grunow) Cleve	1909 1914 (as 'Pleurosigma kützingii') iss		Baci
Gyrosigma obtusatum (Sullivant & Wormley) C. S. Boyer	1914 1926 (as 'Pleurosigma scalproides')	2007-9S (as 'G. scalproides')	Baci
Gyrosigma sciotoense (Sullivant) Cleve		1991-2007F-2009S (as 'G. nodiferum')	Baci
Gyrosigma wormleyi (Sullivant) Boyer	1926 (as 'Pleurosigma parked')		Baci
Halamphora coffeaeformis (C.Agardh) Levkov	1872 1909 (as 'Amphora c.')		Baci
Halamphora montana (Krasske) Levkov		1991-2007F-2009S (as 'Amphora m.')	Baci
Halamphora normanii (Rabenhorst) Levkov	1926 (as 'Amphora n.')	2007-9S (as 'Amphora n.')	Baci
Halamphora thumensis (A. Mayer) Levkov		2007-9S (as 'Amphora t.')	Baci
Halamphora veneta (Kützing) Levkov	1909 1926 (as 'Navicula v.'; 1926 as 'Amphora v.')	1991-2007F-2009S 2007-9S	Baci
Handmannia austriaca M. Peragallo in Handmann	1913 (1972 1991 as 'Handmanna a.') iss		Baci
Handmannia austriaca var. radiata M.Peragallo ex R.Handmann	1913		Baci
Handmannia glabriuscula (Grunow) Kociolek & Khursevich	1909 1913 1926 (1909 1926 as 'Cyclotella compta'; 1913 as 'Cyclotella compta var. g.')		Baci
Hannaea arcus (Ehrenberg) R.M.Patrick in R.M.Patrick & C.W.Reimer	1872 1909 1913 1914 1926 (1872 1909 1913 1914 1926 as 'Eunotia a.'; 1914 also as 'Ceratoneis a.')	1991-2007F-2009S 2007-9S (1991-2007F-2009S as 'Fragilaria a.')	Baci
Hannaea arcus var. amphioxys (Rabenhorst) R.M.Patrick	1913 1914 (as 'Ceratoneis a.')		Baci
Hantzschia amphioxys (Ehrenberg) Grunow in Cleve & Grunow	1913 1914 1926 (1914 1926 also as 'Nitzschia a.')	2007-9S	Baci
Hantzschia amphioxys var. minor H.Peragallo	1914		Baci
Hantzschia elongata (Hantzsch) Grunow	1926		Baci
Hariotina polychorda (Korshikov) E.Hegewald in E.Hegewald, P.F.M.Coesel &		2009-14ALS (as 'Coelastrum polychordum')	Chlo

Tab. 7: continued

P.Hegewald			
Taxon	19/20th century	20/21th century	Phylon
Hariotina reticulata P.A.Dangeard	1909 (as 'Coelastrum reticulatum')	2007-9S14ALS	Chlo
Hippodonta capitata (Ehrenberg) Lange-Bertalot, Metzeltin & Witkowski	1909 1914 1926 (as 'Synedra c.')	1991-2007F-2009S (as 'Navicula c.')	Baci
Hippodonta costulata (Grunow) Lange-Bertalot, Metzeltin & Witkowski		2007-9S (as 'Navicula c.')	Baci
Hippodonta lüneburgensis (Grunow) Lange-Bertalot, Metzeltin & A.Witkowski		2007-9S (as 'Navicula capitata lueneburgiensis') iss	Baci
Humidophila aerophila (Krasske) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová		2007-9S (as 'Navicula a.')	Baci
Hydrodictyon reticulatum (Linnaeus) Bory		2009-14ALS (as 'Cyanodictyon r.')	Chlo
Iconella bifrons (Ehrenberg) Ruck & Nakov in Ruck et al.	1914 1926 (as 'Surirella b.')	2007-9S	Baci
Iconella biseriata (Brébisson) Ruck & Nakov in Ruck et al.	1872 1909 1914 1926 (as 'Surirella b.')		Baci
Iconella helvetica (Brun) Ruck & Nakov in Ruck et al.		2007-9S (as 'Surirella linearis h.')	Baci
Iconella hibernica (Ehrenberg)	1909 (as 'Camylodiscus hibernicus')		Baci
Karayevia clevei (Grunow) Bukhtiyarova		1991-2007F-2009S (as 'Achnanthes c.')	Baci
Karayevia kolbei (Hustedt) Bukhtiyarova		2007-9S (as 'Achnanthes k.i.')	Baci
Karayevia laterostrata (Hustedt) Bukhtiyarova		2007-9S (2007-9S as 'Navicula l.' and (as 'Achnanthes l.')	Baci
Karayevia ploenensis (Hustedt) Bukhtiyarova		1991-2007F-2009S (as 'Achnanthes p.')	Baci
Karayevia suchlandtii (Hustedt) Bukhtiyarova		2007-9S (as 'Achnanthes s.')	Baci
Kirchneriella obesa (West) West & G.S.West	1909	2007-9S14ALS	Chlo
Kobayasiella parasubtilissima (Kobayasi & Nagumo) Lange-Bertalot		2007-9S (as 'Navicula subtilissima')	Baci
Korshikoviella limnetica (Lemmermann) P.C.Silva		2007-9S	Chlo
Kurtkrammeria aequalis (W.Smith) L.Bahls	1926 (as 'Cymbella a.')		Baci
Lagerheimia genevensis (Chodat) Chodat	1909	2007-9S14ALS	Chlo
Lemnicola hungarica (Grunow) Round & Basson	1926 (as 'Achnanthes h.')	2007-9S	Baci
Limnococcus limneticus (Lemmermann) Komárková, Jezberová, O.Komárek & Zapomelová	1909 (as 'Chroococcus l.')	2007-9S14ALS	Proc
Limnothrix redekei (Goor) Meffert		2009-14ALS	Proc
Lindavia affinis (Grunow) Nakov, Guillory, Julius, Theriot & Alverson	1914 (as 'Cyclotella a.')		Baci
Lindavia bodanica (Eulenstein ex Grunow) T.Nakov, Guillory, Julius, Theriot & Alverson	1872 1909 1926 (as 'Cyclotella b.')	2007-9S14ALS (2007-9S as 'Cyclotella b.')	Baci
Lindavia comta (Kützing) Nakov, Gullory, Julius, Theriot & Alverson	1901 1906 1909 1913 1914 (as 'Cyclotella c.')		Baci
Lindavia radiosa var. tenuis (Fricke) T.Nakov et al.	1926 (as 'Cyclotella comta radiosa tenuis')		Baci
Luticola cohnii (Hilse) D.G.Mann in Round, R.M.Crawford & D.G.Mann		2007-9S (as 'Navicula c.')	Baci
Luticola goeppertiana (Bleisch) D.G. Mann		1991-2007F-2009S 2007-9S (1991-2007F-2009S as 'Navicula g.'; 2007-9S as 'Epithemia g.')	Baci
Luticola nivalis (Ehrenberg) D.G.Mann in Round, R.M.Crawford & D.G.Mann		2007-9S (as 'Navicula n.')	Baci
Luticola quineuensis (Grunow) Levkov, Metzeltin & A.Pavlov	1914 (as 'Navicula quinquenodia')		Baci
Luticola ventricosa (Kützing) D.G.Mann in Round, R.M.Crawford & D.G.Mann	1914 1926 (as 'Stauroneis v.')		Baci
Mastogloia lacustris (Grunow) Grunow in Van Heurck		2007-9S (as 'Mastogloia smithii l.')	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Mastogloia smithii</i> Thwaites ex W.Smith	1872 1909 1914 1926	2007-9S	Baci
<i>Mayamaea agrestis</i> (Hustedt) Lange-Bertalot		2007-9S (as ' <i>Navicula a.</i> ')	Baci
<i>Mayamaea atomus</i> (Kützing) Lange-Bertalot	1913 1926 (as ' <i>Navicula a.s.</i> ')	1991-2007F 2007-9S	Baci
<i>Mayamaea atomus</i> var. <i>permitis</i> (Hustedt) Lange-Bertalot		1991-2007F-2009S (as ' <i>Navicula a. p.</i> ')	Baci
<i>Mayamaea muraliformis</i> Lange-Bertalot		2007-9S (as ' <i>Navicula m.</i> ')	Baci
<i>Melosira binderiana</i> (Kützing) G.Rabenhorst	1909		Baci
<i>Melosira juergensii</i> f. <i>bothnica</i> (Grunow) Cleve	1913 (as ' <i>M. jürgensii</i> ')		Baci
<i>Melosira lineata</i> (Dillwyn) C.Agardh	1914		Baci
<i>Melosira lineolata</i> var. <i>robusta</i> Héribaud-Joseph	1909 (as ' <i>M. l.</i> ')		Baci
<i>Melosira varians</i> Agardh	1909 1926	1991-2007F-2009S	Baci
<i>Meridion circulare</i> (Greville) Agardh	1913 (as ' <i>Navicula acrosphaeria genuina</i> ')		Baci
<i>Meridion circulare</i> (Greville) Agardh var. <i>circulare</i>	1913 1914 1926 (as ' <i>M. c.</i> '; 1913 also as ' <i>Meridion c. f. curta</i> ')	1991-2007F-2009S	Baci
<i>Meridion circulare</i> f. <i>minor</i> Schaarschmidt	1914		Baci
<i>Meridion circulare</i> var. <i>constrictum</i> (Ralfs) Van Heurck		2007-9S (as ' <i>Meridion circulare constricta</i> ')	Baci
<i>Meridion circulare</i> var. <i>zinckenii</i> (Kützing) Grunow	1914		Baci
<i>Merismopedia minima</i> G.Beck in G.Beck & Zahlbruckner		2007-9S	Proc
<i>Merismopedia tenuissima</i> Lemmermann		2009-14ALS	Proc
<i>Merismopedia warmingiana</i> (Lagerheim) Forti		2009-14ALS	Proc
<i>Micractinium quadrisetum</i> (Lemmermann) G.M.Smith		2009-14ALS	Chlo
<i>Microcostatus krasskei</i> (Hustedt) Johansen & Sray		2007-9S (as ' <i>Navicula k.</i> ')	Baci
<i>Microcystis aeruginosa</i> (Kützing) Kützing		2009-14ALS	Proc
<i>Microcystis flosaquae</i> (Wittrock) Kirchner		2009-14ALS	Proc
<i>Microcystis ichthyoblabe</i> (G.Kunze) Kützing		2009-14ALS	Proc
<i>Microcystis novacekii</i> (Komárek) Compère		2009-14ALS	Proc
<i>Microcystis wesenbergii</i> (Komárek) Komárek ex Komárek in Joosen		2009-14ALS	Proc
<i>Monactinus simplex</i> (Meyen) Corda		2007-9S	Chlo
<i>Monoraphidium arcuatum</i> (Korshikov) Hindák		2009-14ALS	Chlo
<i>Monoraphidium contortum</i> (Thuret) Komárková-Legnerová in Fott	1909	2007-9S14ALS	Chlo
<i>Monoraphidium dybowskii</i> (Woloszynska) Hindák & Komárková-Legnerová in Komárková-Legnerová		2009-14ALS	Chlo
<i>Monoraphidium fontinale</i> Hindák		2009-14ALS	Chlo
<i>Monoraphidium griffithii</i> (Berkeley) Komárková-Legnerová	1909	2007-9S14ALS	Chlo
<i>Monoraphidium komarkovae</i> Nygaard		2009-14ALS	Chlo
<i>Monoraphidium tortile</i> (West & G.S.West) Komárková-Legnerová		2007-9S	Chlo
<i>Muelleria gibbula</i> (Cleve) Spaulding & Stoermer	1913 (as ' <i>Navicula silicula</i> var. <i>gibberula</i> ')	2007-9S (as ' <i>Navicula g.</i> ')	Baci
<i>Navicula acrosphaeria</i> var. <i>elongata</i> Héribaud-Joseph	1913		Baci
<i>Navicula angusta</i> Grunow		2007-9S	Baci
<i>Navicula antonii</i> Lange-Bertalot in U.Rumrich, Lange-Bertalot & M.Rumrich		1991-2007F-2009S (as ' <i>Navicula menisculus grunowii</i> ')	Baci
<i>Navicula aquaedurae</i> Lange-Bertalot		2007-9S	Baci
<i>Navicula asellus</i> Weinhold ex Hustedt in A.Schmidt		2007-9S	Baci
<i>Navicula bacilliformis</i> Grunow in Cleve & Grunow	1913 1914 1926		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Navicula bicephala</i> Hustedt	1909 1914		Baci
<i>Navicula bipunctata</i> Grunow	1926		Baci
<i>Navicula budensis</i> Grunow in Van Heurck	1926		Baci
<i>Navicula canoris</i> M.H.Hohn & Hellerman		2007-9S	Baci
<i>Navicula capitatoradiata</i> Germain		1991-2007F-2009S	Baci
<i>Navicula cari</i> Ehrenberg	1913	1991-2007F-2009S 2007-9S (2007-9S as 'N. graciloides')	Baci
<i>Navicula catalanogermanica</i> Lange-Bertalot & G.Hofmann in Lange-Bertalot		2007-9S	Baci
<i>Navicula cataracta-rheni</i> Lange-Bertalot		2007-9S (as 'N. cataractarheni') iss	Baci
<i>Navicula cryptocephala</i> Kützing	1872 1909 1913 1926 (1913 1926 also as 'Achnanthes minutissima c.')	1991-2007F-2009S	Baci
<i>Navicula cryptofallax</i> Lange-Bertalot & Hofmann		2007-9S	Baci
<i>Navicula cryptotenella</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Navicula cryptotenelloides</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Navicula cymbula</i> Donkin	1914		Baci
<i>Navicula dicephala</i> Ehrenberg	1913 1926		Baci
<i>Navicula digitoradiata</i> (W.Gregory) Ralfs in Prichard	1914 (as 'N. digito-radiata')		Baci
<i>Navicula erifuga</i> Lange-Bertalot in Krammer & Lange-Bertalot	1914 (as 'N. leptcephala')		Baci
<i>Navicula exilis</i> Kützing	1913 1926 (as 'N. cryptocephala e.')	2007-9S	Baci
<i>Navicula firma</i> var. <i>diminuta</i> Pantocsek	1913 1914 1926		Baci
<i>Navicula flantica</i> Grunow		2007-9S	Baci
<i>Navicula gendrei</i> Héribaud-Joseph	1926		Baci
<i>Navicula gottlandica</i> Grunow in Van Heurck	1913 1926 (as 'N. gothlandica') iss	2007-9S	Baci
<i>Navicula gregaria</i> Donkin		1991-2007F-2009S	Baci
<i>Navicula harderi</i> Hustedt in Brendemühl		2007-9S	Baci
<i>Navicula ignota</i> var. <i>ignota</i> Krasske		2007-9S	Baci
<i>Navicula integra</i> (W. Smith) Ralfs		2007-9S	Baci
<i>Navicula jakovljevicii</i> Hustedt		1991-2007F-2009S	Baci
<i>Navicula lacuum</i> Lange-Bertalot, Hofmann, Werum & Van de Vijver		1991-2007F-2009S (as 'Nitzschia l.')	Baci
<i>Navicula laevis</i> Pantocsek	1926		Baci
<i>Navicula legumen</i> Ehrenberg	1926	2007-9S (as 'Stauroneis l.')	Baci
<i>Navicula limosa</i> var. <i>subinflata</i> Grunow	1913 1914 1926		Baci
<i>Navicula lundii</i> Reichardt		2007-9S	Baci
<i>Navicula menisculus</i> Schumann	1914 1926	2007-9S	Baci
<i>Navicula mutica</i> var. <i>ventricosa</i> (Kützing) Cleve & Grunow	1914 (as 'N. m.')	1991-2007F-2009S 2007-9S	Baci
<i>Navicula nivaloides</i> W.Bock		2007-9S	Baci
<i>Navicula oblonga</i> Kützing	1909 1913 1914 1926		Baci
<i>Navicula oblonga</i> var. <i>curta</i> M.Peragallo	1926		Baci
<i>Navicula palpebralis</i> Brébisson ex W.Smith	1914		Baci
<i>Navicula peregrina</i> (Ehrenberg) Kützing	1909 1913		Baci
<i>Navicula perminuta</i> Grunow		2007-9S	Baci
<i>Navicula praeterita</i> Hustedt		2007-9S	Baci
<i>Navicula pseudolanceolata</i> Lange-Bertalot		2007-9S	Baci
<i>Navicula pseudotuscula</i> Hustedt		2007-9S	Baci
<i>Navicula pupula</i> var. <i>minor</i> Kützing	1926		Baci
<i>Navicula radiosa</i> Kützing	1872 1909 1913 1914 1926 (1913 1914 1926 also as 'N. r. acuta')	1991-2007F-2009S	Baci
<i>Navicula radiosafallax</i> Lange-Bertalot		2007-9S	Baci
<i>Navicula recens</i> (Lange-Bertalot) Lange-Bertalot		2007-9S	Baci
<i>Navicula reichardtiana</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Navicula reinhardtii</i> Grunow sensu Krammer & Lange-Bertalot	1914 1926 (1926 as 'N. reinhartii')iss	1991-2007F-2009S	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Navicula rhynchocephala</i> Kützing	1914 1926	2007-9S	Baci
<i>Navicula rhynchotella</i> Lange-Bertalot	1914 (as ' <i>N. rhynchcephala</i> amphicerus')		Baci
<i>Navicula rostellata</i> Kützing	1914	2007-9S (as ' <i>N. viridula</i> r.')	Baci
<i>Navicula rotaeana</i> (Rabenhorst) Grunow in Van Heurck	1914 1926		Baci
<i>Navicula rotaeana</i> var. <i>oblongella</i> Grunow	1914		Baci
<i>Navicula schmassmannii</i> Hustedt		2007-9S	Baci
<i>Navicula schroeteri</i> F.Meister		2007-9S	Baci
<i>Navicula seibigii</i> Lange-Bertalot		2007-9S	Baci
<i>Navicula semen</i> Ehrenberg	1913 (as ' <i>N. semen</i> ') unnamed var.		Baci
<i>Navicula slesvicensis</i> Grunow		1991-2007F-2009S	Baci
<i>Navicula söhrensensis</i> Krasske		2007-9S (as ' <i>N. sohrensensis</i> ') iss	Baci
<i>Navicula splendicula</i> Van Landingham		1991-2007F-2009S	Baci
<i>Navicula striolata</i> (Grunow) Lange-Bertalot		2007-9S	Baci
<i>Navicula subconstricta</i> (Ehrenberg) H.W.Reichardt	1914		Baci
<i>Navicula submuralis</i> Hustedt		2007-9S	Baci
<i>Navicula tenelloides</i> Hustedt		2007-9S	Baci
<i>Navicula termes</i> (Ehrenberg) O'Meara	1913 1914 1926		Baci
<i>Navicula tridentula</i> Krasske		2007-9S	Baci
<i>Navicula tripunctata</i> (O.F.Müller) Bory in Bory de Saint-Vincent	1913 1914 1926 (as ' <i>N. gracilis neglecta</i> ')	1991-2007F-2009S	Baci
<i>Navicula trivialis</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Navicula vernalis</i> Donkin	1914		Baci
<i>Navicula vilaplanii</i> (Lange-Bertalot & Sabater) Lange-Bertalot & Sabater in U.Rumrich, Lange-Bertalot & M.Rumrich		1991-2007F-2009S (as ' <i>N. longicephala</i> v.')	Baci
<i>Navicula viridula</i> (Kützing) Ehrenberg	1913 1914 1926	2007-9S	Baci
<i>Navicula viridula</i> f. <i>minor</i> Grunow in Van Heurck	1926		Baci
<i>Navicula viridula</i> var. <i>avenacea</i> (Brébisson) Van Heurck	1913 1926 (1926 also as ' <i>N. avenacea</i> ')		Baci
<i>Navicula viridula</i> var. <i>germainii</i> (Wallace) Lange-Bertalot		2007-9S	Baci
<i>Navicula viridula</i> var. <i>linearis</i> Hustedt		2007-9S	Baci
<i>Navicula weinzierlii</i> H.Schimanski		2007-9S	Baci
<i>Navicula wildii</i> Lange-Bertalot		2007-9S	Baci
<i>Neidium affine</i> (Ehrenberg) Pfitzer	1913 1914 1926 (as ' <i>Navicula affinis</i> ') iss	2007-9S	Baci
<i>Neidium alpinum</i> Hustedt		2007-9S	Baci
<i>Neidium ampliatum</i> (Ehrenberg) Krammer in Krammer & Lange-Bertalot	1913 1926 (as ' <i>Navicula iridis ampliata</i> ')	2007-9S	Baci
<i>Neidium binodeforme</i> Krammer		2007-9S	Baci
<i>Neidium binodis</i> (Ehrenberg) Hustedt		2007-9S	Baci
<i>Neidium bisulcatum</i> (Lagerstedt) Cleve var. <i>bisulcatum</i>	1913 1926 (as ' <i>Navicula bisulcata</i> ')	2007-9S	Baci
<i>Neidium bisulcatum</i> var. <i>subundulatum</i> (Grunow) Reimer in Patrick & Reimer	1913 (as ' <i>Navicula firma</i> var. <i>subundulata</i> ')		Baci
<i>Neidium bisulcatum</i> var. <i>turgidulum</i> (Lagerstedt) F.Meister	1926 (as ' <i>Navicula bisulcata turgidula</i> ')		Baci
<i>Neidium dubium</i> (Ehrenberg) Cleve	1913 1926 (as ' <i>Navicula dubia</i> ')		Baci
<i>Neidium iridis</i> (Ehrenberg) Cleve agg.	1909 1913 1914 1926 (1909 1913 1926 as ' <i>Navicula firma</i> ' and as ' <i>Navicula amphigomphus</i> ', 1926 also as ' <i>Navicula amphigompha</i> '; 1913 1926 also as ' <i>Navicula i. istriana</i> '; 1926 also as ' <i>Navicula firma obliqua</i> '; 1909 also as ' <i>Navicula i. unnamed</i> var.')		Baci
<i>Neidium productum</i> (W. Smith) Cleve var. <i>productum</i>	1914 1926 (as ' <i>Navicula producta</i> ')	2007-9S (as ' <i>Stauroneis producta</i> ')	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Nephrocytium agardhianum</i> Nägeli (as 'Agardhianum')		2009-14ALS	Chlo
<i>Nephrocytium limneticum</i> (G.M.Smith) G.M.Smith		2009-14ALS	Chlo
<i>Nitzschia alpina</i> Hustedt		2007-9S	Baci
<i>Nitzschia amphibia</i> Grunow	1913 1914 1926	1991-2007F-2009S	Baci
<i>Nitzschia angustata</i> Grunow	1909 1913 1914 1926	2007-9S	Baci
<i>Nitzschia angustata</i> var. <i>curta</i> Cleve	1914 1926		Baci
<i>Nitzschia angustatula</i> Lange-Bertalot		2007-9S	Baci
<i>Nitzschia angustiforaminata</i> Lange-Bertalot		2007-9S	Baci
<i>Nitzschia archibaldii</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Nitzschia bremensis</i> Husted		2007-9S	Baci
<i>Nitzschia brevissima</i> Grunow		2007-9S	Baci
<i>Nitzschia bulnheimiana</i> (Rabenhorst) H.L.Smith		2007-9S (as 'N. frustulum b.')	Baci
<i>Nitzschia calida</i> Grunow		2007-9S	Baci
<i>Nitzschia capitellata</i> Hustedt var. <i>capitellata</i>	1914 (as 'Diatoma capitutulata' and as 'Synedra c.')	2007-9S	Baci
<i>Nitzschia commutata</i> Grunow in Cleve & Grunow	1914	2007-9S	Baci
<i>Nitzschia constricta</i> (Gregory) Grunow	1872 1909 1913 1926 (as 'Suriella linearis c.')		Baci
<i>Nitzschia dealpina</i> Lange-Bertalot & Hofmann		2007-9S	Baci
<i>Nitzschia debilis</i> Arnott		1991-2007F-2009S	Baci
<i>Nitzschia denticula</i> Grunow	1914 1926 (1926 also as 'N. denticola') ^{iss}	1991-2007F 2009-14ALS (1991-2007F as 'Denticula kuetzingii'; 2009-14ALS as 'Closterium kuetzingii')	Baci
<i>Nitzschia dissipata</i> (Kützing) Grunow subsp. <i>dissipata</i>	1914 1926 (as 'N. d.')	1991-2007F-2009S	Baci
<i>Nitzschia dissipata</i> var. <i>media</i> (Hantzsch) Grunow in Van Heurck	1914 (as 'N. m.')	2007-9S	Baci
<i>Nitzschia draveillensis</i> Coste & Ricard		2007-9S	Baci
<i>Nitzschia dubia</i> W. Smith	1909 1914 1926	2007-9S (2007-9S also as 'Neidium dubium')	Baci
<i>Nitzschia elegantula</i> Grunow in van Heurck	1914		Baci
<i>Nitzschia fonticola</i> Grunow var. <i>fonticola</i>	1913 (as 'N. f.')	1991-2007F-2009S	Baci
<i>Nitzschia fossilis</i> (Grunow) Grunow in Van Heurck		2007-9S	Baci
<i>Nitzschia frustulum</i> (Kützing) Grunow var. <i>frustulum</i>	1914 (as 'N. f.')	2007-9S	Baci
<i>Nitzschia frustulum</i> var. <i>inconspicua</i> Grunow		1991-2007F-2009S (as 'N. inconspicua')	Baci
<i>Nitzschia fruticosa</i> Hustedt		2007-9S	Baci
<i>Nitzschia gessneri</i> Hustedt		2007-9S	Baci
<i>Nitzschia graciliformis</i> Lange-Bertalot & Simonsen		2007-9S	Baci
<i>Nitzschia gracilis</i> Hantzsch	1909 1914 1926	1991-2007F	Baci
<i>Nitzschia hantzschiana</i> Rabenhorst	1909 1914 (1909 as 'Tryblionella h.')	1991-2007F-2009S	Baci
<i>Nitzschia heufferiana</i> Grunow	1913 1914 1926 (1913 1914 1926 also as 'Navicula cinta heufferi') ^{iss}	1991-2007F-2009S	Baci
<i>Nitzschia homburgiensis</i> Lange-Bertalot		2007-9S	Baci
<i>Nitzschia hungarica</i> Grunow	1913 1926 (as 'Cymbella h.')	2007-9S	Baci
<i>Nitzschia intermedia</i> Hantzsch	1914	2007-9S	Baci
<i>Nitzschia levidensis</i> (W. Smith) Grunow var. <i>levidensis</i>		1991-2007F-2009S	Baci
<i>Nitzschia linearis</i> var. <i>subtilis</i> Hustedt		1991-2007F-2009S	Baci
<i>Nitzschia linearis</i> W. Smith	1872 1909 1913 1914 1926 (1872 1909 1913 1914 1926 also as 'Suriella l.'; 1914 as 'Ceratonis l.')	1991-2007F-2009S 2007-9S	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Nitzschia littoralis</i> Grunow		2007-9S	Baci
<i>Nitzschia macilentata</i> W.Gregory in Greville	1909 1926		Baci
<i>Nitzschia microcephala</i> Grunow	1926 (as ' <i>Cymbella</i> m.')	1991-2007F-2009S	Baci
<i>Nitzschia minuta</i> Kützing (Bleisch)	1914		Baci
<i>Nitzschia modesta</i> Hustedt		2007-9S	Baci
<i>Nitzschia oligotraphenta</i> (Lange-Bertalot) Lange-Bertalot		1991-2007F	Baci
<i>Nitzschia palea</i> (Kützing) W.Smith	1872 1909 1913 1914 (1913 as ' <i>N. palea</i> var. <i>tenuirostris</i> ')	1991-2007F-2009S	Baci
<i>Nitzschia palea</i> var. <i>debilis</i> (Kützing) Grunow in Cleve & Grunow		2007-9S	Baci
<i>Nitzschia paleacea</i> (Grunow) Grunow in Van Heurck	1913 1926	1991-2007F-2009S	Baci
<i>Nitzschia perminuta</i> (Grunow) Peragallo		2007-9S	Baci
<i>Nitzschia pura</i> Hustedt		2007-9S	Baci
<i>Nitzschia pusilla</i> Grunow	1913 1926 (as ' <i>Cymbella</i> p.')	1991-2007F-2009S	Baci
<i>Nitzschia recta</i> Hantzsch	1914	1991-2007F-2009S	Baci
<i>Nitzschia sigma</i> (Kützing) W. Smith	1914	2007-9S	Baci
<i>Nitzschia sigma</i> var. <i>intercedens</i> Grunow	1926		Baci
<i>Nitzschia sigmoidea</i> (Nitzsch) W. Smith	1909 1913 1914 1926 (1926 also as ' <i>N. elongata</i> ')	2007-9S	Baci
<i>Nitzschia sociabilis</i> Hustedt		1991-2007F-2009S	Baci
<i>Nitzschia solita</i> Hustedt		2007-9S	Baci
<i>Nitzschia subacicularis</i> Hustedt	1909 1914 (as ' <i>N. acicularis</i> ')	1991-2007F-2009S14ALS 2007-9S	Baci
<i>Nitzschia sublinearis</i> Hustedt		1991-2007F-2009S	Baci
<i>Nitzschia supralitorea</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Nitzschia tenuis</i> W.Smith	1909 1913 1914 1926		Baci
<i>Nitzschia thermalis</i> (Ehrenberg) Auerswald in Rabenhorst	1926 (as ' <i>Navicula</i> t.')		Baci
<i>Nitzschia tryblionella</i> Hantzsch in Rabenhorst	1914 1926 (as ' <i>Surirella gracilis</i> ')	2007-9S	Baci
<i>Nitzschia tubicola</i> Grunow in Cleve & Grunow		2007-9S	Baci
<i>Nitzschia valdecostata</i> Lange-Bertalot & Simonsen		2007-9S	Baci
<i>Nitzschia valdestriata</i> Aleem & Hustedt		2007-9S	Baci
<i>Nitzschia vermicularis</i> (Kützing) Hantzsch	1909 1914 1926	2007-9S	Baci
<i>Nitzschia vermicularis</i> var. <i>lamprocampa</i> (Hantzsch ex Cleve & Grunow) Grunow in Van Heurck	1909 (as ' <i>N. l.</i> ')		Baci
<i>Nitzschia wuellerstorffii</i> Lange-Bertalot		1991-2007F-2009S	Baci
<i>Nupela lapidosa</i> (Krasske) Lange-Bertalot		2007-9S (as ' <i>Navicula l.</i> ')	Baci
<i>Oocystis borgei</i> J.W.Snow		2007-9S	Chlo
<i>Oocystis lacustris</i> Chodat		2007-9S	Chlo
<i>Oocystis marssonii</i> Lemmermann		2009-14ALS	Chlo
<i>Oscillatoria limosa</i> C.Agardh ex Gomont		2009-14ALS	Proc
<i>Pandorina morum</i> (O.F.Müller) Bory in J.V.Lamouroux, Bory & Deslongs-champs (as ' <i>mora</i> ')	1909	2007-9S14ALS	Chlo
<i>Pantocsekiella comensis</i> (Grunow) K.T.Kiss & E.Ács in Ács et al.	1909 1926 (as ' <i>Cyclotella</i> c.')	2007-9S14ALS	Baci
<i>Pantocsekiella kuetzingiana</i> (Thwaites) K.T.Kiss & E.Ács in Ács et al.	1913 1926 (as ' <i>Cyclotella</i> k.')	2009-14ALS	Baci
<i>Pantocsekiella ocellata</i> (Pantocsek) K.T.Kiss & E.Ács in Ács et al.	1909 (as ' <i>Cyclotella</i> o.')	2007-9S14ALS	Baci
<i>Parlibellus crucicula</i> (W.Smith) Witkowski, Lange-Bertalot & Metzeltin		2007-9S (as ' <i>Navicula</i> c.')	Baci
<i>Parlibellus protracta</i> (Grunow) Witkowski, Lange-Bertalot & Metzeltin		1991-2007F-2009S (as ' <i>Navicula</i> p.')	Baci
<i>Pediastrum duplex</i> Meyen	1909	2007-9S14ALS	Chlo
<i>Peridinium willei</i> Huitfeldt-Kaas (as ' <i>Willei</i> ')	1909	2007-9S14ALS	Myzo
<i>Phacotus lenticularis</i> (Ehrenberg) Deising		2009-14ALS	Chlo
<i>Pinnularia acrosphaeria</i> var. <i>sandvicensis</i>	1909 (as ' <i>Navicula ramingensis</i> ')		Baci

Tab. 7: continued

A.Schmidt			
Taxon	19/20th century	20/21th century	Phylon
<i>Pinnularia appendiculata</i> (C.Agardh) Schaarschmidt	1926 (as ' <i>Navicula</i> a.')	2007-9S	Baci
<i>Pinnularia bicapitata</i> (Lagerstedt) Cleve	1909 1926 (as ' <i>Navicula</i> b.')		Baci
<i>Pinnularia borealis</i> Ehrenberg var. <i>borealis</i>	1909 (as ' <i>Amphora</i> b.')	2007-9S	Baci
<i>Pinnularia brauniana</i> (Grunow) Studnicka		2007-9S (2007-9S also as ' <i>Pinnularia braunii</i> ')	Baci
<i>Pinnularia brebissonii</i> (Kützing) Rabenhorst	1913 1914 1926 (1913 as ' <i>Navicula</i> b.', ' <i>Navicula</i> b. var. <i>curta</i> ', ' <i>Navicula</i> brebissonii' iss; 1913 1914 as ' <i>Gomphonema</i> brebissonii'; 1914 also as ' <i>Pleurosigma</i> b.'; 1926 as ' <i>Navicula</i> b. <i>curta</i> ')	2007-9S	Baci
<i>Pinnularia cardinalis</i> (Ehrenberg) W.Smith	1913 1926 (as ' <i>Navicula</i> c.')		Baci
<i>Pinnularia dactylus</i> Ehrenberg	1913 (as ' <i>Navicula</i> d.')		Baci
<i>Pinnularia divergens</i> W.Smith	1909 1913 1914 1926 (as ' <i>Navicula</i> major'; 1913 also as ' <i>Navicula</i> d.')		Baci
<i>Pinnularia episcopalis</i> Cleve	1913 1926 (as ' <i>Navicula</i> e. <i>brevis</i> ')		Baci
<i>Pinnularia flexuosa</i> Cleve	1913 1926 (as ' <i>Navicula</i> f.')		Baci
<i>Pinnularia gentilis</i> (Donkin) Cleve	1913 1926 (as ' <i>Navicula</i> g.')		Baci
<i>Pinnularia gibba</i> (Ehrenberg) Ehrenberg	1913 1926 (as ' <i>Navicula</i> stauroptera')		Baci
<i>Pinnularia globiceps</i> W.Gregory		2007-9S	Baci
<i>Pinnularia gracillima</i> W.Gregory	1913 1926 (as ' <i>Navicula</i> g.')		Baci
<i>Pinnularia hemiptera</i> (Kützing) Rabenhorst	1914 (as ' <i>Navicula</i> h.')		Baci
<i>Pinnularia intermedia</i> (Lagerstedt) Cleve		2007-9S	Baci
<i>Pinnularia islandica</i> Østrup		2007-9S (as ' <i>P. woerthensis</i> ')	Baci
<i>Pinnularia johnsonii</i> W.Smith	1926 (as ' <i>Navicula</i> j.')		Baci
<i>Pinnularia lagerstedtii</i> (Cleve) Cleve-Euler		2007-9S	Baci
<i>Pinnularia lata</i> (Brébisson) W.Smith	1926 (as ' <i>Navicula</i> l.')		Baci
<i>Pinnularia lundii</i> Hustedt var. <i>lundii</i>		2007-9S	Baci
<i>Pinnularia macilenta</i> Ehrenberg	1909 1914 (as ' <i>Navicula</i> m.')		Baci
<i>Pinnularia major</i> (Kützing) Rabenhorst		2007-9S	Baci
<i>Pinnularia major</i> var. <i>linearis</i> Cleve	1913 1926 (as ' <i>Navicula</i> m. l.')		Baci
<i>Pinnularia major</i> var. <i>paludosa</i> F.Meister	1926 (as ' <i>Navicula</i> m. p.')		Baci
<i>Pinnularia microstauron</i> (Ehrenberg) Cleve var. <i>microstauron</i>	1913 1914 1926 (as ' <i>Navicula</i> mikrostauroon') iss	2007-9S	Baci
<i>Pinnularia nobilis</i> (Ehrenberg) Ehrenberg	1909 1913 1926 (1909 1913 1926 as ' <i>Navicula</i> n.'; 1909 also as ' <i>Navicula</i> n. f. <i>minor</i> ') 1926 also (as ' <i>Stauroneis</i> n.')		Baci
<i>Pinnularia nodosa</i> (Ehrenberg) W.Smith	1913 (as ' <i>Navicula</i> n.')	2007-9S	Baci
<i>Pinnularia parva</i> W.Gregory	1914 (as ' <i>Navicula</i> p.')		Baci
<i>Pinnularia rupestris</i> Hantzsch in Rabenhorst	1913 1914 1926 (as ' <i>Navicula</i> r.')		Baci
<i>Pinnularia rupestris</i> Krammer		2007-9S	Baci
<i>Pinnularia schoenfelderii</i> Krammer		2007-9S (2007-9S also as ' <i>Navicula schoenfeldii</i> ')	Baci
<i>Pinnularia scotica</i> Krammer		2007-9S	Baci
<i>Pinnularia septentrionalis</i> Krammer	1913 1914 (as ' <i>Navicula mesolepta</i> stauroneiformis') ev		Baci
<i>Pinnularia silvatica</i> J.B.Petersen		2007-9S	Baci
<i>Pinnularia sinistra</i> Krammer		2007-9S	Baci
<i>Pinnularia subcapitata</i> Gregory var. <i>subcapitata</i>	1914 1926 (as ' <i>Navicula</i> s.')	2007-9S (as ' <i>P. subcapitata</i> ')	Baci
<i>Pinnularia subcapitata</i> var. <i>elongata</i> Krammer	1926 (as ' <i>Navicula oblonga</i> s.'; 1926 also as ' <i>Navicula acrosphæria</i> e.')		Baci
<i>Pinnularia subgibba</i> Krammer		2007-9S	Baci
<i>Pinnularia subrupestris</i> Krammer		2007-9S	Baci
<i>Pinnularia tabellaria</i> Ehrenberg	1914 1926 (as ' <i>Navicula</i> t.')		Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Pinnularia viridiformis</i> Krammer		2007-9S	Baci
<i>Pinnularia viridis</i> (Nitzsch) Ehrenberg	1909 1913 1914 1926 (as 'Navicula v.')	2007-9S	Baci
<i>Pinnularia viridis</i> var. <i>commutata</i> (Grunow) Cleve	1913 1926 (as 'Navicula c.')		Baci
<i>Placoneis amphibola</i> (Cleve) E.J.Cox	1913 1914 1926 (as 'Navicula a.')		Baci
<i>Placoneis clementis</i> (Grunow) Cox		2007-9S (as 'Navicula c.')	Baci
<i>Placoneis elginensis</i> (W.Gregory) E.J.Cox	1914 1926 (as 'Navicula anglica')	1991-2007F-2009S (as 'Navicula e.')	Baci
<i>Placoneis exigua</i> (W.Gregory) Mereschkovsky		2007-9S (as 'Navicula e.')	Baci
<i>Placoneis gastrum</i> (Ehrenberg) Mereschkowsky	1913 1926 (as 'Navicula g.')		Baci
<i>Placoneis hambergii</i> (Hustedt) K.Bruder in K.Bruder & L.K.Medlin		2007-9S (as 'Navicula h.')	Baci
<i>Placoneis placentula</i> (Ehrenberg) Heinzerling	1872 1909 1913 1914 1926 (as 'Cocconeis p.'; 1914 1926 as 'Navicula p.')	1991-2007F-2009S 2007-9S	Baci
<i>Plagioselmis nannoplanctica</i> (H.Skuja) G.Novarino, I.A.N.Lucas & S.Morrall		2009-14ALS	Cryp
<i>Planctonema lauterbornii</i> Schmidle (as 'lauterborni')		2009-14ALS	Chlo
<i>Planktolyngbya limnetica</i> (Lemmermann) Komárková-Legnerová & Cronberg		2009-14ALS	Proc
<i>Planktosphaeria gelatinosa</i> G.M.Smith		2009-14ALS	Chlo
<i>Planktothrix rubescens</i> (De Candolle ex Gomont) Anagnostidis & Komárek		2007-9S	Proc
<i>Planktothrix suspensa</i> (Pringsheim) Anagnostidis & Komárek		2009-14ALS	Proc
<i>Planothidium delicatulum</i> (Kützing) Round & Bukhtiyarova	1926 (as 'Achnanthes delicatula')	2007-9S	Baci
<i>Planothidium dubium</i> (Grunow) Round & Bukhtiyarova		2007-9S (as 'Achnanthes lanceolata dubia')	Baci
<i>Planothidium frequentissimum</i> (Lange-Bertalot) Lange-Bertalot var. <i>frequentissimum</i>		1991-2007F-2009S (as 'Achnanthes lanceolata frequentissima')	Baci
<i>Planothidium lanceolatum</i> (Brébisson ex Kützing) Lange-Bertalot	1913 1914 1926 (as 'Achnanthes lanceolata'; 1914 as 'Achnantheidium l.')	1991-2007F-2009S	Baci
<i>Planothidium minutissimum</i> (Krasske) Lange-Bertalot		2009-14ALS (as 'Achnantheidium m.')	Baci
<i>Planothidium oestrupii</i> (Cleve-Euler) Round & Bukhtiyarova var. <i>oestrupii</i>		2007-9S (as 'Achnanthes o.')	Baci
<i>Planothidium peragalli</i> (Brun & Héribaud) Round & Bukhtiyarova	1914 (as 'Achnanthes p.')	2007-9S	Baci
<i>Platessa conspicua</i> (A. Mayer) Lange-Bertalot		1991-2007F-2009S (as 'Achnanthes c.')	Baci
<i>Platessa holsatica</i> (Hustedt) Lange-Bertalot		2007-9S 2009-14ALS (2007-9S as 'Achnanthes h.'; 2009-14ALS as 'Aphanocapsa h.')	Baci
<i>Platessa lutheri</i> (Hustedt) Potapova		2007-9S (as 'Achnanthes l.')	Baci
<i>Platessa montana</i> (Krasske) Lange-Bertalot		2007-9S (as 'Achnanthes m.')	Baci
<i>Platessa zieglerei</i> (Lange-Bertalot) Lange-Bertalot		2007-9S (as 'Achnanthes z.')	Baci
<i>Pleurosigma curvulum</i> (Ehrenberg) Ralfs	1914		Baci
<i>Pleurotaenium trabecula</i> Nägeli		2009-14ALS	Char
<i>Psammothidium acidoclinatum</i> (Lange-Bertalot) Lange-Bertalot		2007-9S (as 'Nitzschia acidoclinata')	Baci
<i>Psammothidium altaicum</i> (Poretzky) Bukhtiyarova in Bukhtiyarova & Round		2007-9S (as 'Achnanthes altaica')	Baci
<i>Psammothidium bioretii</i> (Germain) Bukhtiyarova & Round		1991-2007F-2009S (as 'Achnanthes b.')	Baci
<i>Psammothidium chlidanos</i> (M.H.Hohn et Hellerman) Lange-Bertalot		2007-9S (as 'Achnanthes c.')	Baci

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Psammothidium curtissimum</i> (J.R.Carter) Aboal		2007-9S (as ' <i>Achnanthes curtissima</i> ')	Baci
<i>Psammothidium daonense</i> (Lange-Bertalot) Lange-Bertalot		1991-2007F-2009S (as ' <i>Achnanthes daonensis</i> ')	Baci
<i>Psammothidium helveticum</i> (Hustedt) Bukhtiyarova & Round	1914 (as ' <i>Gomphonema</i> h.')	2007-9S 2009-14ALS (2007-9S as ' <i>Achnanthes helvetica</i> '; 2009-14ALS as ' <i>Gymnodinium</i> h.')	Baci
<i>Psammothidium lauenburgianum</i> (Hustedt) Bukhtiyarova & Round		1991-2007F-2009S (as ' <i>Achnanthes lauenburgiana</i> ')	Baci
<i>Psammothidium levanderi</i> (Hustedt) Czarnecki		2007-9S (as ' <i>Achnanthes l.</i> ')	Baci
<i>Psammothidium marginulatum</i> (Grunow) Bukhtiyarova & Round	1926 (as ' <i>Cyclotella marginulata</i> ')	2007-9S (as ' <i>Achnanthes marginulata</i> ')	Baci
<i>Psammothidium rechtense</i> (Leclercq) Lange-Bertalot		2007-9S (as ' <i>Achnanthes rechtensis</i> ')	Baci
<i>Psammothidium sacculus</i> (J.R.Carter) Bukhtiyarova in Bukhtiyarova & Round as ' <i>sacculum</i> ')		2007-9S (as ' <i>Achnanthes saceula</i> ')	Baci
<i>Psammothidium subatomoides</i> (Hustedt) Bukhtiyarova & Round		1991-2007F-2009S (1991-2007F as ' <i>Achnanthidium atomoides</i> '; 1991-2007F-2009S as ' <i>Achnanthes</i> s.')	Baci
<i>Psammothidium ventrale</i> (Krasske) Bukhtiyarova & Round		2007-9S (as ' <i>Navicula ventralis</i> ')	Baci
<i>Pseudanabaena catenata</i> Lauterborn		2009-14ALS	Proc
<i>Pseudanabaena galeata</i> Boecher		2009-14ALS	Proc
<i>Pseudanabaena limnetica</i> (Lemmermann) Komárek		2009-14ALS	Proc
<i>Pseudofallacia occulta</i> (Krasske) Y.Liu, J.P.Kociolek & Q.X.Wang in Liu et al.		2007-9S (as ' <i>Navicula o.</i> ')	Baci
<i>Pseudopediastrum boryanum</i> (Turpin) E.Hegewald in Buchheim et al.		2007-9S (as ' <i>Pediastrum b.</i> ')	Chlo
<i>Pseudostaurosira elliptica</i> (Schumann) Edlund, Morales & Spaulding	1913 1926 (as ' <i>Fragilaria e.</i> ')	2007-9S	Baci
<i>Pseudostaurosira parasitica</i> var. subconstricta (Grunow) E.Morales in E.Morales & Edlund		1991-2007F-2009S (as ' <i>Fragilaria p. s.</i> ')	Baci
<i>Quadricoccus ellipticus</i> Hortobágyi		2009-14ALS	Proc
<i>Quadrigula pfitzeri</i> (Schröder) G.M.Smith		2009-14ALS	Chlo
<i>Radiocystis geminata</i> Skuja		2009-14ALS	Proc
<i>Reimeria sinuata</i> (Gregory) Kociolek & Stoermer	1914 1926 (1914 as ' <i>Nitzschia</i> s.'; 1926 as ' <i>Cymbella curta</i> ')	1991-2007F-2009S 2007-9S (1991-2007F-2009S as ' <i>Cymbella</i> s.')	Baci
<i>Rhodomonas lacustris</i> Pascher & Ruttner in Pascher		2007-9S	Cryp
<i>Rhodomonas lacustris</i> var. <i>nannoplanctica</i> (Skuja) Javornicky		2007-9S (as ' <i>R. minuta</i> ')	Cryp
<i>Rhodomonas lens</i> Pascher & Ruttner in Pascher		2009-14ALS	Cryp
<i>Rhoicosphenia abbreviata</i> (Agardh) Lange- Bertalot	1872 1909 1914 (1872 1909 as ' <i>Roicosphenia curvata</i> ') iss (1914 as ' <i>Gomphonema</i> <i>abbreviatum</i> '; 1914 also as ' <i>Gomphonema curvatum</i> ' and as ' <i>R. curvata</i> ')	1991-2007F-2009S	Baci
<i>Rhopalodia gibba</i> (Ehrenberg) Otto Müller	1913 1914 1926 (1913 1926 as ' <i>Navicula g.</i> '; 1926 also as ' <i>Cymbella g.</i> ')	2007-9S (2007-9S also as ' <i>Pinnularia g.</i> ')	Baci
<i>Rhopalodia gibba</i> var. <i>ventricosa</i> (Kützing) H.Peragallo & M.Peragallo	1913 1914 (1914 as ' <i>R. v.</i> ')		Baci
<i>Rhopalodia gibberula</i> (Ehrenberg) Otto Müller	1872 1909 (as ' <i>Epithemia g.</i> ')		Baci
<i>Rhopalodia parallela</i> (Grunow) O. Müller	1872 1909 (1872 1909 as ' <i>Epithemia gibba</i> var. p.'; 1909 as ' <i>Eunotia parallela</i> p.')		Baci

Tab. 7: continued

<i>Scenedesmus communis</i> E.Hegewald		2009-14ALS (as ' <i>S. quadricauda</i> ')	Chlo
<i>Scenedesmus ecornis</i> (Ehrenberg) Chodat		2009-14ALS	Chlo
<i>Scenedesmus ellipticus</i> Corda		2009-14ALS	Chlo
<i>Scenedesmus obtusus</i> f. <i>disciformis</i> (Chodat) Compère		2007-9S (as ' <i>S. disciformis</i> ')	Chlo
<i>Scenedesmus obtusus</i> Meyen		2009-14ALS	Chlo
<i>Sellaphora bacillum</i> (Ehrenberg) D.G.Mann	1913 1926 (1913 as ' <i>Navicula</i> b. minor' and as ' <i>Navicula</i> b. minor' iss (1913 1926 as ' <i>Navicula</i> b.')	2007-9S	Baci
<i>Sellaphora curta</i> C.E.Wetzel, L.Ector, B.Van de Vijver, Compère & D.G.Mann	1914 (as ' <i>Navicula</i> c.')		Baci
<i>Sellaphora joubaudii</i> (Germain) Aboal		1991-2007F-2009S (as ' <i>Navicula</i> j.')	Baci
<i>Sellaphora laevis</i> (Kützing) D.G. Mann var. <i>laevis</i>	1913 (as ' <i>Navicula</i> l.')	2007-9S	Baci
<i>Sellaphora medioconvexa</i> (Hustedt) C.E.Wetzel in Wetzel et al.		2007-9S (as ' <i>Navicula</i> m.')	Baci
<i>Sellaphora pseudobacillum</i> (Grunow) Lange-Bertalot & Metzeltin in Metzeltin, Lange-Bertalot & Nergui	1913 1914 1926 (as ' <i>Navicula</i> p.')		Baci
<i>Sellaphora pupula</i> (Kützing) Mereschowsky var. <i>pupula</i>	1913 1914 1926 (as ' <i>Navicula</i> p.')	1991-2007F-2009S	Baci
<i>Sellaphora seminulum</i> (Grunow) D.G. Mann		1991-2007F-2009S (as ' <i>Navicula</i> s.')	Baci
<i>Sellaphora stroemii</i> (Hustedt) D.G. Mann		2007-9S (as ' <i>Navicula</i> s.')	Baci
<i>Sellaphora vitabunda</i> (Hustedt) D.G.Mann		2007-9S (as ' <i>Navicula</i> v.')	Baci
<i>Simonsenia delognei</i> (Grunow) Lange-Bertalot		1991-2007F-2009S	Baci
<i>Snowella lacustris</i> (Chodat) Komárek & Hindák		2009-14ALS	Proc
<i>Staurastrum avicula</i> Brébisson in Ralfs (as ' <i>Avicula</i> ')		2009-14ALS	Char
<i>Staurastrum avicula</i> var. <i>lunatum</i> (Ralfs) Coesel & Meesters		2009-14ALS (as ' <i>S. lunatum</i> ')	Char
<i>Staurastrum cingulum</i> (West & G.S.West) G.M.Smith		2009-14ALS	Char
<i>Staurastrum furcigerum</i> (Brébisson) W.Archer in Pritchard		2009-14ALS	Char
<i>Staurastrum gracile</i> Ralfs ex Ralfs		2007-9S	Char
<i>Staurastrum teliferum</i> Ralfs		2009-14ALS	Char
<i>Staurastrum tetracerum</i> Ralfs ex Ralfs		2009-14ALS	Char
<i>Stauridium tetras</i> (Ehrenberg) E.Hegewald in Buchheim et al.		2009-14ALS (as ' <i>Pediastrum</i> t.')	Chlo
<i>Staurodesmus dejectus</i> var. <i>dejectus</i> Teiling		2009-14ALS (as ' <i>S. d.</i> ')	Char
<i>Stauroneis acuta</i> W.Smith	1926		Baci
<i>Stauroneis agrestis</i> J.B.Petersen		2007-9S	Baci
<i>Stauroneis anceps</i> Ehrenberg var. <i>anceps</i>	1913 1914 1926 (1913 also as ' <i>S. a. linearis</i> '; 1926 also as ' <i>Diatoma</i> a.')	2007-9S	Baci
<i>Stauroneis gracilis</i> Ehrenberg	1913 1914 1926 (1914 1926 also as ' <i>S. amphilepta</i> ')		Baci
<i>Stauroneis ignorata</i> Hustedt		2007-9S (as ' <i>S. prominula</i> ')	Baci
<i>Stauroneis kriegeri</i> Patrick		2007-9S	Baci
<i>Stauroneis lanceolata</i> Kützing	1926		Baci
<i>Stauroneis obtusa</i> Lagerstedt		2007-9S	Baci
<i>Stauroneis phoenicenteron</i> (Nitzsch) Ehrenberg sensu stricto	1909 1913 1914 1926	2007-9S	Baci
<i>Stauroneis quadrata</i> Héribaude-Joseph	1914		Baci
<i>Stauroneis smithii</i> Grunow var. <i>smithii</i>	1914 1926 (as ' <i>S. s.</i> '; 1914 also as ' <i>Pleurosigma</i> s.')	1991-2007F-2009S	Baci
<i>Stauroneis thermicola</i> (Petersen) Lund		1991-2007F-2009S	Baci
<i>Stausirella harrisonii</i> (W.Smith) E. Morales & C.E.Wetzel in Morales et al.	1909 1926 (as ' <i>Fragilaria harrisonii</i> ' iss)		Baci
<i>Stausirella mutabilis</i> (W.Smith) E.Morales	1872 1909 1913 1926 (as		Baci

Tab. 7: continued

& Van de Vijver in Morales et al.	'Fragilaria m.')		
Taxon	19/20th century	20/21th century	Phylon
Stephanodiscus alpinus Hustedt in Huber-Pestalozzi		2007-9S	Baci
Stephanodiscus astraea (Kützing) Grunow	1914 1926		Baci
Stephanodiscus hantzschii Grunow in Cleve & Grunow	1909	2007-9S14ALS	Baci
Stephanodiscus minutulus (Kützing) Cleve & Möller	1909	2007-9S14ALS	Baci
Stephanodiscus neoastraea		2007-9S	Baci
Surirella amphioxys W.Smith		2007-9S	Baci
Surirella angusta Kützing	1914 1926	1991-2007F-2009S	Baci
Surirella apiculata W.Smith	1914		Baci
Surirella bifrons f. minor Østrup	1914		Baci
Surirella birostrata Hustedt ex Ant.Mayer		2007-9S	Baci
Surirella biseriata var. subconstricta F.Meister	1926		Baci
Surirella brebissonii Krammer & Lange-Bertalot		1991-2007F-2009S	Baci
Surirella crumena Brébisson		2007-9S	Baci
Surirella elegans Ehrenberg	1926		Baci
Surirella helvetica Brun	1926 (1926 also as 'Cocconema h.')		Baci
Surirella librile Ehrenberg	1872 1909 1913 1926 (1872 1909 1913 1926 as 'Cymbella ehrenbergii'; 1926 also as 'Cymatopleura solea')		Baci
Surirella minuta Brébisson ex Kützing nom. illeg.	1909 1914 1926 (1909 1914 as 'S. ovata')	1991-2007F-2009S	Baci
Surirella ovalis Brébisson	1909	2007-9S	Baci
Surirella panduriformis W.Smith	1914 (as 'S. pinnata p.')		Baci
Surirella roba Leclercq		2007-9S	Baci
Surirella robusta Ehrenberg	1926		Baci
Surirella spiralis Kützing	1909 1926 (1926 as 'Campylodiscus spirales') iss		Baci
Surirella splendida (Ehrenberg) Kützing	1909 1914 1926 (1926 also as 'S. splendens') iss	2007-9S	Baci
Surirella subsalsa W.Smith		2007-9S	Baci
Surirella tenera var. nervosa A.Schmidt in Schmidt et al.	1926		Baci
Surirella tenera var. splendidula A.Schmidt in A.Schmidt et al.	1926		Baci
Surirella terricola Lange-Bertalot & E.Alles in Lange-Bertalot & Metzeltin		2007-9S	Baci
Synedra acuta Ehrenberg	1914		Baci
Synedra capitellata var. cymbelloides Grunow	1914		Baci
Synedra delicatissima var. mesoleia Grunow	1914		Baci
Synedra familiaris Kützing	1914		Baci
Synedra gracilis Kützing	1914		Baci
Synedra schroeteri Meister	1926		Baci
Synedra ulna f. rostrata Mayer	1914		Baci
Tabellaria fenestrata (Lyngbye) Kützing	1872 1909 1913 1914 1926	2007-9S	Baci
Tabellaria flocculosa (Roth) Kützing	1872 1909 1913 1914 1926	2007-9S	Baci
Tabellaria ventricosa Kützing	1914 1926 (1914 also as 'Cocconema v.')	2007-9S	Baci
Tabularia fasciculata (C.Agardh) D.M.Williams & Round	1926 (as 'Synedra affinis')	2007-9S (as 'Fragilaria f.')	Baci
Tabularia investiens (W.Smith) D.M.Williams & Round	1914 (as 'Synedra i.')		Baci
Tetrachlorella alternans (G.M.Smith) Korshikov		2009-14ALS	Chlo
Tetrachlorella incerta Hindák		2009-14ALS	Chlo
Tetrademus lagerheimii M.J.Wynne & Guiry		2009-14ALS (as 'Scenedesmus acuminatus')	Chlo

Tab. 7: continued

Taxon	19/20th century	20/21th century	Phylon
<i>Tetraëdron minimum</i> (A.Braun) Hansgirg	1909 (as 'Tetraedron m.') iss	2007-9S14ALS	Chlo
<i>Tetraëdron triangulare</i> Korshikov		2009-14ALS (as 'Tetraedron t.') iss	Chlo
<i>Tetraselmis cordiformis</i> (H.J.Carter) Stein		2009-14ALS	Chlo
<i>Tetrastrum triangulare</i> (Chodat) Komárek		2009-14ALS	Chlo
<i>Thalassiosira weissflogii</i> (Grunow) G.Fryxell & Hasle		2009-14ALS	Baci
<i>Trachelomonas hispida</i> (Perty) F.Stein		2009-14ALS	Eugl
<i>Trachelomonas volvocina</i> (Ehrenberg) Ehrenberg		2009-14ALS	Eugl
<i>Treubaria setigera</i> (W.Archer) G.M.Smith		2009-14ALS	Chlo
<i>Tryblionella acuta</i> (Cleve) D.G.Mann in Round, Crawford & D.G.Mann	1914 (as 'Nitzschia a.')		Baci
<i>Tryblionella angustata</i> W.Smith	1872 1909		Baci
<i>Tryblionella apiculata</i> W.Gregory		1991-2007F-2009S (as 'Nitzschia constricta')	Baci
<i>Ulnaria amphirhynchus</i> (Ehrenberg) Compère & Bukhtiyarova in Bukhtiyarova & Compère	1909 1913 1914 1926 (1909 1913 1914 1926 as 'Navicula a.'; 1926 also as 'Navicula amphirhyncha' and as 'Synedra amphirhynchus') iss (1914 also as 'Synedra ulna a.')		Baci
<i>Ulnaria biceps</i> (Kützing) Compère	1909 1914 1926 (as 'Synedra longissima')		Baci
<i>Ulnaria danica</i> (Kützing) Compère & Bukhtiyarova in Bukhtiyarova & Compère	1909 1913 1914 1926 (1909 1926 as 'Synedra d.'; 1913 1914 as 'Synedra ulna d.')		Baci
<i>Ulnaria delicatissima</i> (W.Smith) Aboal & P.C.Silva	1914 1926 (1926 as 'Synedra delectissima')iss (1909 1914 also as 'Synedra acus d.'; 1926 also as 'Synedra d.')	1991-2007F 2009-14ALS (1991-2007F as 'Fragilaria d.')	Baci
<i>Ulnaria delicatissima</i> var. <i>angustissima</i> (Grunow) Aboal & P.C.Silva	1926 (1926 as 'Synedra delectissima a.')	2007-9S 2009-14ALS (2007-9S as 'Fragilaria ulna angustissima')	Baci
<i>Ulnaria lanceolata</i> (Kützing) Compère	1926 (as 'Synedra l.')		Baci
<i>Ulnaria oxyrhynchus</i> (Kützing) Aboal in Aboal, Alvarez Cobelas, Cambra & Ector	1914 (as 'Synedra ulna o.')		Baci
<i>Ulnaria ramesii</i> (Héribaud-Joseph) T.Ohtsuka in Ohtsuka et al.	1914 (as 'Synedra ramesii') iss		Baci
<i>Ulnaria ulna</i> (Nitzsch) Compère in Jahn et al.	1926 (as 'Synedra splendens genuina')		Baci
<i>Ulnaria ulna</i> var. <i>notata</i> (Kützing) Aboal in Aboal, Alvarez Cobelas, Cambra & Ector	1914 (as 'Synedra n.')		Baci
<i>Ulnaria ulna</i> var. <i>splendens</i> (Kützing) Aboal in Aboal, Alvarez Cobelas, Cambra & Ector	1872 1909 1913 1914 1926 (as 'Synedra s.')		Baci
<i>Ulnaria vitrea</i> (Kützing) E.Reichardt	1909 1926 (as 'Synedra v.')		Baci
<i>Verrucodesmus verrucosus</i> (Y.V.Roll) E.Hegewald in Hegewald, Bock & Krienitz		2009-14ALS (as 'Scenedesmus v.')	Chlo
<i>Willea rectangularis</i> (A.Braun) D.M.John, M.J.Wynne & P.M.Tsarenko	1909 (as 'Crucigeniella r.')	2007-9S14ALS	Chlo
<i>Willea vilhelmii</i> (Fott) Komárek		2007-9S	Chlo

Interestingly 219 taxa are common to HANDMANN and the recent determiners, 303 are only recorded the beginning of the 20th century, while 428 are restricted to the turns of the 20/21th century. The differences may be related to the number of samples and collectors: comparatively few, but also embracing small water bodies and fens sampled by HANDMANN and SCHIEDER compared to the much more intense and regular sam-

pling by a large group of scientists (Tab. 4, 6). The aim is to induce re-identification of the many unnamed vouchers, particularly on the “type plates” with 40 (2 slides), 45, 48, 50 (3 slides), 62, 70 or 135 “types” from Upper Austria (Fig. 64), including a closer look on the subspecific taxa hidden in the undetermined specimens of HANDMANN.

Biographical sketches of outstanding contributors to the “Microcosm Archive Linz”

The following biographical entries about 10 men and two women who have made significant contributions to microscopic collections and knowledge archives as regards protistology and an appreciation of the natural world. Their sequence is according to the (first) year of acquisition. They are accompanied by lists of key dates in the scientist’s lives and biographies of sources for further information. 28 photographs accompany the entries. In different ways all exemplary personalities are united by “their Leeuwenhoekian and Ehrenbergian love for their ‘wee beasties’ as CORLISS once puts it.

Wilhelm FOISSNER (*1948)

Curriculum Vitae

A categorised biographical sketch appeared in the Festschrift 2008, so here a chronology of important dates focusing on Austria is given.

- Born 18 August 1948 in the village of Wartberg ob der Aist, Upper Austria
- 1954–1962 Basic schools
- 1962–1967 Apprentice as a carpenter in the city of Linz, Upper Austria; finished with fellow degree
- 1966–1974 Honorary scientist at the municipal Natural History Station at Linz (cp. p. 318)
- 1967–1968 Compulsory military service
- 1968–1973 Laboratory assistant in a medical laboratory
- 1973 Higher School Certificate (A Levels) as non-resident pupil in Vienna
- 1973–1979 Study of zoology and botany at the University of Salzburg
- 1974–1980 Teacher at medical schools in the hospital of the city of Linz; responsible for microscopy and photography
- 1979 Doctorate to Dr. phil.
- 1980 Christian-DOPPLER-price for biology
- 1980–1986 Assistant at the Institute for Zoology of the University of Salzburg
- 1981 Among the 32 founding members of the DGP
- 1982 Inaugural dissertation (“Habilitation” in German): Dr. phil. habil.
- 1985 SANDOZ-price for biology; TRATZ-price for scientific research in Salzburg
- 1987 Professor (Extraordinarius in German) of Zoology at University of Salzburg; board of reviewers “European Journal of Protistology”; foundation of the “Wilhelm and Ilse FOISSNER Stiftung” to promote



Fig. 71: Discussion round on occasion of the 20th anniversary of the “Biological Centre” in the Castle Museum on 15 June 2013. From left to right: Dir. Heinz MITTER, chair of the entomological working group; Wilhelm FOISSNER as representant of university research, Dr. Gerhard AUBRECHT, the then head of the natural science section of the Upper Austrian Museum and the moderator Karl PLOBERGER.

German-speaking protozoologists outside of the academic research and to stimulate classical, morphology-oriented alpha-taxonomy.

- 1988 Co-organizer of the 7th Annual Meeting of the DGP in Salzburg; co-editor of the international journal “Biology and Fertility of Soils”
- 1991–1996 Vice President of the International Society of Protozoologists
- 1992 Listed among the top six protozoologists worldwide; STIEGL-price for water protection; co-editor of the “Archiv für Protistenkunde”
- 1996–1999 President of the German Society of Protozoologists
- 2001 Co-organizer of the XIth International Congress of Protozoology held in Salzburg
- 2003 Cultural medal of the Upper Austrian federal state government for a considerable donation to the Biology Centre in Linz
- 2006–2007 President of the International Society of Protistologists
- 2016 Eduard REICHENOW medal of the DGP
- 2017 Retirement

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A short biography, taxa and publications from 1967 to 2017 of Wilhelm FOISSNER and co-workers can be downloaded from <http://www.wfoissner.at>; photographs taken in Linz can be found on <http://www.zobodat.at/personen.php?id=590&bio=full>.

Primary contributions

- Considerable improvement of supravital staining with methyl green pyronine to differentiate important cell organelles, such as the nuclear apparatus and mucocysts (1979) and silver impregnation methods (1982, 1984, 2014);
- Establishment of nomenclatural and taxonomic standards for ciliate systematics (alpha-taxonomy): live observation, morphometry (quantitative-statistical analysis of feature differences) and preparation methods (since 1975); introduced (partially with co-workers) 768 species- and 247 genus-series taxa and unmached productivity;
- Introduction of the „non-flooded Petri dish“ method (1987, 1999) and further techniques for the examination of organismal diversity were continuously improved (1985, 1987, 1992, 2001). A probability-based approach using large sample collectives (1997) and a

statistical ACE (abundance-based coverage estimation) model (2006) was introduced to study the global soil ciliate diversity;

- Evaluation of theoretical concepts has focused on the r/k [reproductive versus capacity] continuum (1985), the phenomenon of ciliatostasis (1987–1989), the role of indicator species in freshwater (1982, 1986, 1988, 1989, 1991–1999, 2004) and of an autochthonous soil ciliate community (1985, 1987, 1988, 1989, 1991, 1993) including the discovery of mycophagy, a new feeding strategy (1986);
- The moderate endemism model proposed in 1999 greatly enhanced the discussion on diversity, dispersal and geographic distribution of protists.

Contents of collection

Series descriptions: period 1966–2015

Between 1974 and 1991 roughly 1200 slides have been deposited, which currently amount to the four-fold (see below). However, they are mainly including type slides or related series, the vast majority of morphological, ontogenetical and ecological preparations (estimated to about 20,000 slides, FOISSNER personal communication) are at present still in Salzburg to be at hand.

Series 1 Prepared organisms

The taxa recorded nominally on the 4,751 slides as regarding designated types are listed in AESCHT (2008) and the present volume (see p. 483–502). Among other highlights in the collection is the complete bundle of the original publications, in addition also bound chronologically in SB\$

Series 2 Publications

From 1967 until now Wilhelm FOISSNER wrote 767 publications dealing with protists, mainly with ciliates (\$\$\$ single authored; in \$\$\$ cases of multiauthored papers he is the principal\$ author): 15 monographs, 41 book chapters, five guest editions, 431 journal articles, 15 reports

and short communications, seven book reviews, and 255 abstracts. In total, his publications cover more than 17,000 printed pages. AESCHT & BERGER (2008) gave a complete chronological and categorised bibliography, where it is not so easy to locate a particular work. Therefore, here an alphabetical list according to author(s) and year of publication, devoid the title, but citing the journal, volume and page numbers as well as the reference code for retrieval follows:

AESCHT E. & FOISSNER W. (1989) *Catalogus Faunae Austriae* **1a**: 1–79 [FOI206].

AESCHT E. & FOISSNER W. (1990) *JoPr Suppl.* **37**: Abstr. 52 [FOI220].

AESCHT E. & FOISSNER W. (1990) *Zool. Anz.* **225**: 101–111 [FOI221].

AESCHT E. & FOISSNER W. (1991) *VDI-Berichte* **901**: 985–1002 [FOI235].

AESCHT E. & FOISSNER W. (1992) Allen Press, Lawrence B-6.1–B-6.4 [FOI247].

AESCHT E. & FOISSNER W. (1992) Allen Press, Lawrence B-7.1–B-7.4 [FOI246].

AESCHT E. & FOISSNER W. (1992) *Arch. Hydrobiol. Supplement* **90** (Biol. Beiträge) **2**: 207–251 [FOI248].

AESCHT E. & FOISSNER W. (1992) *Biol. Fertil. Soils* **13**: 17–24 [FOI249].

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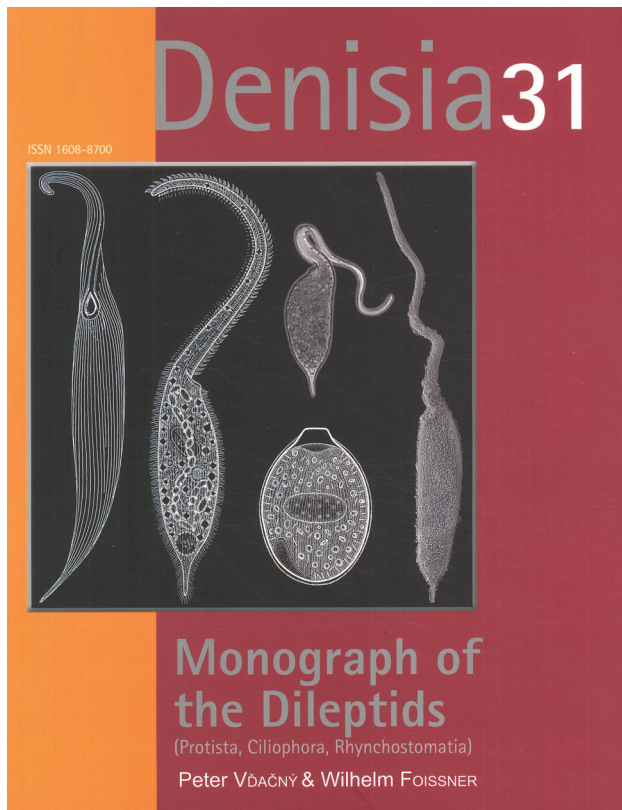


Fig. 72: Title page of the monograph in 2012 showing live and prepared dileptids; the ellipsoidal figure is a resting cyst

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- FOISSNER W. (2016): *Heterometopus meisterfeldi* nov. gen., nov. spec. (Protozoa, Ciliophora), a new metopid from Australia. — *Eur. J. Protistol.* **55**: 118–127 [FOI755].
- FOISSNER W. (2016): Protists as bioindicators in activated sludge: identification, ecology and future need. — *Eur. J. Protistol.* **55**: 75–94 [FOI756].
- FOISSNER W. (2016): Terrestrial and semiterrestrial Ciliates (Protozoa, Ciliophora) from Venezuela and Galápagos. *Denisia* **35**: 1–912 [FOI744].
- FOISSNER W. (2016): This and that; yesterday, today, tomorrow; here and there: a medley. 35th annual meeting of the German Society for Protozoology, Neuchâtel, Februar 23th–26th. Abstr. from Program: 21 [FOI753].

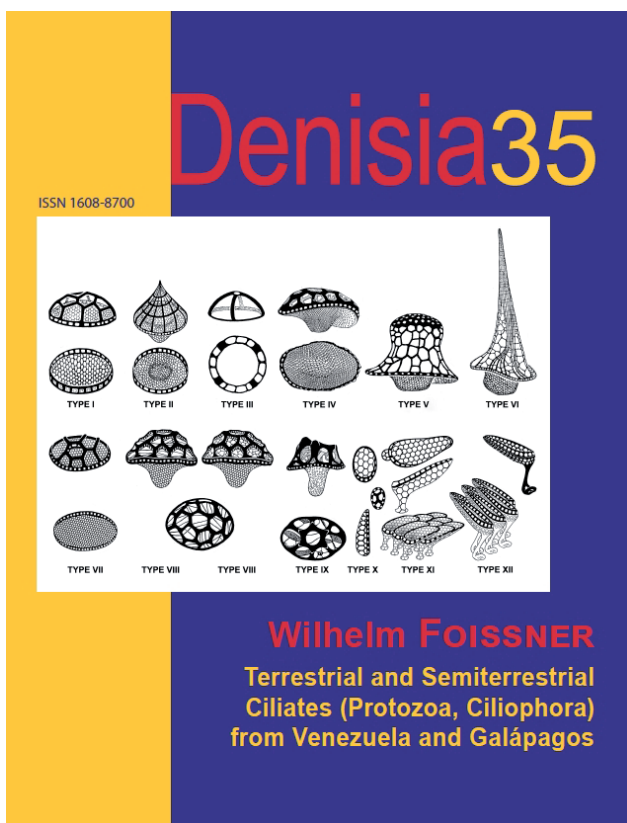


Fig. 73: Title page of the monograph in 2016 showing lepidosome types in the suborder Trachelophyllina

KUMAR S. & FOISSNER W. (2016): High cryptic soil ciliate (Ciliophora, Hypotrichida) diversity in Australia. — Eur. J. Protistol. **53**: 61–95 [FOI745].

FOISSNER W. (2017): Dispersal of ciliated protozoa: lessons from a 4-year-experiment with environmental micro- and mesocosms. — 15th International Congress of Protistology 30th July–4th August 2017 Prague, Czech Republic: 1 [FOI763].

KUMAR S. & FOISSNER W. (2017): Morphology and ontogenesis of *Stylonychia (MetaStylonychia) nodulinucleata* nov. subgen. (Ciliophora, Hypotrichida) from Australia. — Eur. J. Protistol. **57**: 61–72 [FOI757].

VĚAČNÝ P. & FOISSNER W. (2017): A huge diversity of metopids (Ciliophora, Armophorea) in soil from the Murray River floodplain, Australia. I. Description of five new species and redescription of *Metopus setosus* KAHL, 1927. — EJP **57**: 35–76 [FOI762].

VĚAČNÝ P. & FOISSNER W. (2017): A huge diversity of metopids (Ciliophora, Armophorea) in soil from the Murray River floodplain, Australia. II. Morphology and morphogenesis of *Lepidometopus platycephalus* nov. gen., nov. spec. — AcPr **56**: 39–57 [FOI761].

Series 3 Unpublished material

The two volumes of the doctoral thesis,

correspondence with publishing houses, peer-reviews, lectures, routine paperwork (administrative efforts), Indian ink drawings and original typoscripts submitted were archived in maps and files. Two huge electronic archives of FOISSNER's assistants, one of 205 GB (2006–2011), the other 373 GB (2012–2018), include original micrographs, morphometric tables and many more, were deposited on the servers of the Upper Austrian Museum.

Series 4 Documentation

BERGER & AL-RASHEID (2008) listed 174 genera and seven subgenera introduced by FOISSNER and co-workers, since then 66 **taxa of the genus-series** have to be added yielding 247 taxa:

Aciculoplites FOISSNER & GABILONDO in GABILONDO & FOISSNER, 2009 [aAu022]: 6

Afrokeronopsis FOISSNER & STOECK, 2008 [FOI623]: 4 (subgenus of *Neokeronopsis*)

Allotrichides FOISSNER, 2016 [FOI744]: 770

Apoavestina FOISSNER, 2016 [FOI744]: 289

Apocoriplites OERTEL, WOLF, AL-RASHEID & FOISSNER, 2008 [FOI633]: 242

Apocyrtilophosis FOISSNER, BOURLAND, WOLF, STOECK & DUNTHORN, 2014 [FOI736]: 43

Apodileptus VĚAČNÝ & FOISSNER, 2011 [FOI660]: 311

Apogonostomum FOISSNER, 2016 [FOI744]: 611

Apometopides FOISSNER, 2016 [FOI744]: 874

Apometopus FOISSNER, 2016 [FOI744]: 869

Aponotohymena FOISSNER, 2016 [FOI744]: 769

Apotrachelius VĚAČNÝ & FOISSNER, 2011 [FOI657]: 135

Apowoodruffia FOISSNER, 2016 [FOI744]: 369

Bromeliothrix FOISSNER, 2010 [FOI668]: 161

Cariacothrix ORSI, EDGCOMB, FARIA, FOISSNER, FOWLE, HOHMANN, SUAREZ, TAYLOR, TAYLOR, VĚAČNÝ & EPSTEIN, 2012 [FOI693]: 1427

Cataphractes FOISSNER, 2016 [FOI744]: 118

Cintetochilides FOISSNER, 2016 [FOI744]: 429

Columnospatha FOISSNER, 2016 [FOI744]: 187

Cotterillia FOISSNER & STOECK, 2010 [FOI667]: 31

Declivistoma FOISSNER, AGATHA & BERGER in BERGER & AL-RASHEID, 2008 [aAu025]: 72

Emarginatophrya FOISSNER, 2016 [FOI744]: 286

Enchelariophrya FOISSNER, 2016 [FOI744]: 230

Facetospatha FOISSNER, 2016 [FOI744]: 187

- Fragmospina* FOISSNER, 2016 [FOI744]: 727
Fuscheriides GABILONDO & FOISSNER, 2009 [FOI634]: 2
Gastrostylides FOISSNER, 2016 [FOI744]: 770
Glaucomides FOISSNER, 2013 [FOI717]: 155
Gonostomoides FOISSNER, 2016 [FOI744]: 632
Hemioxytricha FOISSNER, 2016 [FOI744]: 769
Heterometopus FOISSNER, 2016 [FOI755]: 118
Idiodeviata FOISSNER, 2016 [FOI744]: 578
Kamburophrys FOISSNER & OERTEL, 2009 [FOI626]: 206
Lepidothrix FOISSNER, 2016 [FOI744]: 781
Levicolaps FOISSNER, KUSUOKA & SHIMANO, 2008 [FOI625]: 197
Lingulothrix FOISSNER, 2016 [FOI744]: 106
Mamillospatha FOISSNER, 2016 [FOI744]: 185
Mancothrix FOISSNER, 2016 [FOI744]: 403
Metagonostomum FOISSNER, 2016 [FOI744]: 611
Metathrix FOISSNER, 2016 [FOI744]: 469
Metauroleptus FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 336
Microcolpoda FOISSNER, 2016 [FOI744]: 294
Microdileptus VĎAČNÝ & FOISSNER, 2011 [FOI657]: 242
Monomacrocaryon VĎAČNÝ, ORSI, BOURLAND, SHIMANO & FOISSNER, 2011 [FOI657]: 310
Monomicrocaryon FOISSNER, 2016 [FOI744]: 751
Notodeviata FOISSNER, 2016 [FOI744]: 567
Orborhabdostyla FOISSNER, BLAKE, WOLF, BREINER & STOECK, 2009 [FOI635]: 293
Oxytrichella FOISSNER, 2016 [FOI744]: 776
Paragonostomoides FOISSNER, 2016 [FOI744]: 610
Paroxytricha FOISSNER, 2016 [FOI744]: 734
Protoplagiocalpa FOISSNER, 2016 [FOI744]: 452
Pseudobirojimia FOISSNER, 2016 [FOI744]: 524
Pseudohemisincirra FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 343
Pseudotelotrochidium FOISSNER, 2016 [FOI744]: 474
Psilotrichides HEBER, STOECK & FOISSNER, 2014 [FOI738]: 275
Quadrística FOISSNER, 2016 [FOI744]: 769
Renoplites FOISSNER, 2016 [FOI744]: 254
Reticoleps FOISSNER, KUSUOKA & SHIMANO, 2008 [FOI625]: 198
Sagittarides FOISSNER & BUOSI in FOISSNER, 2016 [FOI744]: 392
Sandmannides FOISSNER, 2016 [FOI744]: 340
Sandmanniella FOISSNER & STOECK, 2009 [FOI624]: 482
Schmidingerothrix FOISSNER, 2012 [FOI689]: 239
Suturothrix FOISSNER, 2008 [FOI632]: 86
Totothrix FOISSNER, 2016 [FOI744]: 816
Trachelophyllides FOISSNER, 2016 [FOI744]: 72
Viridoparamecium KREUTZ, STOECK & FOISSNER, 2012 [ZR0150]: 562 (subgenus)
Vorticellides FOISSNER, BLAKE, WOLF, BREINER & STOECK, 2009 [FOI635]: 306
- BERGER & AL-RASHEID (2008) listed 553 species and 30 subspecies introduced by FOISSNER and co-workers, since then 185 **taxa of the species-series** have to be added yielding 768 taxa:
Aciculoplites ethiopiensis FOISSNER & GABILONDO in GABILONDO & FOISSNER, 2009 [aAu022]: 6
Afrokeronopsis aurea FOISSNER & STOECK, 2008 [FOI623]: 4
Apoavestina amazonica FOISSNER, 2016 [FOI744]: 290
Apocarchesium arndti NORF & FOISSNER, 2010 [FOI670]: 251
Apocoriplites lajacola OERTEL, WOLF, AL-RASHEID & FOISSNER, 2008 [FOI633]: 242
Apodileptus edaphonicus VĎAČNÝ & FOISSNER, 2012 [FOI657]: 339
Apodileptus visscheri rhabdoplites VĎAČNÝ & FOISSNER, 2012 [FOI657]: 334
Apogonostomum pantanalense FOISSNER, 2016 [FOI744]: 611
Apogonostomum vleiicola FOISSNER, 2016 [FOI744]: 616
Apometopus (Apometopus) pelobius FOISSNER, 2016 [FOI744]: 869
Apotrachelius multinucleatus VĎAČNÝ & FOISSNER, 2012 [FOI657]: 135
Apowoodruffia salinaria FOISSNER & BUOSI in FOISSNER, 2016 [FOI744]: 369
Arcuospathidium bromelicola FOISSNER, WOLF, KUMAR, XU & QUINTELA-ALONSO, 2014 [FOI705]: 160
Australothrix fraterculus FOISSNER, 2016 [FOI744]: 491
Australothrix venezuelensis FOISSNER, 2016 [FOI744]: 497
Bilamellophrya fraterculus FOISSNER, 2016 [FOI744]: 99
Birojimia litoralis FOISSNER, 2016 [FOI744]: 504
Bistichella chilensis FOISSNER, 2016 [FOI744]: 592
Bistichella kenyaensis FOISSNER, 2016 [FOI744]: 596
Bromeliophrya quadrística FOISSNER & STOECK, 2013 [FOI718]: 232
Bromeliothrix metopoides FOISSNER, 2010 [FOI668]: 161
Bryometopus rostratus FOISSNER, 2016 [FOI744]: 344
Cariacothrix caudata ORSI, EDGCOMB, FARIA, FOISSNER, FOWLE, HOHMANN, SUAREZ, TAYLOR, TAYLOR, VĎAČNÝ & EPSTEIN, 2012 [FOI693]: 1427
Cataphractes austriacus FOISSNER, 2016 [FOI744]: 118
Cataphractes terricola FOISSNER, 2016 [FOI744]: 130
Caudiholosticha halophila FOISSNER, 2016 [FOI744]: 532

- Caudiholosticha silvicola* FOISSNER, 2016 [FOI744]: 531
Caudiholosticha virginensis FOISSNER, 2016 [FOI744]: 535
Cinetochilides monomacronucleatus FOISSNER, 2016 [FOI744]: 440
Cinetochilides terricola FOISSNER, 2016 [FOI744]: 430
Cladotricha chilensis FOISSNER, 2016 [FOI744]: 541
Cladotricha digitata FOISSNER, 2016 [FOI744]: 550
Colpoda ephemera FOISSNER, 2016 [FOI744]: 265
Columnnospatha bromelicola FOISSNER, WOLF, KUMAR, XU & QUINTELA-ALONSO, 2014 [FOI705]: 160
Condylotomides coeruleus FOISSNER, 2016 [FOI744]: 851
Coriplites grandis OERTEL, WOLF, AL-RASHEID & FOISSNER, 2008 [FOI633]: 237
Coriplites proctori OERTEL, WOLF, AL-RASHEID & FOISSNER, 2008 [FOI633]: 240
Coriplites tumidus FOISSNER, 2016 [FOI744]: 179
Cotterillia bromelicola FOISSNER & STOECK, 2010 [FOI667]: 31
Dileptus longitrichus VĎAČNÝ & FOISSNER, 2008 [FOI654]: 219
Dileptus microstoma VĎAČNÝ & FOISSNER, 2008 [FOI654]: 212
Dileptus semiarmatus VĎAČNÝ & FOISSNER, 2008 [FOI654]: 217
Dileptus sphagnicola VĎAČNÝ & FOISSNER, 2012 [FOI657]: 269
Dileptus tirjakovae VĎAČNÝ & FOISSNER, 2008 [FOI622]: 437
Dimacrocaryon amphileptoides paucivacuolatum VĎAČNÝ & FOISSNER, 2012 [FOI657]: 178
Dimacrocaryon arenicola VĎAČNÝ & FOISSNER, 2012 [FOI657]: 167
Dimacrocaryon brasilinese VĎAČNÝ & FOISSNER, 2012 [FOI657]: 162
Drepanomonas hymenofera venezuelensis OMAR & FOISSNER, 2013 [FOI721]: 421
Drepanomonas minuta FOISSNER & OMAR in OMAR & FOISSNER, 2014 [FOI742]: 296
Drepanomonas multidentata FOISSNER & OMAR in OMAR & FOISSNER, 2014 [FOI742]: 299
Drepanomonas vasta FOISSNER & OMAR in OMAR & FOISSNER, 2013 [FOI721]: 432
Emarginatophrya terricola FOISSNER, 2016 [FOI744]: 287
Enchelariophrya wolfi FOISSNER, 2016 [FOI744]: 231
Enchelyodon alqasabi FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 327
Enchelyodon floridensis FOISSNER, 2016 [FOI744]: 141
Enchelyodon gondwanensis FOISSNER, 2016 [FOI744]: 136
Enchelyodon isostichos FOISSNER, 2016 [FOI744]: 146
Enchelyodon monoarmatus monoarmatus FOISSNER, 2016 [FOI744]: 154
Enchelyodon monoarmatus pyriformis FOISSNER, 2016 [FOI744]: 166
Enchelys lajacola FOISSNER & OERTEL, 2009 [FOI626]: 211
Enchelys micrographica FOISSNER, 2010 [FOI662]: 72
Enchelys terricola lanceoplites FOISSNER, 2016 [FOI744]: 246
Enchelys terricola terricola FOISSNER, 2016 [FOI744]: 246
Enchelys tumida FOISSNER, 2016 [FOI744]: 251
Erimophrya monostyla FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 348
Fuscheria nodosa salisburgensis FOISSNER & GABILONDO in GABILONDO & FOISSNER, 2009 [FOI634]: 16
Fuscheria ulurensis FOISSNER & GABILONDO in GABILONDO & FOISSNER, 2009 [FOI634]: 10
Fuscheriides tibetiensis GABILONDO & FOISSNER, 2009 [FOI634]: 2
Glaucomides bromelicola FOISSNER, 2013 [FOI717]: 155
Gonostomoides bimacronucleatus FOISSNER, 2016 [FOI744]: 637
Gonostomoides caudatus FOISSNER, 2016 [FOI744]: 640
Gonostomoides fraterculus FOISSNER, 2016 [FOI744]: 644
Gonostomoides galapagensis FOISSNER, 2016 [FOI744]: 632
Gonostomum bromelicola FOISSNER, 2016 [FOI744]: 686
Gonostomum caudatum FOISSNER, 2016 [FOI744]: 660
Gonostomum fraterculus FOISSNER, 2016 [FOI744]: 696
Gonostomum halophilum FOISSNER, 2016 [FOI744]: 651
Gonostomum lajacola FOISSNER, 2016 [FOI744]: 676
Gonostomum multinucleatum FOISSNER, 2016 [FOI744]: 679
Gonostomum salinarum FOISSNER, 2016 [FOI744]: 658
Grossglockneria lajacola FOISSNER, 2016 [FOI744]: 302
Hemioxytricha isabelae FOISSNER, 2016 [FOI744]: 770
Heterometopus meisterfeldi FOISSNER, 2016 [FOI755]: 119
Heterourosomoida salinarum FOISSNER, 2016 [FOI744]: 806
Idiodeviata venezuelensis FOISSNER, 2016 [FOI744]: 579
Ileonema chobicola FOISSNER, 2016 [FOI744]: 52
Leptopharynx australiensis OMAR & FOISSNER, 2012 [FOI701]: 93
Leptopharynx brasiliensis FOISSNER & OMAR in OMAR & FOISSNER, 2012 [FOI661]: 31
Leptopharynx bromelicola FOISSNER, WOLF, YASHCHENKO & STOECK, 2011 [FOI666]: 135
Leptopharynx bromeliophilus OMAR & FOISSNER, 2012 [FOI701]: 90
Leptopharynx costatus gonohymen FOISSNER & OMAR in

- OMAR & FOISSNER, 2012 [FOI661]: 39
- Leptopharynx lajacola* OMAR & FOISSNER, 2014 [FOI742]: 308
- Levicoleps biwae* FOISSNER, KUSUOKA & SHIMANO, 2008 [FOI625]: 197
- Lingulothrix galapagensis* FOISSNER, 2016 [FOI744]: 106
- Mamillospatha lepidosomata* FOISSNER, WOLF, KUMAR, XU & QUINTELA-ALONSO, 2014 [FOI705]: 165
- Mancothrix pelobia* FOISSNER, 2016 [FOI744]: 403
- Maryna meridiana* FOISSNER, 2016 [FOI744]: 317
- Metathrix ellipsoidea ellipsoidea* FOISSNER, 2016 [FOI744]: 469
- Metathrix ellipsoidea oligostriata* FOISSNER, 2016 [FOI744]: 474
- Metauroleptus arabicus* FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 338
- Metopus filum* VĎAČNÝ & FOISSNER, 2017 [FOI762]: 37
- Metopus magnus* VĎAČNÝ & FOISSNER, 2017 [FOI762]: 52
- Metopus murrayensis* VĎAČNÝ & FOISSNER, 2017 [FOI762]: 60
- Metopus palaeformides* VĎAČNÝ & FOISSNER, 2017 [FOI762]: 41
- Microcolpoda bambicola* FOISSNER, 2016 [FOI744]: 295
- Microdileptus microstoma* VĎAČNÝ & FOISSNER, 2008 [FOI654]: 212
- Microdileptus semiarmatus* VĎAČNÝ & FOISSNER, 2008 [FOI654]: 217
- Monomicrocaryon crassicirratum* FOISSNER, 2016 [FOI744]: 762
- Monomicrocaryon euglenivorum euglenivorum* FOISSNER, 2016 [FOI744]: 756
- Monomicrocaryon euglenivorum fimbriacirratum* FOISSNER, 2016 [FOI744]: 757
- Monomicrocaryon granulatum* FOISSNER, 2016 [FOI744]: 752
- Neokeronopsis asiatica* FOISSNER, SHI, WANG & WARREN, 2010 [FOI669]: 89
- Neokeronopsis (Afrokeronopsis) aurea* FOISSNER & STOECK, 2008 [FOI623]: 4
- Notodeviata halophila* FOISSNER, 2016 [FOI744]: 567
- Notohymena quadrinucleata* FOISSNER, 2016 [FOI744]: 722
- Odontochlamys buitkampii* FOISSNER, 2016 [FOI744]: 429
- Odontochlamys denticulata* FOISSNER, 2016 [FOI744]: 424
- Orborhabdostyla bromelicola* FOISSNER, BLAKE, WOLF, BREINER & STOECK, 2009 [FOI635]: 294
- Oxytricha arabica* FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 344
- Oxytricha lithofera* FOISSNER, 2016 [FOI744]: 699
- Oxytricha longigranulosa imperfecta* FOISSNER, 2016 [FOI744]: 749
- Oxytricha longigranulosa sinensis* FOISSNER, 2016 [FOI744]: 742
- Oxytricha pulvillus* FOISSNER, 2016 [FOI744]: 704
- Oxytrichella mahadjacola* FOISSNER, 2016 [FOI744]: 776
- Parabistichella bergeri bergeri* FOISSNER, 2016 [FOI744]: 599
- Parabistichella bergeri brevisticha* FOISSNER, 2016 [FOI744]: 606
- Paracolpoda lajacola* FOISSNER, 2016 [FOI744]: 275
- Paragonostomum australiense* FOISSNER, 2016 [FOI744]: 622
- Paroxytricha quadrinucleata* FOISSNER, 2016 [FOI744]: 735
- Phialinides bicaryomorphus* FOISSNER, 2016 [FOI744]: 241
- Plagiocampa monotricha* FOISSNER, 2016 [FOI744]: 459
- Platynematum salinarum* FOISSNER, JUNG, FILKER, RUDOLPH & STOECK, 2014 [FOI737]: 176
- Platynematum terricola* FOISSNER, 2016 [FOI744]: 441
- Platyophrya bromelicola* FOISSNER & WOLF, 2009 [FOI628]: 88
- Platyophryides macrostoma* FOISSNER, 2016 [FOI744]: 409
- Pleuroplites cavicola* FOISSNER, 2016 [FOI744]: 260
- Protoplagiocampa lajacola* FOISSNER, 2016 [FOI744]: 452
- Protospathidium lepidosomatium* FOISSNER, WOLF, KUMAR, XU & QUINTELA-ALONSO, 2014 [FOI705]: 165
- Protospathidium salinarum* FOISSNER, 2016 [FOI744]: 187
- Pseudohemisincirra arabica* FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 343
- Pseudomonilicaryon brachyproboscis* VĎAČNÝ & FOISSNER, 2008 [FOI654]: 225
- Pseudomonilicaryon fraterculum* VĎAČNÝ & FOISSNER, 2012 [FOI657]: 371
- Pseudomonilicaryon gracile antevacuolatum* VĎAČNÝ & FOISSNER, 2012 [FOI657]: 397
- Pseudomonilicaryon gracile oviplites* VĎAČNÝ & FOISSNER, 2012 [FOI657]: 399
- Pseudomonilicaryon marinum minimum* VĎAČNÝ & FOISSNER, 2012 [FOI657]: 359
- Pseudoplatyophrya galapagensis* FOISSNER, 2016 [FOI744]: 308
- Pseudoplatyophrya isabelae* FOISSNER, 2016 [FOI744]: 304
- Pseudoplatyophrya spinosa* FOISSNER, 2016 [FOI744]: 311
- Pseudotelotrochidium epistylis* FOISSNER, 2016 [FOI744]: 475
- Pseudourostyla dimorpha* FOISSNER, 2016 [FOI744]: 524
- Pseudovorticella bromelicola* FOISSNER, BLAKE, WOLF,

- BREINER & STOECK, 2009 [FOI635]: 315
- Psilotrichides hawaiensis* HEBER, STOECK & FOISSNER, 2014 [FOI738]: 275
- Renoplites venezuelensis* FOISSNER, 2016 [FOI744]: 255
- Rimaleptus brasiliensis* VĎAČNÝ & FOISSNER, 2012 [FOI657]: 214
- Rimaleptus canadensis* VĎAČNÝ & FOISSNER, 2012 [FOI657]: 196
- Rimaleptus longitrichus* VĎAČNÝ & FOISSNER, 2008 [FOI654]: 219
- Rimaleptus tirjakovae* VĎAČNÝ & FOISSNER, 2008 [FOI622]: 437
- Sagittaria venezuelensis* FOISSNER, 2016 [FOI744]: 380
- Sagittarides oblongistoma* FOISSNER & BUOSI in FOISSNER, 2016 [FOI744]: 393
- Sandmannides venezuelensis* FOISSNER, 2016 [FOI744]: 341
- Sandmanniella terricola* FOISSNER & STOECK, 2009 [FOI624]: 482
- Schmidingerothrix extraordinaria* FOISSNER, 2012 [FOI689]: 239
- Schmidingerothrix salinarum* FOISSNER, FILKER & STOECK, 2014 [FOI723]: 73
- Semispathidium breviarmatum* VĎAČNÝ & FOISSNER, 2013 [FOI722]: 535
- Semispathidium fraterculum* FOISSNER & AL-RASHEID in FOISSNER, HESS & AL-RASHEID, 2010 [FOI630]: 62
- Semispathidium longiarmatum* VĎAČNÝ, SLOVÁK & FOISSNER, 2014 [FOI739]: 331
- Semispathidium pulchrum* FOISSNER, HESS & AL-RASHEID, 2010 [FOI630]: 67
- Spathidium alqasabi* FOISSNER, QUINTELA-ALONSO & AL RASHEID, 2008 [FOI631]: 323
- Spathidium bromelicola* FOISSNER, WOLF, KUMAR, XU & QUINTELA-ALONSO, 2014 [FOI705]: 180
- Spathidium bromeliophilum* FOISSNER, WOLF, KUMAR, XU & QUINTELA-ALONSO, 2014 [FOI705]: 171
- Spathidium curiosum* FOISSNER, 2016 [FOI744]: 204
- Spathidium dispar* FOISSNER, 2016 [FOI744]: 217
- Spathidium duschli* FOISSNER, 2016 [FOI744]: 207
- Spathidium inopinatum* FOISSNER, 2016 [FOI744]: 201
- Spathidium stetteri* FOISSNER, 2016 [FOI744]: 194
- Spathidium wolffi* FOISSNER, WOLF, KUMAR, XU & QUINTELA-ALONSO, 2014 [FOI705]: 187
- Sterkiella ecuadoriana* FOISSNER, 2016 [FOI744]: 810
- Stylonychia gibbera* FOISSNER, 2016 [FOI744]: 828
- Stylonychia notophorides* FOISSNER, 2016 [FOI744]: 835
- Suturothrix monoarmata* FOISSNER, 2008 [FOI632]: 89
- Tetrahymena aquasubterranea* QUINTELA-ALONSO, NITSCHKE, WYLEZICH, ARNDT & FOISSNER, 2013 [FOI694]: 245
- Totothrix panamensis* FOISSNER, 2016 [FOI744]: 817
- Urosomoida galapagensis* FOISSNER, 2016 [FOI744]: 800
- Urosomoida halophila* FOISSNER, 2016 [FOI744]: 796
- Urotricha spetai* FOISSNER, 2012 [FOI656]: 174
- BERGER & AL-RASHEID (2008) listed 396 **new combinations** made by FOISSNER and co-workers, since then 110 have to be added yielding 506 transferances:
- Allotrichides antarcticus* (BERGER, 1999) FOISSNER, 2016 [FOI744]: 770
- Apertospathula implicata* (KAHL, 1930) FOISSNER & OERTEL, 2009 [FOI626]: 213
- Apocrytolophosis minor* (VUXANOVICI, 1963) FOISSNER, BOURLAND, WOLF, STOECK & DUNTHORN, 2014 [FOI736]: 43
- Apodileptus visscheri* (DRAGESCO, 1963) VĎAČNÝ, ORSI, BOURLAND, SHIMANO & FOISSNER, 2011 [FOI660]: 311
- Apodileptus visscheri visscheri* (DRAGESCO, 1963) VĎAČNÝ, ORSI, BOURLAND, SHIMANO & FOISSNER, 2011 [FOI660]: 311
- Apometopus (Apometopides) pyriformis* (LEVANDER, 1894) FOISSNER, 2016 [FOI744]: 869
- Aponotophymena australis* (FOISSNER & O'DONOGHUE, 1990) FOISSNER, 2016 [FOI744]: 770
- Australocirrus aspoECKi* (FOISSNER, 1995) KUMAR & FOISSNER, 2015 [FOI751]: 211
- Australocirrus australis* (FOISSNER, 1995) KUMAR & FOISSNER, 2015 [FOI751]: 218
- Australocirrus shii* (SHI, WEI & WANG, 1997) KUMAR & FOISSNER, 2015 [FOI751]: 211
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- 250 colleagues (an increase of 63 compared to 2008) from all over the world are **co-authors** in FOISSNER's publications, demonstrating the high number of international relationships. In alphabetical order these are ACHTERBERG C. VAN, ADAM H., AESCHT E. (= WIRNSBERGER E.), AGATHA S., AL-RASHEID K.A.S., AMMERMANN D., ANDERSON R., AUGUSTIN H., BARDELE C.F., BAUCH C., BAUER R., BAUMGARTNER M., BECARES E., BERGER H., BERNATZKY G., BERNHARD D., BERTHOLD A., BICK H., BLAKE N., BLANTON R.L., BLATTERER H., BOENIGK J., BONACCORSO E., BOURLAND W. A., BREINER H.-W., BRENDLE K., BRON A., BROZEK S., BRUCKNER A., BRUEMMER F., BUCHGRABER K., BURKL G., BYERN J. VON, CHAO A., CHARLESTON T., CHATZINOTAS A., COLEMAN D., CORDEIRO T., CORLISS J.O., COSTAS B., COTTERILL F.P.D., CYRAN N., CZAPIK A., DARBYSHIRE J.F., DASTYCH H., DETCHEVA R., DIDIER P., DOMINGO H., DÖRFELT H., DRAGESCO J., DUNTHORN M., DURAN-RAMÍREZ C.A., DYAL P., EDGCOMB V., EICKER A., EIGNER P., EPPINGER M., EPSTEIN S. S., FARIA J., FILKER S., FOISSNER I., FOWLE W.H., FRANZ H., FRIED J., FUNKE W., GABILONDO R., GÄCHTER E., GANNER B., GARCÍA-FRANCO J. G., GELTZER J.G., GORDON D.P., GRIFFIN A., GROS P., GRYIER M.J., GSCHWIND K., GUHL W., GUINEA A., HACKL E., HACKSTEIN J.H.P., HASELWANDTNER K., HASLAUER J., HAUNSCHMID R., HAUSMANN K., HEATWOLE H., HEBER D.,

HEHN M., HEISS E., HENSCHER T., HERZOG E., HESS S., HIERSCHLAEGER M., HOFFMAN G.L., HOHMANN T., INOUE E., JANZ H., JI D., JUNG J.-H., JÜRGENS K., KAGE C., KAGE M., KATZ L.-A., KLEPAL W., KNIGHT R., KOBAYASHI T., KOHMANN F., KOPESZKI H., KORGANOVA G.A., KRAINER K.-H., KRAUTGARTNER W.D., KREUTZ M., KRIENITZ L., KUHLMANN S., KUMAR S., KUSUOKA Y., LAIBL J., LEE J.J., LEHLE E., LEI Y.-L., LEIPE D.D., LEITNER, LEWIS SMITH R.I., LI P.C., LINDNER R., LOBBAN C.S., LOHMEYER T., LOSERT A., LÜFTENEGGER G., LYNN D.H., MARTÍN-CERECEDA M., MAYÉN-ESTRADA R., MAYER E., MCMANUS G.B., MEDICUS R., MEISTERFELD R., MILASOWSZKY N., MILLER W.R., MITCHELL A.J., MOOG O., MOSER B., MULISCH M., MÜLLER H., MUSCH E., MYLNIKOV A.P., NEUNER W., NISHINO M., NITSCHKE F., NORF H., NOVARINO G., O'DONOGHUE P.J., OERTEL A., OLEKSIV I., OMAR A., OPITZ H., OPPELT A., ORSI W., OTT J.A., ÖZBEK S., PAN H.-Y., PAOLETTI M.G., PAWLOWSKI J., PEER T., PETZ W., PEUKERT B., PFABEL C., PFEFFER M., PFISTER G., PFLEGER H.S., PICHLER M., PILSL P., PIROG K., POCHON X., PRATT J.R., PRESCOTT D.M., PUM M., PUYTORAC P. DE, QUERNER P., QUINTELA-ALONSO P., RIEDER N., RÖTTGER R., RUCH B., RUDOLPH J., RYAN P.G., RYDLOW M., SCHÄFER U., SCHAUMBURG J., SCHEFFEL U., SCHEFTER M., SCHIFFMANN H., SCHIFTNER U., SCHILLER W., SCHLEGEL M., SCHMIDT H., SCHÖNBORN W., SCHUBERT G., SCHWEIKERT M., SESSITSCH A., SHEN Y., SHI X., SHIELDS G., SHIMANO S., SIMONSBERGER P., SIMPSON A.G.B., SKOGSTAD A., SLOVÁK M., SMITH R.J., SNOEYENBOS-WEST O.L.O., SONG W., SONNTAG B., STADLER P., STARLINGER F., STECHMANN A., STEINER E., STETTER K.O., STOECK T., STOEHER O., STRÜDER-KYPKE M., SUAREZ P., TAURER-ZEINER C., TAYLOR C., TAYLOR G.T., TESAROVA P., THOMPSON G., TUERK R., UNTERWEGER A., URABE M., VAN DER STAAY G.W.M., VĎAČNÝ P., VOSS H.-J., WAITZBAUER W., WANG R., WANNER M., WARREN A., WATKINS B.P., WEBER F., WEISSE

T., WEISSENBACHER B., WENZEL F., WIACKOWSKI K., WILBERT N., WITTMANN H., WODARZ D., WOLF K., WÖFL S., WRIGHT A.-D.G., WURTH C., XU K., YASHCHENKO V., YEATES G.W., ZANKL A., ZECHMEISTER-BOLTENSTERN S.

Digitized content: none.

Future prospects

- A systematic (virtual) catalogue including all descriptions, figures and diagnoses of taxa established by the FOISSNER school would be very helpful
- Evaluation of the biocoenoses represented on the slides
- Integration of the further about 20,000 slides, biggest taxonomic offprint and book collection worldwide as well as original drawings, protocols etc. housed in FOISSNER's private laboratory
- Hopefully all prepared, drawn and morphometrically analysed not yet described species can be submitted to publication

Bruno Maria KLEIN (1891–1968)

Curriculum Vitae

- Born 19 August 1891 in Vienna (Maximilian was later changed to Maria)
- First World War in Galicia
- 1 February 1921 till 31 March 1927 preparator in the Natural History Museum in Vienna on project basis
- 1926 first publication on the silverline system applied in analogy to the neurobiological method of Camillo GOLGI and Santiago Ramón Y CAJAL
- 1 April 1927 permanent position in the herpetology section
- 1927/29 lectures in the Zoological-Botanical Association of Vienna
- 1935 glass model of *Glaucoma*; „infusorian



Fig. 74: Bruno Maria KLEIN, the discoverer of the silverline system, and documents on public marks of respect as presented in the exhibition “The Protozoa – a hidden world” in 1994.

AESCHT E. (1994): Die Erforschung der Urtiere (Protozoen) in Österreich. — Kataloge des OÖ. Landesmuseums N. F. 71: 7–79 [first actual bibliography including 21 figures and relations to FOISSNER; see short summary in HAUSMANN & MACHEMER present volume p. 34].

AESCHT E. (2003): Zur Geschichte der Sammlung “Wirbellose Tiere” (ohne Insekten) am Biologiezentrum Linz. — BNO 12: 51–88 [see <https://www.zobodat.at/personen.php?id=7779&bio=full>].

AESCHT E. (2007): Bio:Artefakt–(k)ein Gegensatz? In: C/o:K [Institut für Kunstinitiativen], BIO Fakte ARTE Fakte. — Publikation Nr. 6, Linz 6: 4–21 [AEE102].

studies on the German Sunda expedition

- 1938 film
- 28 January 1952 Ph. D. honoris causa at the University of Vienna; 21 March honorary citizen of St. Andrä Wördern; 8–10 September honorary member of the American Society of Protozoologists (nominated by J.O. CORLISS)
- 1950s judge on European shorthair cats
- 1956 retirement
- 1958 first text on his silver impregnation method in English language
- 9 August 1961 visit of J.O. CORLISS in St. Andrä Wördern
- 17 August 1968 visit of W. FOISSNER in St. Andrä Wördern
- Death 18 August 1968

Additional bibliographic (& other) sources

EISELT J. (1969): Dr. phil. h. c. Bruno M. KLEIN †. — Ann. Naturhistor. Mus. Wien 53: 25–34.

CORLISS J.O. (1969): Bruno M. KLEIN, 1891–1968. — JoPr 16: 586–587.

Primary contributions:

- Discoverer of the silverlinie system in ciliates and further protists
- Applying silver impregnation staining methods to cancer cells in histological sections revealed earliest stages and even spontaneous remissions
- Conception of bio- and artefact at organic level

Contents of collection

Series descriptions: period 1905—1959

The scientific estate of Bruno M. KLEIN did not go to the Natural History Museum, where he had worked for 35 years, but to the Lower Austrian Museum (“Niederösterreichisches Landesmuseum”), from where in 1992 a permanent loan to the Biology Center of Upper Austria Landesmuseum in Linz was appointed via Gerhard TUISL and Erich STEINER, representants of the institution. Ms. Anna HOKE, his longtime

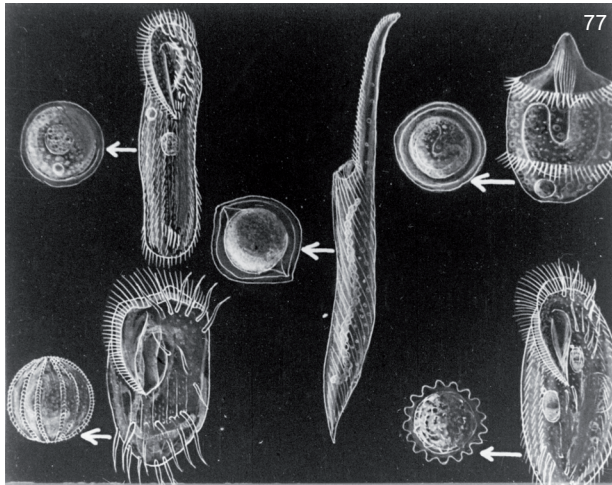
Fig. 75–80: Shots of the black and white film on “Infusoria” by KLEIN. — 75: Draft of the glass model of *Glaucoma*. — 76: Life forms of a peritrich ciliate. — 77: Cysts of five different taxa of ciliates. — 78: Reconstruction of ciliary motility. — 79: Extrusomes. — 80: silverline system and ciliary fibers.



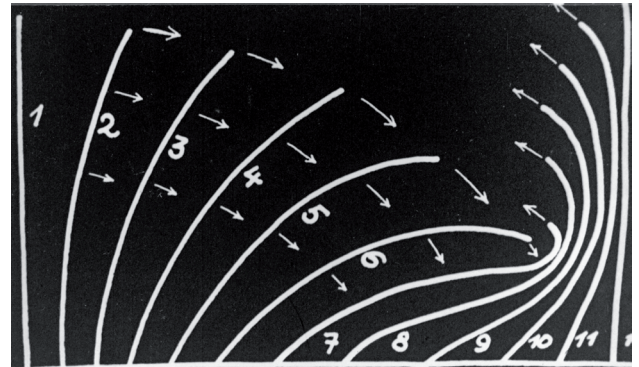
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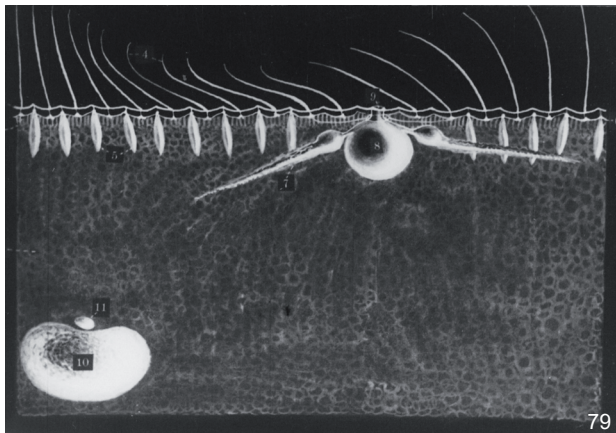


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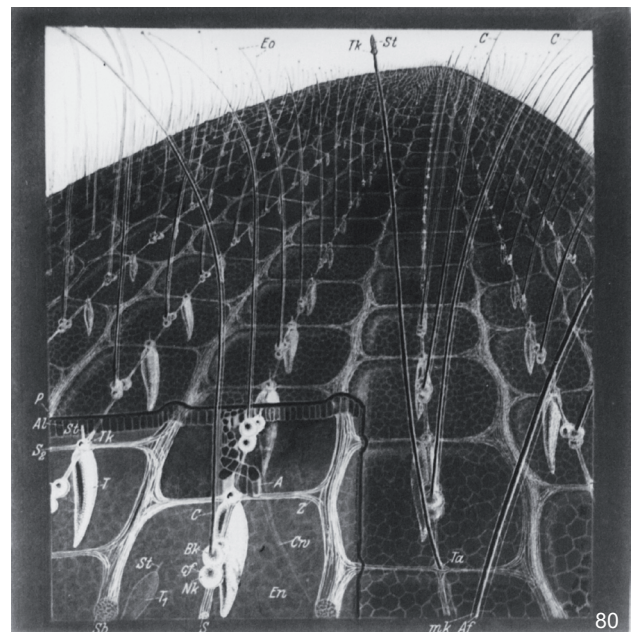


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housekeeper, passed on additional materials to me during my visit at St. Andrä Wördern in 1993. Particularly valuable are 300 of more than 700 “ciliate” slides on which his publications are based and which he himself has arranged in three preparation boxes. Other highlights in the collection are drafts on exhibitions and aesthetic drawings.

Series 1 Prepared organisms

45 boxes contain 4294 slides including 1092 (25,4 %) on limnetic and parasitic protists, 230 (5,4 %) on diverse invertebrates, 257 (6,0 %) on insects, 2116 (49,3 %) on vertebrates, 127 (3,0 %) on plants, 12 (0,3 %) on procaryotes and on diverse unlabeled or anorganic samples 460 (10,7 %). 2884 of the slides are dated; several exotic sampling sites very probably have their origin in the collections of the Natural History Museum, because no travels of KLEIN outside Austria are known.

KLEIN was rather morphogenetically and physiologically interested, so his collection does not contain designated types. However, the 80 slides collected by Alfred KAHL (1877–1946) in Hamburg around 1928/1929 might represent syntypes; this needs further investigations.

Series 2 Publications

400 offprints of his own 141 publications on ciliates, amoebae, flagellates, insects, spiders, vertebrates (mostly cats), molluscs, crystalline, and preparation techniques are available for dissemination. His chronological bibliography is given by AESCHT (1994), therefore here I categorise his contributions according to the main topics, journal, volume and page numbers and the reference code under which the reprint can be found:

On ciliates:

Annalen des Naturhistorischen Museums in Wien 52: 20–53 (1942) [KLE087]; 54–65 + Taf. V (1942) [KLE088]; 53: 156–336+Taf.VIII-XXII (1943) [KLE092].

Annls Protistol. 4: 55–68 + Taf. VI, VII (1934) [KLE036].
Arch. Hydrobiol. Suppl. 14: 292–294 (1935) [KLE048].

Arch. Protistenk. 56: 244–279 (1926) [KLE002]; 58: 55–142 (1927) [KLE004]; 62: 177–260 + Taf. 7–10 (1928) [KLE006]; 65: 183–257, Taf. 9 (1929) [KLE008]; 69: 235–326, Taf. 14 (1930) [KLE011]; 74: 401–416, Taf. 11 (1931) [KLE021]; 79: 147–169 (1933) [KLE031]; 87: 299–313, Taf. 11 (1936) [KLE050]; 88: 1–22, Taf. 1 (1936) [KLE052]; 188–191 (1937) [KLE053]; 192–210, Taf. 3 (1937) [KLE054]; 90: 292–298, Taf. (1938) [KLE062]; 92: 401–407, Taf. 26 (1939) [KLE068]; 408–414 (1939) [KLE069]; 96: 1–30, Taf. 1, 2 (1942) [KLE089].

Biol. Zbl. 56: 174–188 (1936) [KLE049].

Boll. Lab. Zool. agr. Bachic. R. Ist. sup. agr. Milano 4: 117–150 (1934) [KLE037]; 6: 111–154 + Taf. II (1935) [KLE046].

Cytologia 10: 423–433 (1940) [KLE074].

Der Naturforscher 4: 316–323 + Taf. 53 (1928) [KLE007]; 8–13, Taf. 4 (1928)? [KLE005]; 5, 1: 460–468 + Taf. 81 (1929) [KLE009].

Die Umwelt, Wien 1/8: 321–323 (1947) [KLE098].

Ergebn. Biol. 8: 75–179 (1932) [KLE027].

JoPr 5: 99–103 (1958) [KLE131].

Mikrokosmos 20: 233–235 (1927) [KLE003]; 31: 76–81 (1938) [KLE059]; 33: 13–17 (1940) [KLE075]; 36: 110–114 (1943) [KLE093]; 94 (1943) [KLE091]; 39: 225–227 (1950) [KLE109]; 42: 49–52 (1952) [KLE118]; 45: 203–208 (1956) [KLE129]; 46: 241–244 (1957) [KLE130]; 54: 101–105 (1965) [KLE139].

MittBl. mikrograph. Ges. Wien (1960) 28–30 (1960) [KLE134] (1965)/1; 3–7 (1965) [KLE138]; (1966) 6–9 (1966) [KLE140]; (1968) 44–48 (1968) [KLE142].

Natur Techn (1950) 214–216 (1950) [KLE108].

Natur Volk 69: 431–440 (1939) [KLE066].

Öst. zool. Z. 1: 627–635 (1948) [KLE103].

Pan-Bildband, Wien 36 Bilder + Text (1938) [KLE063].

Umschau, Frankfurt a. M. 44: 101–103 (1940) [KLE071].

Universum, Natur u. Techn (1954) 243–249 (1954) [KLE125].

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- Der getreue Eckhart 19: 237–239 (1942) [KLE086] (1939)/2 unpag. (4 pp.) (1939) [KLE070] (1940) 320 (1940) KLE073
- Kleintier und Pelztier 10: 72–74 (1934) [KLE035].
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- MittBl. mikrograph. Ges. Wien 1961: 2–5 (1961) [KLE136].
- Natur Techn. (1949) 106 (1949) [KLE104]; (1950) 13–15 (1950) [KLE107]; (1951) 5–7 (1951) [KLE111].
- Österr. Tierschutzkalender 8: 42–43 (1935) [KLE040].
- Umwelt, Wien 1/12: 410–417 (1948) [KLE100].
- Universum, Natur u. Techn. (1953) 694–696 (1953) [KLE122]; (1954) 435–439 (1954) [KLE126].
- Wiss. Fortschr. 15: 72–76 (1941) [KLE077]; 16: 441–444 (1942) [KLE084].
- Wochenrundschau 72/2: 7 (1941) [KLE080].
- On general biology:**
- Biol. Zbl. 52: 709–715 (1932) [KLE029].
- Der Naturforscher 10: 84–85 + Taf. VII (1933) [KLE033]; 6,1: 377–380 + Taf. 79 (1930) [KLE012]; 6,9: 329–335 + Taf. 68, 69 (1929) [KLE010]; 7, 1: 478 + Taf. 95, 96 (1931) [KLE016]; 8, 1: 12–15 + Taf. 3 (1931) [KLE017]; 411–414 + Taf. 90, 91 (1932) [KLE026]; 8, 2: 72–73 + Taf. 11 (1931) [KLE018]; 8, 3: 81–88 + Taf. 17, 18 (1931) [KLE020].
- Flugbl. naturhist. Mus. Wien 7: 1–2 (1954) [KLE124].
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- Natur Volk 69: 386–390 (1939) [KLE065]; 70: 65–69 (1940) [KLE072]; 71: 129–139 (1941) [KLE078]; 351–355 (1941) [KLE081].
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- Wissen f. Alle (1943)/3–112–114 (1943) [KLE095].
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- Acta Carcologica 1/2: 1–10 (1934) [KLE038].
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- Arch. Dermatol. Siphilis 171: 280–300 (1935) [KLE043]; 173: unpag. (1935) [KLE045].
- Ärztl. Korrespondenz (1933) 134–137 (1933) [KLE032].
- Biol. Heilkunst 12: 664–668 (1931) [KLE024]; 13: 766–768 (1932) [KLE028]; 14: 53–57 (1933) [KLE030].
- Der Öst. Arzt 2: 99–102 (1935) [KLE042].
- Hippokrates, Z. f. prakt. Heilkunst 4: 311–16,346–59,378–94 (1933) [KLE034]; 6: 283–288 (1935) [KLE044]; 7: 970–974 (1936) [KLE051].
- Revista Sanateata, Bukarest 12: 19–21 (1935) [KLE041].
- Z. Krebsforsch. 41: 87–102 (1934) [KLE039]; 45: 399–422 (1937) [KLE055].
- Z. wiss. Mikrosk. 54: 181–192 (1937) [KLE057].
- On cats:**
- Der Lichtbildner 3: 1–2 (1943) [KLE090].
- Der Naturforscher 7, 6: 201–207 + Taf. 41, 42 (1930) [KLE013]; 7, 9: 326–331 + Taf. 65, 66 (1930) [KLE014]; 8, 6: 177–181 + Taf. 41, 42 (1931) [KLE022].
- Der Tierfreund, Z. Wiener Tierschutzver. (1954)/1: ? (1954) [KLE123].
- Die deutsche Jugendzeitung 9, 38: 149–150 (1930) [KLE154].
- Jb. Ges. Natur u. Techn. (1953) 85–105 (1953) [KLE120].
- Natur Techn. 11: 241–243 (1948) [KLE102]; 3: 57–59 (1951) [KLE112].
- Naturschutz, Berlin 12, 8: 193–200 (1931) [KLE019].
- Österr. Tierschutzkalender 17: 62–63 (J. (1951) (1950) [KLE110]; 18: 49–51 (J. (1952) (1951) [KLE115].
- Universum, Natur u. Techn. 19: 29 (1964) [KLE137].
- Zool. Gart., Leipzig NF 11: 24–31 (1939) [KLE067].
- On techniques:**
- Mikrokosmos 31: 105–111 (1938) [KLE061]; 50: 302–305 (1961) [KLE135].
- Natur Techn. (1948) 103 (1948) [KLE101].
- Wiss. Fortschr. 14: 514–516 (1940) [KLE076].
- Z. wiss. Mikrosk. 54: 421–427 (1937) [KLE058]; 58: 5–13 (1941) [KLE083].
- The collection harbours 1462 reprints of about 500 diverse authors (under the signature [BM0001]–[BM1462]; one can imagine how high postage costs had been for the likely exchange of publications. Favorites with more

than 10 papers are G.H. PARKER (64), J. GELEI (48), L.H. BRETSCHNEIDER (43), B.B. MORGAN (35), E.C. BOVEE (33), R.P. HALL (32), D.H. WENRICH (25), H. KIRBY (29), P.P. GRASSE (29), Z. RAABE (19), C.D. BEERS (18), O. WETTSTEIN (18), V. TARTAR (16), O. JIROVEC (15), T. HUZELLA (13) and I. LEPSI (12).

Series 3 Unpublished material

The collection contains about 2000 transparencies, 3400 glass and 400 photographic negatives, 400 paper positives, 350 letters, a black and white film on “Infusoria” and his camera.

Nine manuscripts mainly deal with the beauty of nature:

1930 Tiergestalten und ihr Verhalten. 120 Bilder von Katzen, Eulen, Chamäleons, Schlangen und Insekten (57 pages);

1943 „Biofakt und Artefakt als konvergente und differente Gebilde“ (36 pages); „Lebenswirken und Kunstschaffen im Spiegel des Ornament“s“ (6 pages); „Zierkunst und Tierzierrat“ (4 pages);

1948 „Merkmal und Luxus in der Tiertracht“ (9 pages);

1962 „Naturschönheit jenseits des Daseinskampfes (contra Lorenz)“ (7 pages);

1966 „Naturschönes als Zweck und Luxus“ (5 pages);

undated are „Die Zelle als Schaustellung“ (9 pages) and “Unsichtbar. Zu einem Film von KAMBE und ROBERTS (23 pages, 17 figs).

Series 4 Documentation

KLEIN’s single co-worker was the physician Dr. Anton MIESSRIEGLER in Wördern, together they published 14 papers between 1933 and 1937. These studies, which are particularly important for psychosomatics, were interrupted by the Second World War and found no continuation.

Contacts with Geza ENTZ (1842–1919; visited KLEIN in Vienna 1926), BRESSLAU, CANELLA, PROVASOLI, CORLISS (1954, 1956), LEVINE, Alfred KAHL (1877–1946; 80 slides from 1928/9),

Dr. Ludwig H. BRETSCHNEIDER (1899–1964, Utrecht; 1926, 1952–1961), who in the 1950s pioneered in the early use of the transmission electron microscope, Max HARTMANN (1930 on flagellates), Dr. Gustaf LASSMANN (1954), W. BAUMEISTER (Bavaria; 1928) are documented. FOISSNER honoured KLEIN by a subgenus (*Kleinstyla* FOISSNER, AGATHA & BERGER, 2002) and *Colpidium kleini* in 1969.

Digitized content: 2000 transparencies in the collection have been scanned and are intended to be made available online through our digital repository ZOBODAT.

Future prospects

- Restauration of the glass model of *Glaucoma*; might bring it from the “Museum of Natural History” in Vienna to Linz
- Slides on cancer should be reinvestigated in the light of psychosomatics
- Early studies and photographic documentations on organic biofacts and artefacts as well as the behaviour of cats are worth to be evaluated

Ewald SCHILD (1899–1962)

Curriculum Vitae

- Born 30 May 1899 in Vienna
- Lecturer in the Pedagogical Institute of Vienna
- Since 1921 Board of the Viennese Education Association
- 1921 founder of a private research laboratory on scientific and applied microscopy; demonstrated a microprojection apparatus of living organisms in a meeting of the “Gesellschaft Deutscher Naturforscher und Ärzte” [Society of German Naturalists and Doctors] at Leipzig
- 1951 Karl-RENNER-price for the construction

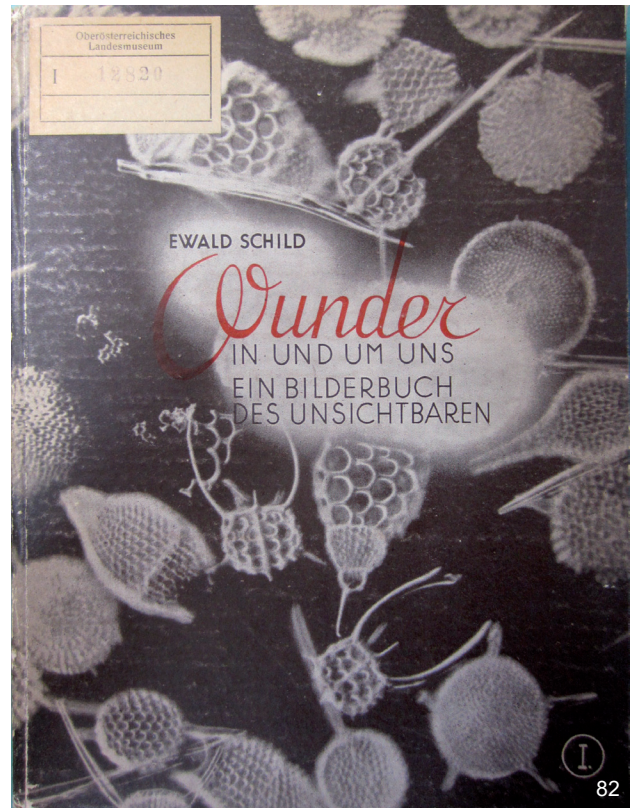


Fig. 81, 82: A composition of images taken by Ewald Schild with himself as the centre of the montage (81) and title page (82) of Ewald SCHILD's book "Wonders in an around us – A picture-book of the invisible", published in Linz 1947.

of the cuvette microscope developed for the direct observation of the microworld of water and soil under natural conditions

- 7 May 1954–1962 director of the "Mikrobiologische Station der Stadt Linz" (Roseggerstraße 22) with courses for at least 700 persons
- 1958 responsible for the section „Natural Sciences“ at the Community College Linz
- Death 2 October 1962 in Linz

Additional bibliographic (& other) sources

- GRÜNBERG F. (1949): Zum 50. Geburtstag Ewald SCHILD's. — Wiener med. Wochenschr. **21/22**: 238–239.
- AESCHT E. (1994): Die Erforschung der Urtiere (Protozoen) in Österreich. — Kataloge des OÖ. Landesmuseums N. F. **71**: 7–79.
- LAISTER G., SCHAUBERGER R. & SCHWARZ F. (2003): „Wohltemperierte“ Ökologie? – Ein halbes Jahrhundert Naturkundliche Station. ÖKO·L **25/1**: 4–9

Primary contributions:

- Austrian pioneer of microcinematography and technological innovations
- Promotor of the fascination for biology, especially microorganisms, in numerous non-academic courses
- Wrote several books about the miracles of the microcosm, which also contains images of protozoa, as well as on practical microscopy (SCHILD 1923, 1947, 1955)
- Edited at least 15 volumes (since 1948) of the „Sammlung Bios“ [Biologie; the first term being reminiscent of FRANCÉ's famous book title of 1923 appears on the dust-jacket, the latter on the cover of the book] in the Viennese publishing house „Brüder HOLLINEK“ contributing to the restoration of natural education in Austria

Contents of collection

Series descriptions: period 1920s—1962

Series 1 Prepared organisms

61 flat maps contain 1112 slides including 78 (7,0 %) on limnetic and parasitic protists, 155 (13,9 %) on diverse invertebrate groups, 117 (10,5 %) on insects, 617 (55,5 %) on vertebrates, 100 (9,0 %) on plants and 45 (4,0 %) on procaryotes. About one third of them are identified to species level, in need of taxonomic revision. As most preparations likely have been prepared during microscopic courses treating general biological questions, rarely a sampling place or date is provided.

Series 2 Publications

SCHILD E. (1921): Regenerationsversuche an Protozoen. — Mitt. Märkischen Mikrobiol. Vereinig.: 1–7 [HB0920].

SCHILD E. (1922): Mikrobiologische Monatshefte **12**: 1–33 [PR7224].

SCHILD E. (1922): Das Rätsel des Lebens – und andere biologische Plaudereien. Freidenker-Verlag, Wien 1922

SCHILD E. (1923): Das Mikroskop Bau Wirkungsweise Handhabung und Pflege. — Karger Verl., Berlin: 1–48 [PR0048].

SCHERPPELTZ O. & SCHILD E. (1923): Mikroprojektionsmethoden. — Entomologischer Anzeiger **3**: 65–69, 77–82, 89–92.

SCHILD E. (1925): Kinematographie des Unsichtbaren. — Urania **1**: 336–338 (1924/25) [PR0221].

SCHILD E. (1926): Der Tanz der *Vorticella*. — Urania **2**: 337–338 (1925/26) [CI7189].

SCHILD E. (1926): Das Diptam-Wunder (Die brennende Pflanze). — Urania **2**: 367–368 (1925/26) [EV8150].

SCHILD E. (1926): Von den kleinsten Baumeistern der Erde. — Urania **2**: 45–48 (1925/26) [PR6180].

SCHILD E. (1926): Leuchtende Bakterien. — Urania **2**: 78–79 (1925/26) [EV0859].

SCHILD E. (1926): Dressierte Krebse, Regenwürmer und Seesterne. — Geistesfreiheit **5**.

SCHILD E. (1927): Ein „herzloses“ Lebewesen. — Urania **3**: 168 (1926/27) [EV7436].

SCHILD E. (1927): Leben im kleinsten Raum. — Urania **3**: 201–202 (1926/27) [PR0220].

SCHILD E. (1927): Die diesjährige Naturforscher- und Aertztagung in Düsseldorf. — Urania **3**: 81–84 (1926/27) [EV0858].

SCHILD E. (1927): Vom geliebten Floh und seinen 2000 Verwandten. Verlag der unabhängigen Wochenschrift „Die Unzufriedene“, Wien.

SCHILD E. (1937): Buntes Leben zieht vorüber... Rundfunkplaudereien. Moldavia Budweis.

SCHILD E. (1943): Praktische Mikroskopie für den Arzt. — Wiener med. Wochenschr.: 1–164+xiv Taf [EVB357].

SCHILD E. (1946/1947): Mikroskopie des Schnees. — Mikroskopie, Zentralblatt für Mikroskopische Forschung und Methodik **1**: 115–124.

SCHILD E. (1947): Wunder in und um uns. Ein Bilderbuch des Unsichtbaren. — Brücken-Verl., Linz: 1–120 [AB1321].

SCHILD E. (1947): Praktische Mikroskopie. 2. verbesserte, ergänzte Aufl. — Maudrich Verl., Wien, Bonn: 1–242 [AEB419].

SCHILD E. (1949): Forschungsarbeiten für wissenschaftliche und angewandte Mikroskopie in Wien; Küvetten-Mikroskopie. — Wiener med. Wochenschr. **21/22**: 235–238 [BM0923 with an autograph to B.M. KLEIN].

SCHILD E. (1955): Praktische Mikroskopie. 3. neubearb., erw. Aufl. — Maudrich Verl., Wien, Bonn: 1–242+XX Taf [LB1410].

Series 3 Unpublished material

The collection contains nearly 1000 transparencies, photographic negatives, paper positives.

Series 4 Documentation

Apart from SCHILD and his laboratory („Mikrobiologische Station“), the following legators (or preparators) are mentioned: „Pracownia biol. Krakow“, Biol. Versuchsanst. Wien, Inst. Pasteur, Reichert Wien; THADEN Kr. (Rendsburg) and LEINFELLNER (on Malaria).

Digitized content: 986 transparencies in the collection have been scanned and are intended to be made available online through our digital repository ZOBODAT.

Future prospects

- Reconstruction of the preparation methods 1920s–1960s
- Microphotography of interesting objects

Jean DRAGESCO (*1920)

Curriculum Vitae

- Born 26 April 1920 in Cluj, Romania
- 1938–1939 Founder of the “Romanian Association of Microscopy” and “Micron”, a monthly magazine in Bucharest, Romania
- 1940–1942 studies on optics and natural sciences in Paris
- 1941 Left Romania in Autumn
- 1944 Free lance researcher in the “Laboratoire d’ Embryogénie Comparée” at the “Collège de France”, directed by Professor E. Fauré-FREMIET
- 1946 Member of the “Centre national de la Recherche Scientifique” (CNRS)
- 1958 Ph. D. (Biology) in Paris
- 1977–1986 Research in equatorial Africa
- 1986 France (since then)
- 1987 Retirement

Additional bibliographic (& other) sources

Astronomical scientific fellowships and awards: <http://www.astro.ro/Dragesco.html>

In 2000, on the occasion of his 80th anniversary, his name was assigned to the asteroid 12498.

Primary contributions:

- Pioneer microcinematic filmer, who made some 15 films on protists
- Described more than 320 new taxa of sand-dwelling ciliates and dinoflagellates (mesopsammon)
- Discovered new fixatives improving protargol impregnation
- Beyond protistology a famous amateur astronomer

Contents of collection

Among the highlights in the collection are the original drawings of his famous book „Ciliés libres de l’Afrique intertropicale“, written with his wife Armelle DRAGESCO-KERNÉIS in 1986. DRAGESCO also donated his books „High resolution astrophotography“ (1995) and „Amintirile unui vanator de imagini in Africa“ (2005). In the latter, he remarked that he just sent „the last box of slides for Linz“.

Series descriptions: period 1997–2006

The collection contains 462 slides of ciliates (six of them of 6 protists); the sampling period spans 1945–1999.

Series 1 Prepared organisms

The taxa recorded nominally on the 462 slides as regarding designated types are listed in AESCHT (2008).



Fig. 83: Jean DRAGESCO during his lecture at the 15th meeting of “German Society for Protozoology” (DGP) in Linz 1996.

Series 2 Publications

More than 160 papers and books on protozoology, wild birds and mammals, photography, cinematography, ballistics, etc. according to the website cited above. Moreover, about 100 papers and books on astronomy, beyond the scope of this paper. As there exists no complete bibliography, nearly hundred papers on protistology and microscopy are given here.

- DRAGESCO J. (1935): Ein neuer Parasit entdeckt. — *Orion* **7/8**: 317 [GP1202].
- DRAGESCO J. (1948): Eine bewegliche mikrokinematographische Einrichtung. — *Mikroskopie* **3**: 238–242.
- DRAGESCO J. (1949): Étude microcinématique de la capture et de l'ingestion des proies chez les ciliés holotriches gymnostomes. — C. r. 13e Congr. int. Zool. Paris **1948**: 227.
- DRAGESCO J. & GUILCHER Y. (1949): Etude microcinématographique de la capture et de l'ingestion des proies chez les infusoires tentaculifères. — C. r. 13e Congr. int. Zool. Paris **1948**: 223 [GP1225].
- DRAGESCO J. & GUILCHER Y. (1949): Etude microcinématographique du bourgeonnement de l'acinétien *Discophrya piriformis*. — C. r. 13e Congr. int. Zool. Paris **1948**: 224 [GP1224].
- DRAGESCO J. & GUILCHER Y. (1950): Sur la structure et le fonctionnement des tentacules d'acinétiens. — *Mikroskopie* **2**: 17–25.
- BLANC-BRUDE R., DRAGESCO J. & HERMET J.P. (1951): Microscopie électronique des tentacules de l'acinétien *Discophrya piriformis* GUILCHER. — *Bull. Micro. Appl.* **2**: 29–30 [GP0445].
- DRAGESCO J. (1952): The mucoïd trichocysts of flagellates and ciliates. — *Proc. 3rd Internat. Congr. Protozool.*: 15.
- DRAGESCO J. (1952): Observation et photographie des infusoires ciliés en contraste de phase. — Le contraste de phase et le contraste par interférences: 258–261 [GP1200].
- DRAGESCO J. (1952): Le flagellé *Oxyrrhis marina*: cytologie, trichocystes, position systématique. — *Bull. Micr. appl.* **2**: 148–157 [PR4111].
- DRAGESCO J. (1952): Sur la structure des trichocystes toxiques des infusoires holotriches gymnostomes. — *Bull. Micr. appl.* **2**: 92–98 [CI2281].
- BEYERSDORFER K. & DRAGESCO J. (1952): Etude comparative des trichocystes de sept espèces de paramecies. — *Revue d'Optique, Paris*: 661–671 [BM1284].
- BEYERSDORFER K. & DRAGESCO J. (1952): Microscopie électronique des trichocystes de *Frontonia*. — *Revue d'Optique (Congr. Microsc. Electr.)* **1952**: 655–660 [BM1285].
- DRAGESCO J. (1953): Microcinématographie des infusoires ciliés. — *Research Film (Göttingen)* **1**: 10–13.
- DRAGESCO J. (1953): Microphotographie à l'aide des éclairages électroniques. — *Mikroskopie (Wien)* **8**: 254–247?
- DRAGESCO J., GUILCHER Y. & FAURÉ-FREMIET E. (1953): Feeding and endogenous budding in suctorians. *Microcinematography*. — *Proc. Soc. Protozool.* **4**: 6.
- DRAGESCO J. (1954): Contribution à la connaissance d'un infusoire commensal de l'amphioxus: *Frontonia branchiostomae* (Codreanu) (I). — *Vie et Milieu* **4**: 605–607 (year 1953) [CI1280] + [GP1201].
- DRAGESCO J. (1954): Sur l'écologie des ciliés psammophiles littoraux de la région de Banyuls-sur-Mer (Pyr.-Or.)(Note préliminaire)(I). — *Vie et Milieu* **4**: 627–632 (year 1953) [CI1288].
- DRAGESCO J. (1954): Diagnoses préliminaires de quelques ciliés nouveaux des sables de Banyuls-Sur-Mer. — *Vie et Milieu* **4**: 633–637 (year 1953) [CI1054].
- DRAGESCO J. (1954): Diagnoses préliminaires de quelques ciliés psammophiles nouveaux. — *Bull. Soc. zool. Fr.* **79**: 57–62 [CI1053].
- DRAGESCO J. (1954): Diagnoses préliminaires de quelques ciliés nouveaux des sables. — *Bull. Soc. zool. Fr.* **79**: 62–70 [CI1052].
- DRAGESCO J. (1955): Contribution à la connaissance d'une algue rarissime *Phaeodactylum tricornerum* BOHLIN. — *Bull. Micro. Appl.* **2**: 41–44 [GP1203].
- DRAGESCO J., BLANC-BRUDE R. & GAUCHERY M. (1955): Anhydrobiose chez un infusoire tentaculifère: *Heliophrya erhardi* (Rieder) Matthes. — *Mikroskopie (Wien)* **10**: 262–266 [CI6020].
- DRAGESCO J., BLANC-BRUDE R. & SKREB Y. (1955): Morphologie et biologie d'un tentaculifère peu connu: *Heliophrya erhardi* (Rieder) Matthes. — *Bull. Micro. Appl.* **2**: 105–112 [GP1222].
- BLANC-BRUDE R., SKREB Y. & DRAGESCO J. (1955): Sur la biologie de *Nucleria delicatula* (CIENKOWSKI). — *Bull. Micro. Appl.* **2**: 9–10 [GP0446].
- DRAGESCO J., BLANC-BRUDE R. & SKREB Y. (1955): Morphologie et biologie d'un tentaculifère peu connu: *Heliophrya erhardi* (RIEDER) MATTHES. — *Bull. Microsc. appl.* **5**: 105–112 [CI4173].
- GRASSE P.-P. & DRAGESCO J. (1957): L'ultrastructure du chromosome des péridiniens et ses conséquences génétiques. — C. r. séanc. Acad. Sci. **245**: 2447–2452 [PR2053].

- DRAGESCO J. (1959): Adaptations morphologiques des ciliés mésopsammiques. — Proc. Int. Congr. Zool. **15**: 332–334 [GP1208].
- DRAGESCO M.J. (1960): DUJARDIN Protistologie. — Congrès des Sociétés savantes: 594–599 [GP1204].
- DRAGESCO J. (1960): Ciliés mésopsammiques littoraux. Systématique, morphologie, écologie. — Trav. Stn. biol. Roscoff (N. S.) **12**: 1–356 [CI1285].
- DRAGESCO J. (1962): L'orientation actuelle de la systématique des ciliés et la technique d'imprégnation au protéinate d'argent. — Boll. Micr. Appl. **11**: 49–58 [CI0006].
- DRAGESCO J. (1962): Capture et ingestion des Proies chez les infusoires ciliés. — Bulletin Biologique de la France et de la Belgique **46**: 123–168 [BM1271].
- DRAGESCO J. (1962): On the biology of sand-dwelling ciliates. — Sci. Progress **50**: 353–363 [CI8035].
- DRAGESCO J. (1963): Compléments a la connaissance des ciliés mésopsammiques de Roscoff. II. Hétérotiches—III. Hypotriches. — Cahiers de Biologie Marine **4**: 251–275 [CI1055].
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- DRAGESCO J. (1963): Révision du genre *Dileptus*, DUJARDIN 1871 (Ciliata Holotricha)(systématique, cytologie, biologie). — Bull. Biol. Fr. Belg. **47**: 103–145 [CI1463].
- DRAGESCO J. (1964): Groupement des protistologues de langue française. — Archives de Zoologie Experimentale et Générale **104**: 163–175 [GP1209].
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- DRAGESCO J. (1965): Ciliés mésopsammiques d'Afrique Noire. — Cahiers de Biologie Marine **6**: 357–399 [CI1465].
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- Series 3 Unpublished material
Correspondence with Linz 1997–2006.
- Series 4 Documentation
- DRAGESCO introduced 32 valid generic names (1954–1999; details cp. AESCHT 2001) and more than 300 species, the original and combining references and type locations of 74 of them can be found in AESCHT (2008). However, many of them are apparently unvouchered as indicated by the missing list given in the latter paper and are in need of nomenclatural and taxonomic evaluation.
- Two genus nomina (*Dragescoa* JANKOWSKI 1974, *Dragescozoon* FOISSNER, AGATHA & BERGER, 2002) and 26 ciliate and one dinoflagellate species nomina have been dedicated to Jean DRAGESCO (in chronological sequence): *Remanella dragescoi* AGAMALIEV, 1966; *Glaucoma dragescoi* CORLISS, 1971; *Oxytricha dragescoi* STILLER, 1974; *Psilotricha dragescoi* GROLIERE, 1975; *Pronyctotherus dragescoi* ALBARET & NJINÉ, 1976; *Kuklikophrya dragescoi* NJINE, 1979; *Kudoella dragescoi* EARL, 1980; *Colpoda dragescoi* CHARDEZ, 1981; *Balantidioides dragescoi* FOISSNER, ADAM & FOISSNER, 1982; *Psammocephalus dragescoi* WICKLOW, 1982; *Holosticha dragescoi* BORROR & WICKLOW, 1983; *Neonyctotherus dragescoi* AFFA’A, 1983; *Urotricha dragescoi* FOISSNER, 1984; *Ottowphrya dragescoi* FOISSNER, 1987; *Platyophryides dragescoi* FOISSNER, 1987; *Paramecium dragescoi* ALIYEV, 1990; *Loxophyllum dragescoi* CAREY SS, 1992; *Heterotachysoma dragescoi* SONG & WILBERT, 1997; *Tachysoma dragescoi* SONG & WILBERT, 1997; *Nassula dragescoi* FOISSNER, AGATHA & BERGER, 2002; *Avelia dragescoi* KALAVATI & RAMAN, 2008; *Euplotes dragescoi* WILBERT & SONG, 2008; *Monocoronella dragescoi* CHEN, DONG, LIN & AL-RASHEID, 2011; *Amphileptus dragescoi* PAN, MA, HU & AL-RASHEID, 2013; *Litonotus dragescoi* PAN, GAO, LIN, WARREN & SONG, 2013; *Tracheloraphis dragescoi* XU, YAN, LI, AL-RASHEID, AL-FARRAJ & SONG, 2014; dinoflagellate: *Thecadinium dragescoi* YAMAGUCHI, HOPPENRATH, POSPELOVA, HORIGUCHI & LEANDER, 2011; combined with *Amphidiniopsis* by HOPPENRATH, SELINA,

YAMAGUCHI & LEANDER in 2012.

Digitized content: none.

Future prospects

- Evaluation of slides concerning community structure
- Validated complete bibliography and taxonomy including recombinations

Josef DIECKMANN (1948–1996)

Curriculum Vitae

Josef DIECKMANN was born on 5 May 1948 and died in Münster on 4 April 1996. As an carpenter DIECKMANN worked as technical customer consultant in Germany, later in all of Europe and even in Korea and China. In his obituary Hans-Dieter GÖRTZ (1996) characterised DIECKMANN as a man with an impressive power of observation, but one extremely self-critical always wanting to improve his own results. At the age of 9, his father gave him a small microscope and initiated the interest on protozoa, but only after getting married he started his scientific investigations and even motivated GÖRTZ to study the symbiosis of bacteria and flagellates in the nuclei of ciliates. Together they published the results in 1977, 1980 and 1987 (see below).

In his privat laboratory DIECKMANN investigated the moss and water samples collected during his journeys. Over the years he supplied his laboratory with excellent microscopes and a complete equipment for the culture, staining and analysis of the morphology and morphogenesis mainly of hypotrich ciliates (DIECKMANN 1987, 1989, 1993). In 1995 he gave a new prescription for protargol impregnation yielding reproducible results and presented in that paper many excellent micrographs of about 30 ciliate species stained with his procedure. So DIECKMANN being an autodidact succeeded to become a fully accepted and highly estimated scientist. He was awarded the “Wilhelm and Ilse FOISSNER Stiftung” in 1989.

Additional bibliographic sources

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HAUSMANN K. & RADEK R. (2006): Festschrift 25 Jahre Deutsche Gesellschaft für Protozoologie. — Schweizerbart'sche Verlagsbuchhandlung, Stuttgart 1–277 [EVB356].

Primary contributions

- Discovered two new protists, a ciliate and a trypanosomatid (see below).
- Improved the protargol impregnation.

Contents of collection

Series descriptions: period 1983–1996

Series 1 Prepared organisms

20 boxes including 1035 microscopic slides arrived in Linz on 20 May 2005 cared for by . Hans-Dieter GÖRTZ. 792 of them are unidentified, but include the sampling place, unfortunately undated, in need of determination.

Series 2 Publications

GÖRTZ H.-D. & DIECKMANN J. (1977): Infektiöse, auf die Kerne von *Paramecium caudatum* spezialisierte Partikel. — 70. Jahrestg. DZG Erlangen: unpag., Abstr.



Fig. 84: Christian BARDELE, Josef DIECKMANN, the second laureate of the Wilhelm and Ilse FOISSNER Stiftung, and Wilhelm FOISSNER at the 8th meeting of “German Society for Protozoology” (DGP) in Iserlohn in 1989.

- GÖRTZ H.-D. & DIECKMANN J. (1977): Life cycle and infectivity of *Holospira elegans* HAFFKINE, a micronucleus-specific symbiont of *Paramecium caudatum* (EHRENBERG). — *Protistologica* **26**: 591–603 [Z07928].
- GÖRTZ H.-D. & DIECKMANN J. (1980): Life cycle and infectivity of *Holospira elegans* HAFFKINE, a micronucleus-specific symbiont of *Paramecium caudatum* (EHRENBERG). — *Protistologica* **16**: 591–603 [GP1778].
- DIECKMANN J. (1985): *Podophrya grelli* n. sp., ein wirtsspezifischer Suctor, parasitierend auf *Stylonychia lemnae* AMMERMAN und SCHLEGEL 1983. — *Arch. Protistenk.* **129**: 155–170 [CI1003].
- GÖRTZ H.-D. & DIECKMANN J. (1987): *Leptomonas ciliatorum* n. sp. (Kinetoplastida, Trypanosomatidae) in the macronucleus of a hypotrichous ciliate. — *JoPr* **34**: 259–263 [Z00904].
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- DIECKMANN J. (1993): Life cycle of *Keronopsis wetzeli* WENZEL 1953 (Ciliophora, Hypotrichida). — *JEM* (IX Int. Congr. Protozool. Abstr.): 31, Abstr. 113 [Z00673].
- DIECKMANN J. (1995): An improved protargol impregnation for ciliates yielding reproducible results. — *EJP* **31**: 372–382 [Z06101].

Series 3 Unpublished material: none.

Series 4 Documentation

DIECKMANN introduced two new species: *Podophrya grelli* in 1985 and as co-author *Leptomonas ciliatorum* in 1987.

FOISSNER in 1998 honoured him by *Keronopsis dieckmanni*.

A list of species extracted from the labels (marked by an asterix*) and his publications indicate the range of taxa likely included in the slides: *Acineria incurvata*, *Blepharisma japonicum**, *B. undulans**, *Bresslaua vorax**, *Chlamydomonadopsis mnemosinae*, *Coleps africanus**, *Colpidium campylum**, *Colpoda steini**, *Euplotes aediculatus**, *E. octocarinatus**, *Glaucoma scintillans**, *Keronopsis wetzeli**, *Laurentiella acumi-*

*nata**, *Leptomonas ciliatorum*, *Loxodes striatus*, *Loxophyllum meleagris**, *Nassula gigas**, *Obertrumia georgiana*, *Ophryoglena catenula**, *Oxytricha bifaria**, *O. granulifera**, *Paraholosticha muscicola**, *P. nana*, *P. ovata*, *P. sterkii**, *Parakahliella macrostoma*, *Paramecium aurelia*, *P. caudatum**, *Platyophrya spumacola*, *Podophrya grelli*, *Pseudomicrothorax dubius**, *Steinia sphagnicola**, *Stentor coeruleus**, *Stylonychia sterkii*, *Stylonychia indica*, *S. lemnae**, *S. mytilus**, *S. notophora*, *S. pustulata*, *S. vorax**, *Tetrahymena rostrata**, *Urostyla grandis*.

Digitized content: none.

Future prospects

- The taxa on 792 slides have to be identified and the community structure might be studied
- Possibly syntypes of *Podophrya grelli* DIECKMANN, 1985 can be made plausible

Raoul Heinrich FRANCÉ (1873–1943)

Curriculum Vitae

- Born 20 May 1874 in Vienna as Rudolf Heinrich FRANZE (changed his name to Raoul H. FRANCÉ, sometimes also Rezső or Henry, respectively)
- 1883 moved to Budapest
- Studies at the Technical University Budapest, supervised by the protozoologist Geza ENTZ (1842–1919)
- Assistant of the botanist Gyula (Julius) KLEIN (1844–1915)
- 1892 1st publication on *Scenedesmus*
- 1893 and 1898 deputy editor of the Journal of the Royal Hungarian Natural Science Society
- 1895/96 Studies at Breslau (Silesia, Germany; present day Wrocław in Poland), supervised by the botanist and microscopist

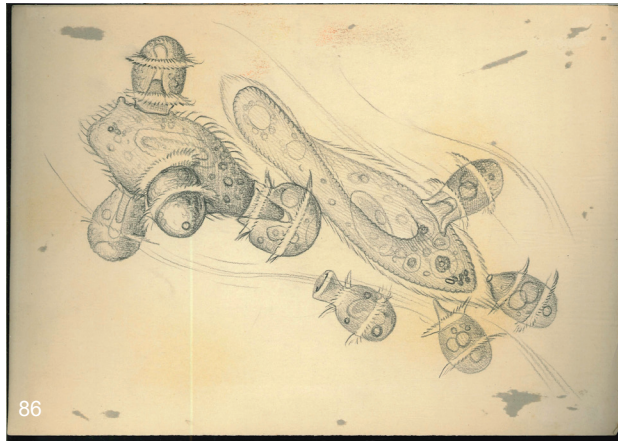


Fig. 85-89: Portrait (85) and originals (86-89) of Raoul Heinrich FRANCÉ. - 86: Pencil drawing of *Didinium* preying upon *Paramecium* from the sketchbook. - 87-89: Handwritten list of the percentual composition of a soil inoculation; the numbers refer to the different groups of organisms.

1 = Kieselplättchen 5 µ Komolac - Lehmin unter Palme. Höhe 9. 5.6.36
 2 = Gipskristall? 6 µ Komolac wie oben. 5.6.36

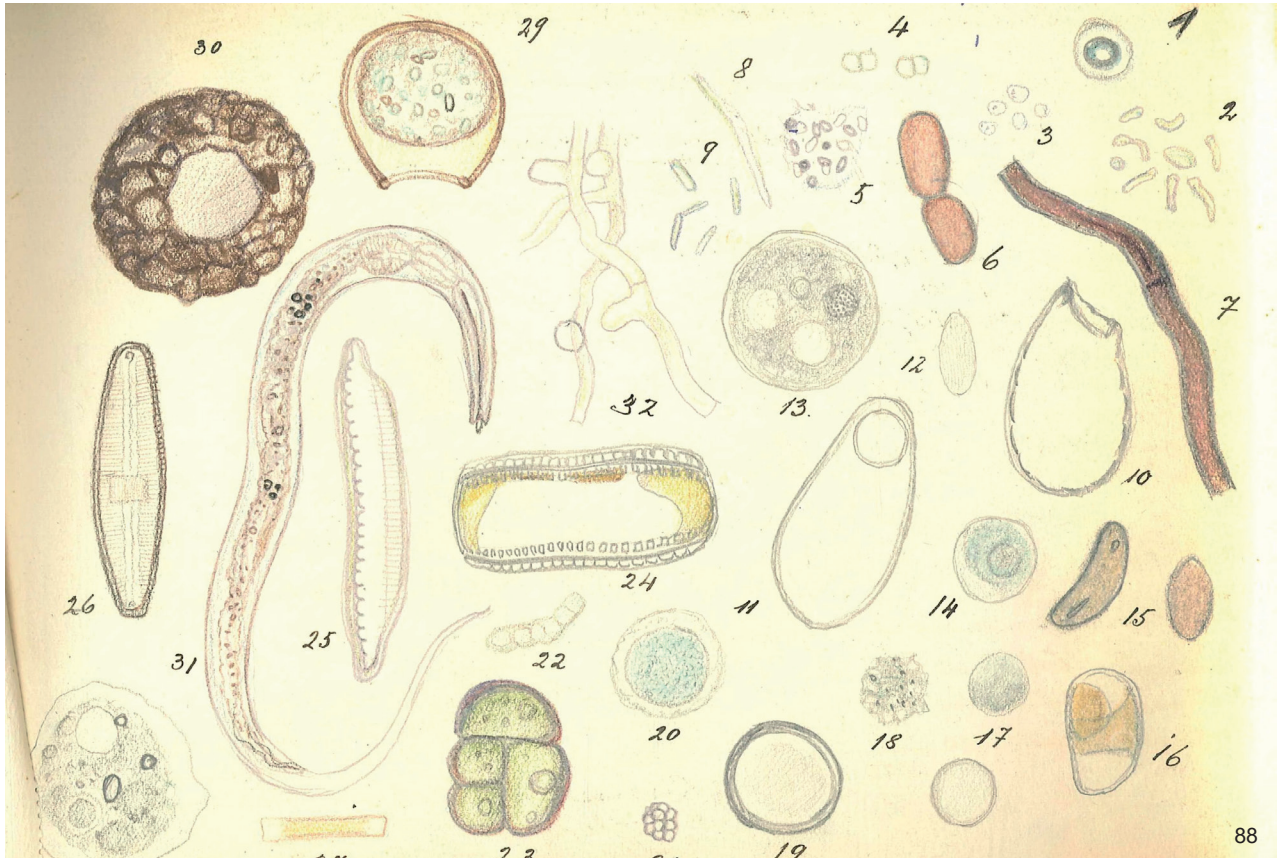
Zusammensetzung des Impfstoffes

Bakterien = N^o 2, 3, 4, 8, 9, 21, 35,
 Nannedaphon = N^o 1, 17, 19,
 Spaltalgen = N^o 20, 22, 14, 40, 38, 49,
 Flagellaten = N^o 16
 Kieselalgen = N^o 24, 25, 26, 27
 Bodenzpilze = N^o 6, 7, 32, 15, 12, 37, 36, 42, 44, 45, 47
 Rhizopoden = N^o 30, 29, 13, 10, 28, 33, 39, 41, 46, 43
 Infusorien = N^o 13
 Nematoden = N^o 31
 Rotatorien = 1

Dazu: Gipskristalle (45) - Humminbestandteile (47) - Pflanzenzellen-
 reste (48) - Ölkropfen (50) - Sklereiden (51) - Kiesel (46) - und Mineral splitter (52)

Volumenzusammensetzung approximativ:

Mineral. Substanz	15%	Organismen prozente:	77%
Flüssige Substanz	65%	Bakterien ca	13%
Organismenmasse	20%	Spaltalgen	7%
	100 Vol%	Nannedaphon	14%
		Kieselalgen	3%
		Bodenzpilze	18%
		Rhizopoden	22%
		Infusorien	3%
		Nematoden	13%
		Rotatorien	7%
			100%



Ferdinand COHN (1828–1898).

- 1898 Deputy head of the experimental station for plant physiology of the Agricultural Academy in Magyaróvár (Ungarisch-Altenburg)
- 1901 marriage with the Viennese Carli MOSER (until 1915)
- 1915 birth of son Walter
- March–December 1902 Manager of the institute for sugar beet cultivation at Aderstedt, near Brunswick (Germany)
- 2 December 1902 Settlement in Munich
- 6 February 1907 Founder of the „Deutsche Mikrobiologische Gesellschaft“ [German Microbiological Society]
- 1 October 1908–1919 Director of the Biological Institut Munich
- 1907–1926 Founder of at least eight journals or periodicals on microscopic or nature topics, most famous „Mikrokosmos“
- 1906–1911 wrote four of eight volumes of „The life of plants“ (cited as „plant-Brehm“), where records of protists are given in the foot notes
- 1912 wrote 1000 pages on „The alps“ reporting about 500 claimings
- Since 1916 cooperation with Annie HARRAR, they married in 1923
- 1919 destruction of Biological Institut Munich [In 1912, FRANCÉ reported on a specimen collection of about 300 slides, among which the amoebic “PENARD collection” had a high value, very likely also destroyed]
- 1919–1923 Dinkelsbühl
- Around 1920 development of a „biotechnic der Feder, termed pen-etching by the artist Rudolf ENGEL-HARDT: Accordingly, four lines, +, x and a point system (with ink on art paper) are best suited to represent the space and therefore also the distribution of

light and shadow; this resulted in a scale of 16 degrees

- Since 1923 book writer and journalist in Salzburg, 1931 Dubrovnik-Ragusa or Graz, 1923—1940 traveling around the world
- Death 3 October 1943 in Budapest

Additional bibliographic (& other) sources

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FISCHER H. (1924): Raoul H. FRANCÉ Das Buch eines Lebens. — Voigtländer R. Verl., Leipzig: 1–191 [FRA276].

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Anonymous (1974): Der Prophet der biologischen Krise: Vor hundert Jahren wurde in Wien R. H. FRANCÉ geboren. — Standard 18.5.1974: 5 [ad0128].

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TENSCHERT G. (1976): Von der Biotechnik zur Kultur- und Lebensphilosophie: Notwendige Wiederentdeckung des Raoul Heinrich FRANCÉ. — Klüter Blätter, Lochham bei München 2: 23–28 [ad0072].

BRETTENTHALER J. (1978) Ein Großer im Reiche der Naturwissenschaften. — In: Marktgemeinde Oberalm (ed.) Oberalm Ein Salzburger Markt einst und jetzt, Salzburg, pp. 86–87.

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- PAULI F.W. (1983): FRANCÉ'S Edaphon und die Biodynamik des Bodens. — Self published: 1–6 [EV6890].
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- HAMMERICH P. (1994): FRANCÉ – der Weise von Dinkelsbühl. — öko-aktuell **63**: 3–6 [ad0031].
- [SOKOLOFF S.] (1994): Symposium in honor of a pioneering systems thinker Raoul H. FRANCÉ. — IFSR Newsletter 1994 No. 32: 1 [ad0050].
- SOKOLOFF S. (1994): Raoul FRANCÉ's heritage a nightmare for specialists. — IFSR Newsletter 1994 No. 32: 2–3 [ad0051].
- PICHLER F. (1997): Biozentrische Modelle der Beitrag von Raoul H. FRANCÉ. — In: WEIBL P. (ed.): Jenseits der Kunst. — Passagen Verl., Wien: 445–447 [ad0065].
- HENKEL K. (1997): Die Renaissance des Raoul Heinrich FRANCÉ. — Mikrokosmos **86**: 3–16 [PR0222].
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- MERTINS D. (2004): «Bioconstructivism». — In: SPUYBROEK L. (ed.): NOX: machining architecture, London: Thames & Hudson: 360–369.
- DAUM A.W. (2007): Gegen die Verhässlichung des Lebens: Das Verständnis von Wissenschaftsjournalismus des Raoul FRANCÉ. — WPK Quarterly **1/2007**: 26–28 [ad0127].
- BERNHARD P. (2009): Der Philosoph des Funktionalismus im Widerstreit mit der modernen Kunst. Raoul FRANCÉ und das Bauhaus. — In: ACKERMANN U., SCHIERZ K.U. & ULBRICHT J.H. (ed.): Streit ums Bauhaus. — Glaux: Jena: 142–149 [ad0064].
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PICHLER F. (2015) Raoul FRANCÉ und sein Werk zu Natur und Leben: Eine kommentierte und illustrierte Bibliographie. — Schr.R. Gesch. Naturwiss. Techni J. Kepler Univ. Linz, Trauner Verl., Linz **32**: 1–99 [LB1573].

Further figures as regards FRANCÉ's works are given by HAUSMANN & MACHEMER in this volume (pages 14–17).

Primary contributions

- Systematics of autotrophic algae and some hetero- or mixotrophic flagellates, testaceans (1892–1900)
- Coined the conception of the edaphon, bionics (as „Biotechnik“) and bicoenotics (1910–1920)
- A precarious figure at a time when “science” became a profession, the rebellion against specialization becomes palpable, consequently he disrupted within the science system [1900–1920]
- Insistence on the “educational value of the microscopic organisms”
- Popularised “biocentric” point of view, which always has the unity of man with nature in mind, based on an „objective philosophy“

Contents of collection

Series descriptions: period 1890–1940

5 boxes with 26 sketch-books with aquarelles and pencil drawings being the highlights in the collection, further separated graphics (landscapes, ethnographics, travel pictures, portraits in different techniques and different sizes) and about 3 running meters of books, which are partially inventorised in the library of the Upper Austrian Museum by Magdalena WIESER.

Series 1 Prepared organisms: none have survived the First and Second World War.

Series 2 Publications

In preparation of the symposium on the 50th year

anniversary of 1993 at the University library in Salzburg with Franz PICHLER in Salzburg in 1993, I focused on FRANCÉ's scientific articles and via international loan organised copies and tried to complete the bibliography. This incomplete status has again been noted in the bibliographies by ROTH (2000) and PICHLER (2015); the latter is a reproduction of the former. Two volumes announced for „Telos–Die Gesetze des Schaffens“, I could find no evidences, possibly they never were printed. 56 book titles in different versions can be found on the homepage of the library of of the Upper Austrian Museum. Many digital versions of the books can be downloaded at the web site www.stiftung-france.de.

So here only the references to taxonomic, biological and ecological topics are given including volumes, pages and additional table plates of the journals. Due to the Hungarian language and some articles published in instalments, these papers are not widely disseminated and noticed, e.g., only nine are recognised in the online plattform “algaebase”.

- FRANZÉ R. (1892): Adatok a *Scenedesmus* morfológiájához [Beiträge zur Morphologie des *Scenedesmus*]. — Természetráji Füzetek **15**: 63–83, 144–165 + Taf. III (in Hungarian) [FRA001].
- FRANZÉ R.H. (1893): Über die Organisation der Choanoflagellaten. — Zool. Anz. **16**: 44–46 [FRA005].
- FRANZÉ R.H. (1893): Új ostoros azalékállatkák a Balatonból [Neue Flagellaten aus dem Plattensee]. — Természetráji Füzetek **16** (1894, 1893'): 89–97/96, 159–168+Taf. 2 (in Hungarian) [FRA003].
- FRANZÉ R.H. (1893): Néhány Chlamydomonadinea systematikájáról [Zur Systematik einiger Chlamydomonaden]. — Természetráji Füzetek **15**: 241–253, 273–285 (, 1892') (in Hungarian) [FRA017].
- FRANZÉ R.H. (1893): Az édesvízi tavak planktonja [Das Plankton der Süßwasserseen]. — Természettud. Közöny **25**: 302–311 (in Hungarian) [FRA108].
- FRANZÉ R.H. (FRANZÉ REZSÖ) (1893): A gánóczi mésztufában talát confervitesek mikroszkopos vizsgálata [Die mikroskopische Untersuchung der „Conferviten“ aus dem Kalktuffe von Gánocz]. — Földrajzi Közlemények **23**: 4–13 (in Hungarian) [FRA002].
- FRANZÉ R.H. (FRANZÉ R.) (1893): Über einige Algenformen. — Österreichische Botanische Zeitschrift **43**: 202–205, 247–252, 282–286, 346–350, 381–386, Taf [FRA245].
- FRANZÉ R.H. (1893): Studien zur Systematik der Chlamydomonaden. — Bot. Zbl. **55**: 392 [FRA244].
- FRANZÉ R.H. (1893): Zur Morphologie und Physiologie der Stigmata der Mastigophoren. — Z. wiss. Zool. **56**: 138–168 + Taf. 8 [FRA004].
- FRANZÉ R.H. (1894): Zur Biologie des Planktons. — Biol. Zbl. **14**: 33–38 [FRA009].
- FRANZÉ R.H. (1894): Adatok Budapest Rotatoriafaunájához [Beiträge zur Kenntnis der Rotatorienfauna Budapest's]. — Természetráji Füzetek **17**: 112–129, 166–184+ Pl. 5, 6 [FRA007].
- FRANZÉ R.H. (1894): Adalékok Biharmegye flórájának ismeretéhez [Beiträge zur Floristik des Biharer Comitatus]. — Természetráji Füzetek **17**: 162–164, 205–208 [FRA253].
- FRANZÉ R.H. (1894): Recherches sur le genre *Phythelios* FRENZ. — Notarisia **1894**: 1–5, 1 Tab. [FRA103].
- FRANZÉ R.H. (1894): Dr. Entz GÉZA a Balaton-bizottság állattani kutatásainak eredményeiről. — Földrajzi Közlemények **22**: [FRA109].
- FRANZÉ R.H. (1894): A Balaton iszapja [Über den Schlamm des Plattensees]. — Földrajzi Közlemények **24**: 142–147 [FRA010].
- FRANZÉ R.H. (1894): Die Polytomeen, eine morphologisch-entwicklungsgeschichtliche Studie. — Jb. wiss. Bot. **26**: 295–378, Taf. 15–18 [FRA008].
- FRANZÉ R.H. (1894): A choanoflagelláták szervezete [Über die Organisation der Choanoflagellaten]. — Természetráji Füzetek Suppl. **29**: 122–127 [For the first time signs his name FRANCÉ REZSO instead of FRANCÉ REZSO] [FRA006].
- FRANZÉ R.H. (1895): A kolozsvári lignit mikroszkopikus növény- és állatvilága [Die mikroskopische Pflanzen- und Tierwelt des Kolozsvärer Lignites]. — Földrajzi Közlemények **25**: 116–118, 150–151 [FRA011].
- FRANZÉ R.H. (1896): Adatok a *Carteria*-félék ismeretéhez [Beiträge zur Kenntnis der Algengattung *Carteria*]. — Természetráji Füzetek **19**: 105–113, Tab. I [FRA012].
- FRANZÉ R.H. (1896): A Challenger-expedíció és tudományos eredményei [Die Challenger-Expedition und ihre wissenschaftliche Ergebnisse]. — Természettudományi közöny **28**: 1–21 [FRA313].
- FRANZÉ R.H. (1897): A Craspedomonadinak szervezete [Der Organismus der Craspedomonaden]. — Königl. Ungar. Naturwiss. Ges., Budapest: 1–248 [FRA013] [FRA014].

- FRANCÉ R.H. (1897): Die Protozoen. — In: ENTZ G. (ed.): *Die Fauna des Balatonsees*. Resultate der wiss. Erforschung des Balatonsees **2/1**: 1–64 [FRA016].
- FRANCÉ R.H. (1897): A *Chlorogonium*-félék szervezete [Über die Organisation von *Chlorogonium* Ehrb.]. — Természetráji Füzetek **20**: 222–247, 287–308 + Taf. VI [FRA018].
- FRANCÉ R.H. (1897): A *Collodictyon triciliatum* CART. szervezete [Die Organisation von *Collodictyon triciliatum*]. — Természetráji Füzetek **21**: [FRA015].
- FRANCÉ R.H. (1898): Az emberszabásu majmok lélektanából. — Pesti Lloyd: 449–464 [FRA019].
- FRANCÉ R. (1899): A *Collodictyon triciliatum* CART. szervezete [Über den Organismus von *Collodictyon triciliatum* Cart.]. — Természetráji Füzetek **22**: 1–26+Taf.I [FRA020].
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- FRANCÉ R.H. (1912): Das Edaphon – eine neue Lebensgemeinschaft. — Die Kleinwelt **3**: 147–153 (1911/1912) [FRA117].
- FRANCÉ R.H. (1913): Das Edaphon Untersuchungen zur Oekologie der bodenbewohnenden Mikroorganismen. — Arb. biol. Inst. München **2**: 1–99 [FRA145].
- FRANCÉ R.H. (1916): Edaphon. — Öst. Rundschau **47**: 10 [FRA295].

Series 3 Unpublished material

- AESCHT E. (1993): Raoul H. FRANCÉ *1874 Wien – +1943 Budapest Leben und Werk. — Handout [AEE050].

Series 4 Documentation

FRANCÉ introduced two ambiregnal taxa (order Volvocida FRANCÉ, 1894 in zoology / order Volvocales OLTMANN, 1904 in botany; family Phacotaceae FRANCÉ, 1894 in botany / Phacotidae FRANCÉ, 1894 in zoology) and four generic names (*Astrogonium* FRANCÉ 1893 non MUELLER & TROSCHEL, 1842; *Chlamydolepharis* FRANCÉ 1894; *Geococcus* FRANCÉ 1913 non GREEN, 1902; *Diplosigopsis* FRANCÉ 1897). I found 41 species-series taxa (1893–1897) seemingly neglected or synonymised by later authors: *Ascoglena vaginicola* var. *amphoroides*, *Astrogonium alatum*, *Brachionus entzii*, *B. pentacanthus*, *Chlamydomonas halophila*, *C. hyalina*, *Craterella terricola*, *Diffugiella vulgaris*, *Diplosigopsis entzii*, *Euglena minima*,

Geococcus longispina, *G. vulgaris*, *Kleiniella stagnalis*, *Lagenoecca globulosa*, *Leptocinclis aciculare*, *L. globosa*, *L. obtusa*, *Mastogloia minutissima*, *Navicula contenta* var. *capitata*, *N. contenta* var. *constricta*, *N. contenta* var. *parallela*, *N. mutica africana* var. *elliptica*, *N. mutica africana* var. *ovalius*, *N. mutica* var. *africana*, *N. mutica* var. *apiculata*, *N. mutica* var. *capitata*, *N. mutica* var. *elliptica*, *N. mutica* var. *lanceolata*, *N. mutica* var. *oblonga*, *N. mutica* var. *ovalius*, *N. mutica* var. *rhomboides*, *N. mutica* var. *subundulata*, *N. mutica* var. *undulata*, *N. splendida* var. *africana*, *Petalomonas carinata*, *Phacus setosus*, *P. striatus*, *Phythelios ovalis*; *Scenedesmus quadricauda* var. *ecornis*, *Trachelomonas volvocina* var. *hyalina*, *Trinema verucosa*. One genus (*Franceia* LEMMERMANN, 1898, Micractiniaceae) and three species have been named in FRANCÉ's honour (*Golenkinia francéi* CHODAT, 1894; *Lobomonas francéi* P.A. DANGEARD, 1899; *Diplosiga francéi* LEMMERMANN, 1914). In 1954 a street, viz. the Francestraße, in Munich-Untermenzing was named in his honor (https://de.wikipedia.org/wiki/Liste_M%C3%BCnchner_Stra%C3%9Fennamen/F).

Digitized content

About 1400 scans of the sketch-books and graphics.

Winfried KOSTKA provides scanned literature on the biographical archive “Annie FRANCÉ-HARRAR and Raoul Heinrich FRANCÉ” (see www.stiftung-france.de).

Future prospects

- Original descriptions have to be checked and homonymies and/or synonymies clarified
- At least interlinear translations of relevant papers and books are desirable.

Annie FRANCÉ-HARRAR (1886–1971)

Curriculum Vitae

- Born 2 December 1886 as Maria Anna MAYER in München (Pseudonym Annie HARRAR)
- 1916–1918 Training of about 250 laboratory assistants in the Biological Institut Munich; for almost two decades, this resulted in the photographic illustration of Raoul FRANCÉ's works
- 1945 Developed a humus station for urban waste processing near Budapest
- 1947 Settled in Vienna, then in Seewalchen am Attersee
- 1950 „Die letzte Chance – für eine Zukunft ohne Not“ in the „Bayrischen Landwirtschaftsverlag“ [Bavarian Agricultural Publishing house] appreciated by Albert EINSTEIN in a letter as one of the most important works
- 1955–1961 Settlement, accompanied by Ada LAMBERG, in Mexico City to resolve soil degradation in the country
- 1956 Experiments with her soil enhancer Petrofil in Nitrate Works in Linz
- Death 23 January 1971 Hallein

Additional bibliographic (& other) sources

LORENZ-PREUER G. (1951): Die letzte Chance / Ein neues Buch von Anni FRANCÉ-HARRAR. — [Linzer?] Tagblatt 28.5 [ad0004].

PATZ H. (1961): Ruhelose Wanderseele fand Ruhe: Ein Gespräch mit Anni FRANCÉ-HARRAR. — Neue Illustrierte Wochenschau 49, 3.12.: 23 [ad0003].

Anonymous (1963): [Bücherspiegel] Anni FRANCÉ-HARRAR: „So war's um Neunzehnhundert“. — Der Spiegel 3/1963: 65 [ad0010].

Fig. 90–91: Portrait (90) of Annie FRANCÉ-HARRAR at her microscope during her stay in Mexico in the 1950s and leaflet of the publishing house in Munich (91) with a portrait of FRANCÉ-HARRAR on occasion of the delivery of her book "The last chance". The headline states that "the fertiliser industry will set a prize on her head" [translation mine].





Fig. 92: Original aquarell of FRANCÉ-HARRAR's vision of "the good, since generations cultivated, unfertilised arable soil"

Fig. 93: Exhibition on "Soil lives! Life and work of the Annie FRANCÉ-HARRAR" in the Federal State Service Centre (LDZ) near the Linz railway station in 2016 showing among original objects reproductions of her posthumously published "Handbook of soil".

BRONSART H. VON (1965): Ein ganzes Leben für die Forschung: Anni FRANCÉ-HARRARs unzerstörbare Vitalität und scharfgeschliffener Geist. — *Stuttgarter Nachrichten* **233**: 40 [ad0002].

BARTSCH G. (1966): „Und eines Tages...“ Annie FRANCÉ-HARRAR: Weltberühmte Biologin und Romanautorin wurde 80 Jahre alt. — *Freie illustr. Wochenschau* Nr. 8 20.2. 1966: 9 [ad0067].

ANONYMOUS (1966): Karneolring für Anni FRANCÉ-HARRAR. — *Amtsblatt der Landeshauptstadt Salzburg* Nr. 23/24, 24.12. 1966: 20 [ad0007].

Anonymous (1967): Annie FRANCÉ-HARRAR –80 Jahre. — *Der Stille Weg* **19**: 6 [ad0080].

Anonymous (1971): Kondolenzen: Alexander GERDEISEN [Anni FRANCÉ-HARRAR]. — *Amtsblatt der Landeshauptstadt Salzburg* **3**: 22 [ad0009].

KLEINE G.H. (1981): The suncoast viewed through German eyes [Annie FRANCÉ-HARRAR]. — *Tampa Bay History* **3/2**: 86–83 [ad0012].

STROHMEIER R. (1998): Lexikon der Naturwissenschaftlerinnen und naturkundigen Frauen Europas: Von der Antike bis zum 20. Jahrhundert. — Frankfurt/Main.

INHETVEEN H. & SCHMITT M. (ed.) (2000): *Pionierinnen des Landbaus*. — Dieter Jauch: 127.

ROTH R.R. (2000): Raoul H. FRANCÉ and the doctrine of life. — Self published.

INHETVEEN H., SCHMITT M. & SPIEKER I. (2003): *Women pioneers in the field of organic agriculture. Challenges for history and science*. — Göttingen.

AESCHT E. (2012): Annie FRANCÉ-HARRAR. — In: DALLINGER P.-M. (ed.): *Stichwörter zur oberösterreichischen*, http://www.stifter-haus.at/lib/publication_read.php?articleID=267 [AEE123].

Anonymous (2013): Annie FRANCÉ-HARRAR. — *Munzinger Online*: [1] [ad0088].

HIRSCH A. (2016): „Boden lebt! Leben und Werk der Annie FRANCÉ-HARRAR“. — *Kataloge des Oberösterreichischen Landesmuseums*, N.S. **180**: 1–52.

Postumous

FRANCÉ-HARRAR (BTQ e.V. ed.) (2012): *Handbuch des Bodenlebens*, manuscript from 1959. — Selfpublished, Blue Anathan, Kirchberg/Jagst.

Primary contributions

- Early warner against the massive humus degradation
- One of the pioneers of applied soil biology in Europe and Mexico
- Eloquent professional female writer in

German-language sharing her observations (and fictions) about traveling around the world with the sensitive public

Contents of collection

Series descriptions: period 1916–1971

30 boxes (a small amount came from the personal legacy of René Roth regarding his travels on the traces of both FRANCÉ's), one running meters of books, which are partially inventorised (or listed) in the library of the Upper Austrian Museum by Waltraud FAISSNER 2011 and Magdalena WIESER.

Series 1 Prepared organisms: none.

Series 2 Publications

As no complete bibliography exists, a preliminary version of those references related to Upper Austria is presented here:

FRANCÉ-HARRAR A. (1948): Was isst der Mann aus Tahiti? — *OÖ Nachrichten Linz* **Nr.**: 6 [FAH117].

FRANCÉ-HARRAR A. (1949): Der Pflanzenknochen. — *OÖ Nachrichten Linz* 19 March.

FRANCÉ-HARRAR A. (1949): Der Mann der das Gold überwand. — *OÖ Nachrichten Linz* **24** [FAH118].

FRANCÉ-HARRAR A. (1949): Das Fleisch des Waldes. — *OÖ Nachrichten Linz* **38** [FAH119].

FRANCÉ-HARRAR A. (1949): Der sechste Sinn der Städtegründer. — *OÖ Nachrichten Linz* **Nr.** [FAH114].

FRANCÉ-HARRAR A. (1950): Leben konserviert Leben. — *OÖ Nachrichten Linz* **Nr.**: 5 [FAH116].

FRANCÉ-HARRAR A. (1950): Alkohol – einmal anders. — *OÖ Nachrichten Linz* **Nr.**: 8 [FAH113].

FRANCÉ-HARRAR A. (1951): Entzauberte Zaubermittel? — *OÖ Nachrichten Linz* **Nr.**: 20–22 [FAH115].

She also published in Austrian newspapers in Graz (“Graz am Abend“ 1948) and Vienna, e.g the “Reichspost Wien (1937)“, “Arbeiter-Zeitung“, „Österr. Kurier“, „Wiener Wochenausgabe“, „Die Zeit“, „Neue Zeit“, mainly 1947–1949. 27 book titles can be found on the homepage of the library of of the Upper Austrian Museum (http://aleph21-prod-lbo.obvsg.at/F?func=file&file_name=find-b&local_base=lmo) and on <http://france-harrar.de/index.php>, <http://france-harrar.de/index.php/Bibliographie.html>.

Series 3 Unpublished material

Correspondences, diaries, poems and literary manuscripts:

(undated): Das Warenhaus [soz. Drama]. — Typoscript [FAH148].

(undated): Urgeschichte von Alteuropa. — Typoscript [FAH030].

(undated): Wie bildet sich der Naturboden? — Typoscript [FAH145].

(undated): Wir machen uns fruchtbare Erde! Kurze Anleitung, wie man Humus im handbetrieb macht. — Typoscript [FAH146].

(undated): Das Tier in der Geschichte. — Typoscript: 1–325 [FAH143].

(undated): Der Berg kommt herunter. — Typoscript: 1–5 [FAH144].

(1951): Humuserneuerung als Weltproblem. — Lecture in Rom [FAH070].

(1953): Laborbuch Mexiko. — handwritten [FAH140].

(1956): Vortrag in El Mante, Mexiko Juli 1956. — Typoscript [FAH032].

(1964): Bilderbuch meines Lebens 63/64. — Typoscript with 48 original pictures [FAH141].

Series 4 Documentation

Fragmentary

Digitized content

Selected material in the collection has been scanned by Michael REIFINGER (roughly 4000 in progress, about 3000 items are allocated), but are not yet available online.

Future prospects

- Transcription of the diaries and laboratory notices at Mexico
- History of the patents and experiments with soil microbial

Fig. 94: Karl Gottlieb GRELL and his wife Gudrun in July 1993.



inoculants

- Reconstruction of her photographic contributions to Raoul's books.

Karl Gottlieb GRELL (1912–1994)

Curriculum Vitae

- Born 28 December 1912 in Burg an der Wupper in the Rhine region in Germany
- Education Bad Kreuznach
- 1932 studies in biology, University of Jena
- 1934 studies in biology, University of Bonn
- 1938 Ph.D., University of Bonn
- During Second World War, he was assigned to an anti-malarial unit in southeast Europe
- 28 March 1941 Habilitation in biology, University of Bonn
- 1951–1957 Max-Planck-Institute for Biology in Tuebingen, assistant of MAX HARTMANN
- 1954 Fellowship of the A. ROCKEFELLER Foundation visiting the laboratories of T.M. SONNEBORN, T.-T. CHEN, and L.R. CLEVELAND

- 1956 First edition of the standard text book “Protozoologie”
- 1957–1980 Director of the Zoological Institute of the University of Tuebingen, founder of the protistological school in German-speaking countries
- 1959–1983 Co-editor of the “Archiv für Protistenkunde” (vol. 104–127), till 1994 member of the Advisory board
- 1962/63 Dean of the Mathematical-Natural Scientific Faculty of the University of Tuebingen
- 1968 Second edition (much supplemented) of his book “Protozoologie”
- 1973 English edition of his book “Protozoology”
- 1980–1994 Research on giant plasmodial protists in Australia, Jamaica, Japan, Tenerife resulting in 30 publications in 14 years
- Death 4 October 1994

Additional bibliographic (& other) sources

- CORLISS J.O. (1974): Book review of Protozoology by Karl G. GRELL. — *Science* **184** (4139): 891. doi:10.1126/science.184.4139.891-a.
- TRAGER W. (1975). Book Review of Protozoology by Karl G. GRELL. — *Quarterly Review of Biology* **50**: (2): 210–211. doi:10.1086/408502.
- MATTHES D. (1992): Karl G. GRELL zum 80. Geburtstag. — *Arch. Protistenk.* **142**: 93–94 [Z02053].
- BARDELE C.F. (1994): In Würdigung der Verdienste von Karl G. GRELL. — *Biologie in unserer Zeit* **24**: 292 [PR0170].
- BARDELE C.F. (8 February 1995). “News of Colleagues. Obituary. Karl G. GRELL 1912–1994”. — Email Newsletter.
- RAIKOV I.B. (1995): Karl G. GRELL (1912–1994), outstanding protistologist. In *Memoriam*. — *Arch. Protistenk.* **145**: 1–2 [Z01890].
- HAUSMANN K. (1995): In *Memoriam: Karl Gottfried GRELL (1912–1994)*. — *EJP* **31**: 119–120 [Z01891].
- HAUSMANN K. (1995): Karl GRELL gestorben. — *Mikrokosmos* **84**: 42



Fig. 95: GRELL’s collection amounting to about 13,000 separates, those on zoology occupy the upper three rows, those on protozoology the lower ones.

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Primary contributions

- Founder of phylum Placozoa, a morphologically very ancestral group, in 1971
- Introduced at least 3 families, 7 genera and 11 species ranging from gregarines, foraminifers and radiolarians to hypotrichs and suctorians and an expert in electron microscopy
- GRELL’s standard text book “Protozoologie”

(1956 first edition; 1968 much supplemented second edition; 3rd edition 1973 in English) provided that basis for his German school of protozoologists

- Produced over 50 teaching films

Series descriptions: period 1950–1985

The literature collection embraces about 13,000 separates (about 800 kilogram) accumulated over half a century of academic career, unfortunately not of his own works, which likely remained in Tübingen. 94 boxes (labeled according to a shortened alphabet, e.g. GPAn_p, GPY_Zy, the first two digitis indicate Grell Protozoology) with more than 7051 separates. 107 boxes (labeled according to a shortened alphabet, e.g. GZCa-l, GZCo-z, the first two digitis indicate Grell Zoology) with 5803 separates of 1808 authors on zoology (Fig. 95). The electronic recording of the literature quotations, which are merely available as an internal catalog, was supported by Waltraud STANDHARTINGER. One map with obituaries of biologists has to be processed via ZOBODAT. A wooden index-card box contains selected references and key words.

Series 1 Prepared organisms: none, but see p. 452.

Series 2 Publications

As to my knowledge there exists no complete bibliography, a preliminary one is given here.

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Series 3 Unpublished material

Reproductions and schematic drawings of life cycles for teaching.

Series 4 Documentation

At least 23 species were introduced by GRELL, namely *Rotaliella heterocaryotica* 1954, *Rotaliella roscoffensis* 1957, *Rubratella californica* 1958, *Rubratella intermedia californica* 1958, *Rubratella intermedia* 1956, *Glabratella sulcata* 1958, *Eucoccidium ophryotrochae* 1960, *Metarotaliella parva* 1962, *Metarotaliella simplex* 1973, *Corallomyxa chattoni* (together with BENWITZ) 1978, *Thalassomyxa australis* 1985, *Heterotheca lobata* 1988, *Reticulosphaera socialis* 1989, *Reticulosphaera japonensis* 1990, *Corallomyxa nipponica* 1991, *Leucodictyon marinum* 1991, *Thalassomyxa jamaicensis* 1992, *Synamoeba arenaria* 1994, *Reticulamoeba gemmipara* 1994, *Reticulamoeba minor* 1995, *Stereomyxa angulosa* 1996, *Stereomyxa ramosa* 1996, *Thalassomyxa canariensis* 1994; 10 genera, viz. *Eucoccidium* 1953, *Rotaliella* 1954, *Rubratella* 1956, *Metarotaliella* 1962, *Corallomyxa* 1965, *Stereomyxa* 1965, *Thalassomyxa* 1985,

Heterotheca 1988, *Reticulosphaera* 1989, *Leucodictyon* 1991; 2 families Tachyblastonidae 1950, Stereomyxidae GRELL 1975, one order Promycetozoida 1985 and one phylum Placozoa GRELL 1971.

The genus *Grellia*, a replacement name of *Eucoccidium*, GRELL 1953, and the family Grellidae was established by LEVINE in 1973. At least six specific names honour GRELL: *Centropyxis grelli* LAMINGER, 1973; *Podophrya grelli* DIECKMANN 1985; *Rotaliella grelli* PAWLOWSKI & LEE, 1991; *Anictostoma grelli* FOISSNER, 1993; *Orthoamphisiella grelli* EIGNER & FOISSNER, 1993; *Aphyosemion grelli* VALDESALICI & EBERL, 2013.

The Karl-Gottlieb-GRELL-Prise of the German Society for Protozoology (DGP) was established in recognition of his life's work and is awarded to a young scientist for an outstanding dissertation in the field of protology since 2014.

Digitized content: none.

Future prospects

- Completing the bibliography including autographs and taxonomy.

Klaus HAUSMANN (*1947)

Curriculum Vitae

- Born 24 April 1947 in Gelsenkirchen, Germany
- 1966–1968 Studies in theology, Universities of Bonn and Bochum
- 1968–1971 Studies in biology, University of Bonn
- 1971 Degree Dipl. Biol., University of Bonn
- 1973 Degree Dr. rer. nat., University of Bonn
- 1974–1977 Scientific assistant (Department of Cell Biology, University of Heidelberg)
- 1975 Visiting researcher (Department of Microbiology, University of Honolulu, Hawaii, USA)

- 1978–1984 Academic advice (Department of Cell Biology, University of Heidelberg)
- 1980 Degree Dr. rer. nat. habil. (Habilitation in Cell Biology), University of Heidelberg
- 1980 Visiting researcher (Department of Botany, University of Austin, Texas, USA)
- 1985 Organizer of 4th Annual Meeting of the German Society of Protozoology, Heidelberg
- 1987 Visiting researcher (Department of Microbiology, University of Honolulu, Hawaii, USA)
- 1985–2013 University professor (Division of Protozoology, Institute of Biology / Zoology, Free University of Berlin)
- 1987–1990 Vice-President of the DGP
- 1987–1995 Managing Editor of “European Journal of Protistology”
- 1989–1996 Executive Committee Member at Large International Society of Protozoologists
- 1990–1993 President of the DGP
- 1992 Organizer of 4th International Symposium on Medical and Scientific Photography, Berlin
- 1992–1993 Vice-President International Society of Protozoologists
- 1993 Organizer of IX International Congress of Protozoology, Berlin



Fig. 96: Klaus HAUSMANN, as organiser, and his wife Erika at the European Congress of Protozoology in Berlin 2011.

- 1994–2013 Managing Editor of “Mikrokosmos”
- 1995 Organizer of 14th Annual Meeting of the German Society of Protozoology, Delitzsch
- 1995–2012 Book Review Editor of “European Journal of Protistology”
- 2006 Organizer of 25th Annual Meeting of the German Society of Protozoology, Berlin
- 2006–2011 Secretary General Federation of European Protistological Societies
- 2008–2009 Vice-President International Society of Protistologists
- 2011 Organizer of VI European Congress of Protozoology, Berlin
- 2012 Organizer of International Wendlandian Symposium—Five Decades of Basic Research on Cilia/Flagella and Ciliates/Flagellates, Loge/Lüchow
- 2013 Retirement

Additional bibliographic (& other) sources



Fig. 97–99: Title page of HAUSMANN's autobiography (2018) entitled "Course of life of an only middling talent" (97). – 98: The film collection, predominately provided by Hausmann. – 99: Original showcases of HAUSMANN in the Zoological Institute at Berlin, which are now in Linz. Note the historical objects to the left, the bust of Antonie van LEEUWENHOEK, the discoverer of microscopic organisms, and to the right the translations of HAUSMANN's standard text books.

HAUSMANN K. & RADEK R. (2006): Festschrift 25 Jahre Deutsche Gesellschaft für Protozoologie. — Schweizerbart'sche Verlagsbuchhandlung, Stuttgart 1–277 [EVB356].

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Primary contributions:

- Innovative electron microscopical research on the structure and function of extrusomes of diverse ciliates, e.g. *Paramecium*, *Loxophyllum* and the dinoflagellate *Oxyrrhis*
- Numerous cytological (including ultrastructural) investigations on diverse protists producing strikingly attractive light and electron micrographs and several films
- Three successful editions (partially with co-workers) of a general textbook (in German as well as in English and other languages) on protists

- Experienced manager of scientific and popular journals; also publishing an insightful autobiography
- Important organizer of scientific meetings

Contents of collection

Series descriptions: period 1974–2013

Among the highlights in the immense collection are a bust of Antonie van LEEUWENHOEK (FIG. 99), models, e.g., a reconstruction of the network of protein filaments visible in extruded; complete series of offprints of his own publications, films and protocols including original material of expeditions (about 100 portfolios) and research as well as 400 historical issues on protistology, microscopy and microscopic technology, including the beginnings of electron microscopy.

Series 1 Prepared organisms

About 50 boxes including recent and historical microscopic specimens e.g. of Hans NACHTSHEIM (1890—1979) and Hans-Dieter PFANNENSTIEL, both zoologists in Berlin.

Series 2 Publications

About 160 articles in scientific journals; about 180 articles in popular scientific journals; 36 reviews; 14 chapters in books; 12 books (translated into Chinese, Czech, Dutch, English, Japanese, Korean, Russian, Spanish); 12 scientific films (commentary in German, English, French, Spanish).

Since HAUSMANN gives an actual complete bibliography in his autobiography (Fig. 97), here an alphabetical list according to author(s) and year of publication, devoid of the title, but citing the journal, volume and page numbers as well as the reference code for retrieval follows:

- AKARSU S. & HAUSMANN K. (2007) *Mikrokosmos* **96**: 25–32 [Z08054].
- ALLEN R.D. & HAUSMANN K. (1976) *J. Ultrastruct. Res.* **54**: 224–234 [CI2155].
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The collection harbours 10,736 reprints concerning protistology and cell biology (under the signature [HK0001]–[HK10736]) in 111 boxes, more than 1000 books and 8 journals, some of them renamed thus 11 in total):

- Acta Protozoologica vol. 1–49 (1963–2011, 24 bound);
- Annales de la Station Biologique de Besse-en-Chandesse vol. 1–17 (1966–1983, unbound);
- Cytobiologie, renamed European Journal of Cell Biology vol. 1–51 (1969–1990, unbound);
- Journal of Cell Biology vol. 76–100 (1978–1985, unbound);

Journal of Protozoology vol. 1–17 (12 of them bound), renamed Journal of Eukaryotic Microbiology vol. 40–58 (1993–2011 (mostly bound);

Protistologica vol. 1–22 (1965–1980; all bound), renamed European Journal of Protistology vol. 23–26 (1987–2011, mostly bound)

Transactions of the American Microscopical Society vol. 105–122 (1986–1993, unbound);

Tsitologiya vol. 31–52 (1939–2010, unbound).

Series 3 Unpublished material

About 150 diploma and doctoral theses as regards the working-group and peer-reviews.

Series 4 Documentation

Just at the beginning due to the extent of the collection on a large scale.

Hausmaniella, a genus of colpodid ciliates, was named in honour by Wilhelm FOISSNER in 1984 and the family Hausmanniellidae in 1987.

Monocercomonoides hausmanni, an intestinal flagellate of the termite *Kaloterme sinaicus* was named in my honour by Renate RADEK 1996/97 Arch. Protistenkd. 157, 411.

Digitized content: none.

Future prospects

- Digital bibliographic recording of the separates
- Archivation of the contents of folders, negative and positive material
- Adequate preservation of the historical films
- Scanning of important transparencies

Klaus HECKMANN (1934–2002)

Curriculum Vitae

- Born 20 August 1934 in Mannheim, Germany
- 1958–1962 studied zoology, physiological chemistry and mikrobiology at the University Tübingen
- 1962 Ph. D., supervised by Prof. Dr. K. G.

GRELL on the „Paarungssystem und genabhängige Paarungstypdifferenzierung bei dem hypotrichen Ciliaten *Euplotes vannus* O.F. MÜLLER“

- 1962–1968 Scientific assistant at the Zoological Institut, University Tübingen
- 1963 Fellowship of the British Council at the Institute of Animal Genetics, University of Edinburgh
- 1965–1968 Assistant Professor at the Southwest Center for Advanced Studies in Dallas, Texas, USA
- 1968 Habilitation at the Mathematical-Natural scientific Faculty of the University Tübingen for General Biology and Genetics
- 1969 Head of the newly established section of cell research
- January 1970 University professor for General Biology and Genetics at the University Münster
- April 1970 Director of the Zoological Institut of the University Münster
- 1971–1973 Member of the Senate der University Münster
- 1974 Fellowship at the Centre de Génétique Moléculaire CNRS, Gif-Sur-Yvette
- 1978, 1982 and 1991 Fellowship at the Indiana University, Bloomington Indiana, USA
- 1980–1981 Dean for Biology in the Mathematical-Natural scientific Faculty
- 1981–1987 President of DGP
- 1981–1989 Member of the IUBS Commission on Protozoology
- 1983 Fellowship at the Tohoku University, Sendai, Japan
- 1985–1987 Vice President of the International Society of Protozoologists
- 1993 Vice President of the IXth International



Fig. 100: Klaus HECKMANN as Vice President of the National organizing Committee of the 9th International Congress of Protozoology Berlin in 1993.

Congress of Protozoology

- Since 1994 Honorary member of the Japanese Society of Protozoology
- Since 1995 Honorary Professor der Shanxi University, Taiyuan, P.R. China und
- 1999 Retirement
- Since 2012 Honorary member of the International Society of Protozoologists
- Death 27 October 2012 in Münster

Additional bibliographic (& other) sources

HAUSMANN K. & RADEK R. (2006): Festschrift 25 Jahre Deutsche Gesellschaft für Protozoologie. — Schweizerbart'sche Verlagsbuchhandlung, Stuttgart 1–277 [EVB356].

Primary contributions:

- Eminent researcher on the cytologie and genetics of protozoans focusing on mating-

types, pheromones, predator-induced defenses and bacterial endosymbionts.

Contents of collection

Series descriptions: period 1960s—1980s

About 1000 slides in 14 boxes, and 50 books as well as several volumes of the „Journal of Protozoology“, followed by “Journal of Eukaryotic Mikrobiology” and journals on protistology in Japanese language. In addition, laboratory material such as wooden test tube rack, three-lock slides, Boveri-bowls etc. and an index on slips of paper with addresses and references.

Among the highlights in the collection are two original drawings of GRELL for the standard text book on zoology (“Lehrbuch der Zoologie“) of C. CLAUS and eight postcards showing protists prepared by IMAI S., FUJISHIMA M., ISHIDA M., MIWA M., MIYAKE A., SUGAI T., TSUKII Y. (2) for the Japanese Society of Protozoology.

Series 1 Prepared organisms:

Original foraminifera material from GRELL, polymastigines from CLEVELAND, e. g. *Plasmodium vinckei*, trypanosomes, and *Blepharisma* meiosis made by Akio MIYAKE, and own preparations of *Euplotes* as well as slides for academic zoology courses.

Series 2 Publications

As to my knowledge there exists no complete bibliography, a preliminary one is given here chronologically.

- RUTHMANN A. & HECKMANN K. (1961): Formwechsel und Struktur des Makronucleus von *Bursaria truncatella*. — Arch. Protistenk. **105**: 313–340 [GP4727].
- HECKMANN K. (1961): Paarungstypen und ihre genetische Determination bei dem marinen Ciliaten *Euplotes vannus* O.F. MÜLLER. — Naturwissenschaften **48**: 438–439 [GP2135].
- HECKMANN K. (1963): Paarungssystem und genabhängige Paarungstypdifferenzierung bei dem hypotrichen Ciliaten *Euplotes vannus* O.F. MÜLLER. — Arch. Protistenk. **106**: 393–421 [GP2136].

- HECKMANN K. (1964): Der Zellkern der Protozoen, Tatsachen und Probleme. — Verh. Anatomischen Gesellschaft **113**: 4–31 [GP2137].
- HECKMANN K. (1964): Experimentelle Untersuchungen an *Euplotes crassus* I. Paarungssystem, Konjugation und Determination. — Zeitschrift für Verebnungslehre **95**: 114–124 [GP2138].
- HECKMANN K. & SIEGEL (1964): Evidence for the induction of mating-type substances by cell to cell contacts. — Experimental Cell Research **36**: 688–691 [GP2148].
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- HECKMANN K. & FRANKEL J. (1968): Genetic control of cortical pattern in *Euplotes*. — Journal of Experimental Zoology **168**: 11–38 [CI4037].
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- HECKMANN K. (1970): Paarungstypdifferenzierung bei Ciliaten. — Verh. dt. zool. Ges. **64**: 15–23.
- HECKMANN K. (1975): Wann wird ein Symbiont zu einem Organell? *Omikron*, ein neuer, für *Euplotes aediculatus* essentieller Endosymbiont. — Verh. dt. zool. Ges. **1975**: 163, Abstr [GP2144].
- HECKMANN K. (1975): *Omikron*, ein essentieller Endosymbiont von *Euplotes aediculatus*. — JoPr **22**: 97–104 [CI9028].

- HECKMANN K. (1977): Endosymbionten von Protozoen. — Proc. 5th Internat. Congr. Protozool.: 160–164 [PR9015].
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- HECKMANN K. (1981): Do all fresh water *Euplotes* species depend upon endosymbionts. — VI. intern. Congr. Protozool. Abstr. [GP2152].
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- KUSCH J. & HECKMANN K. (1988): Gamone production in large-scale cultures of *Euplotes octocarinatus*. — JoPr **35**: 337–340 [Z01104].
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- MEYER F., SCHMIDT H.J. & HECKMANN K. (1992): Pheromone 4 gene of *Euplotes octocarinatus*. — Dev. Genet. **13**: 16–25.
- LIANG A. & HECKMANN K. (1993): *Blepharisma* uses UAA as a termination codon. — Naturwissenschaften **80**: 225–226.
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- HECKMANN K. (1995): Karl G. GRELL. — Verh. dt. zool. Ges. **88**: 229–232.
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- KUSCH J. & HECKMANN K. (1996): Population structure of *Euplotes* ciliates revealed by RAPD fingerprinting. — Ecoscience **3**: 378–384 [CI4176].
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- CURTENAZ S., WRIGHT M. & HECKMANN K. (1997): Localization of [gamma]-tubulin in the mitotic and meiotic nuclei of *Euplotes octocarinatus*. — EJP **33**: 1–12 [CI5432].
- KUHLMANN H.-W., BRÜNEN-NIEWEILER C. & HECKMANN K. (1997): Pheromones of the ciliate *Euplotes octocarinatus* not only induce conjugation but also function as chemoattractants. — J. exp. Zool. **277**: 38–48 [CI5421].
- PETERS-REGEHR T., KUSCH J. & HECKMANN K. (1997): Primary structure and origin of a predator released protein that induced defensive morphological changes in *Euplotes*. — EJP **33**: 389–395 [Z06163].
- GRIMM, M., BRUNEN-NIEWEILER, C., JUNKER, V., HECKMANN, K., & BEIER, H. (1998): The hypotrichous ciliate *Euplotes octocarinatus* has only one type of tRNA Cys with GCA anticodon encoded on a single macronuclear DNA molecule. Nucleic Acids Research **26**: 4557–4565.
- KUHLMANN H.-W., KUSCH J. & HECKMANN K. (1998): Predator-induced defenses in ciliated protozoa. — In: TOLLRIAN R. & HARVELL C.D. (ed.): The evolution of inducible defenses. — Princeton Univ. Press, Chicago.
- Series 3 Unpublished material
- Six notebooks with laboratory protocols (1961–1989).
- Series 4 Documentation
- HECKMANN introduced *Urostyla hologama* in 1965 and together with H. J. SCHMIDT the new genus and species *Polynucleobacter necessarius*.
- A new obligate bacterial symbiont *Protistobacter heckmanni* colonizing the ciliate *Euplotes*, was proposed by VANNINI, FERRANTINI, VERNI & PETRONI in 2013 as “candidatus” according to the current rules of prokaryotic nomenclature.
- Digitized content: none.
- Future prospects
- Completion of the bibliography
 - Investigation and documentation of the slides
- Hans MACHEMER (*1934)**
- Curriculum Vitae
- Born 7 September 1934 in Münster, Germany
 - 1954–1955 Studies in architecture, University of Karlsruhe
 - 1955–1964 Studies in biology and chemistry, Universities of Freiburg and Münster
 - 1964 Dr. rer. nat., University of Münster
 - 1964–1966 Scientific Assistant in the Dept. of Zoology, University of Münster
 - 1966–1974 Scientific Assistant in the Dept. of Zoology, University of Tübingen
 - 1971 Habilitation in biology at the University of Tübingen
 - 1971–1973 Postdoc and Research Assistant in the Dept. of Biology, University of

California at Los Angeles

- 1975 University Docent in the Dept. of Zoology, University of Tübingen
- 1975–1999 University Professor of Zoology in the Division Physiology of Excitable Cells, Institute of General Zoology, Ruhr-University Bochum
- 1990–1993 Vice-President of the DGP
- 1993–1996 President of the DGP
- 1999 Retirement

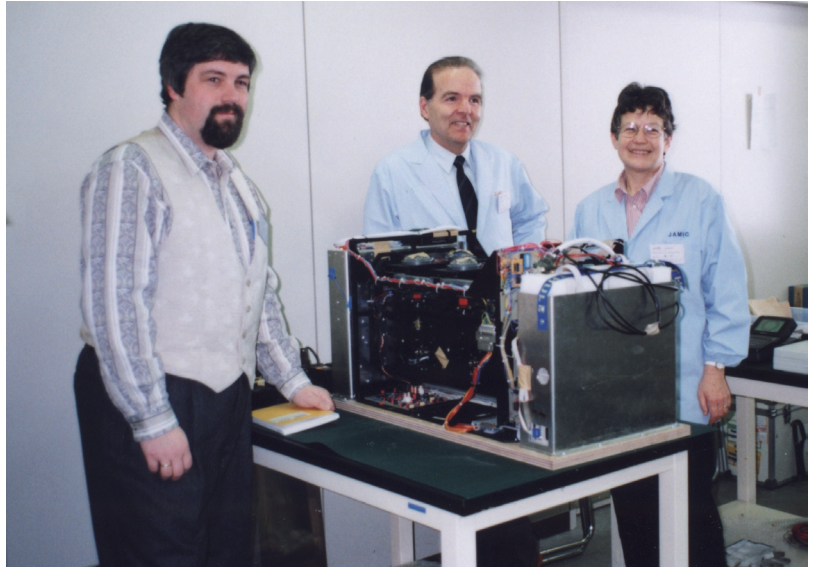


Fig. 101: Richard BRÄUCKER, Hans MACHEMER and his wife Sigrun MACHEMER-RÖHNISCH at the Japan Microgravity Center (JAMIC, Kamisunagawa, Hokkaido, Japan), where they recorded swimming tracks and transient responses of *Paramecium* subjected to an abrupt shift of gravity from 1g to μ g by free-fall experiments in 1996.

Additional bibliographic (& other) sources

- HAUSMANN K. & RADEK R. (2006): Festschrift 25 Jahre Deutsche Gesellschaft für Protozoologie. — Schweizerbart'sche Verlagsbuchhandlung, Stuttgart 1–277 [EVB356].
- HAUSMANN. K. & R. RADEK (ed.) (2014): Cilia and flagella—Ciliates and flagellates. Ultrastructure and cell biology, function and systematics, symbiosis and biodiversity. — Schweizerbart Science Publishers, Stuttgart: 1–299.
- HAUSMANN K. (2018): Lebensweg eines nur durchschnittlich Begabten: Ein Naturwissenschaftler erinnert sich. — Schweizerbart'sche Verlagbuchhandlung, Stuttgart: 1–393 [AB1756], where stated that MACHEMER's precise way of working and demanding educational film impressed im very much.

A short biography, list of publications and topics of papers by Hans MACHEMER and co-workers including Abstr. can be found on the homepage <http://hans-machemer.de/>.

Primary contributions:

- Impact on methods in cell physiology and the understanding of mechanosensory-motor coupling, motor control and coordination of cilia
- Important investigations on electrical properties, gravireception and graviresponses

in various ciliates, sensory mechanisms in ciliates (and a mollusc)

Contents of collection

Series descriptions: period 1965–2014

The collection contains about 3000 black and white or colour transparencies in 24 archival boxes concerning lectures on general zoology and physiology of cilia and behaviour; manuscripts on these lectures and exercises (5 boxes). A bibliographic map collection (Fig. 104) includes about 2800 separates as regards the fields of interest. Currently 452 special items have been recorded.

Among other highlights in the collection are a metallic model of *Stylonychia* (Fig. 102, 103) and a model reconstruction of ciliary metachronism, both accompanied by an authentic popular description, how to use and/or interpret them.

Series 1 Prepared organisms: none.

Series 2 Publications

Research papers (93), reviews and reports

(24), book (1), book chapters (10), popular scientific journals (4), scientific film (1). An actual complete bibliography is available on the homepage (see above), so durability is uncertain, thus the references enriched by a correspondence to the page of the five bound special volumes and a reference code (see p. 461).

MACHEMER H. (1965): Analyse langzeitlicher Bewegungserscheinungen des Ciliaten *Stylonychia mytilus* EHRENBERG. — Arch. Protistenk. **108**: 91–107 [MHS030: 1; MHS035].

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MACHEMER H. (1966): Erschütterungsbedingte Sensibilisierung gegenüber rauhem Untergrund bei *Stylonychia mytilus*. — Arch. Protistenk. **109**: 245–256 [MHS030: 83; MHS039].

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MACHEMER H. (1969): Filmbildanalysen 4 verschiedener Schlagmuster der Marginalcirren von *Stylonychia*. — Z. Vergl. Physiol. **62**: 183–196 [MHS030: 117; MHS041].

MACHEMER H. (1969): Regulation der Cilienmetachronie bei der Fluchtreaktion von *Paramecium*. — JoPr **16**: 764–771 [MHS030: 161; MHS043].

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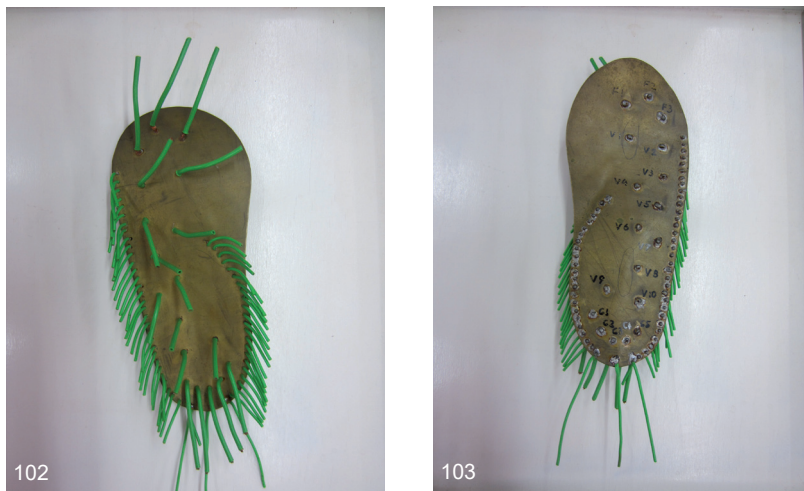


Fig. 102, 103: Front and back side of the metallic model of *Stylonychia* developed by Hans MACHEMER to teach students methods of electrophysiology..



Fig. 104: Hans MACHEMER's hanging file collection amounting to about 2,800 separates of researchers on cell physiology.

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- MACHEMER H. Publications 1986–1989 (Bochum II) Vol. **3**: 791–1177 [MHS032].
- MACHEMER H. Publications 1990–1994 (Bochum III) Vol. **4**: 1170–1520 [MHS033].
- MACHEMER H. Publications 1995–1999 (Bochum IV) Vol. **5**: 1521–1913 [MHS034].

Digitized content: none.

Future prospects

- Recording of the taxa and figures in the publications
- Scanning of the transparencies and correspondence with the literature

Ralf MEISTERFELD (*1946)

Curriculum Vitae (no current one is available; this also applies to his early mentor Theodor GROSPIETSCH) April 1975–August 2011 RWTH Aachen University

Additional bibliographic (& other) sources

https://www.researchgate.net/profile/Ralf_Meisterfeld

HAUSMANN K. & RADEK R. (2006): Festschrift 25 Jahre Deutsche Gesellschaft für Protozoologie. — Schweizerbart'sche Verlagsbuchhandlung, Stuttgart 1–277 [EVB356].

As special issue on occasion of his 70th birthday was edited by E. MITCHELL in *EJP* (2016) vol. **55**: 103–202.

Primary contributions:

- Eminent researcher on the ecology and taxonomy, using scanning electron microscopy to better document taxa of testate amoebae
- Succeeded in culturing over 100 species of testaceans

Contents of collection

Series descriptions: period 1950s–2013

The collection harbours 14,062 reprints concerning protistology and ecology (under the signature MR0001–MR14062). References were provided as electronic (asksam) database, which need to be integrated in the literature database (“BIB_all”). Separates as well as own slides regarding testate amoebae are still housed at his private working place.

It embraces 338 boxes containing slides of microscopic specimens of testate amoebae sampled by GROSPIETSCH among others in Brazil.

Series 1 Prepared organisms

The 7,000 slides are rarely determined at species level, but labelled with the sampling site or a series number.

Series 2 Publications

Since no bibliographies are available, preliminary ones are provided for both authors.

- GROSPIETSCH T. (1952): Die Rhizopodenanalyse als Hilfsmittel der Moorforschung. — *Naturwiss. Berlin* **39**: 318–323 [TE00su].
- GROSPIETSCH T. (1952): Die beschalteten Amöben unserer Hochmoore. — *Mikrokosmos* **41/10**: 219–224 [TE0001].
- GROSPIETSCH T. (1953): Die Untersuchung von Mooren mit Hilfe der Rhizopodenanalyse. — *Mikrokosmos* **42/5**: 101–106 [TE6002].
- GROSPIETSCH T. (1953): Rhizopodenanalytische Untersuchungen an Mooren Ostholsteins. — *Arch. Hydrobiol.* **47**: 321–452 [TE0003].
- GROSPIETSCH T. (1954): Die Bedeutung der Rhizopodenanalyse für die Moorforschung. — *Mitteilungen aus der Max-Planck-Gesellschaft* **2**: 94–97 [TE0004].

- GROSPIETSCH T. (1954): Studien über die Rhizopodenfauna von Schwedisch-Lappland. — *Arch. Hydrobiol.* **49**: 546–580 [TE0005].
- GROSPIETSCH T. (1955): Die testaceen Rhizopoden der Hochmoore und ihre Bedeutung für die Moorforschung. — *Gewässer und Abwässer, Düsseldorf* **6**: 5–19 [TE0006].
- GROSPIETSCH T. (1957): Beitrag zur Rhizopodenfauna des Lago Maggiore. — *Arch. Hydrobiol.* **53**: 323–331 [TE0007].
- GROSPIETSCH T. (1958): Wechseltierchen (Rhizopoden). — Franckh'sche Verlagshandl., Stuttgart: 1–82, pl. 1–4 [AEB589].
- GROSPIETSCH T. (1958): Beiträge zur Rhizopodenfauna Deutschlands. I. Die Thekamöben der Rhön. — *Hydrobiologia* **10**: 305–322 [TE0008].
- GROSPIETSCH T. (1964): Die Gattungen *Cryptodiffugia* und *Diffugiella* (Rhizopoda Testacea). — *Zoologische Anz.* **172/4**: 243–257 [TE0009].
- GROSPIETSCH T. (1965): Wechseltierchen (Rhizopoden). 2. Aufl. B+3. — Franckh'sche Verlagshandl., Stuttgart: 1–87 [LB0680].
- GROSPIETSCH T. (1965): Monographische Studie der Gattung *Hyalosphenia* STEIN (Rhizopoda Testacea). — *Hydrobiologia* **26**: 211–241 [TE0010].
- GROSPIETSCH T. (1965): Schalenamöben im Boden. — *Mikrokosmos* **54**: 14–18 [TE6077].
- GROSPIETSCH T. (1965): Rhizopodenanalytische Untersuchungen im Naturschutzgebiet Bernrieder Filz (Oberbayern). — *Arch. Hydrobiol.* **61**: 100–115 [TE0011].
- GROSPIETSCH T. (1967): Die Rhizopodenanalyse der Moore und ihre Anwendungsmöglichkeit. — In: TÜXEN R. (ed.), *Pflanzensoziologie und Palynologie. Bericht über das Internationale Symposium in Stolzenau/Weser, 1962, der Internationalen Vereinigung für Vegetationskunde*: 181–192 [TE0012].
- GROSPIETSCH T. (1970): Rhizopoda. — In: GRAY P. (ed.): *The Encyclopedia of the Biological Sciences*. Van Nostrand Reinhold Co. (New York): 810–812 [TE0013].
- GROSPIETSCH T. (1971): Rhizopoda, Beitrag zur Ökologie der testaceen Rhizopoden von Marion Island. — In: van ZINDEREN BAKKER E.M.Sc., WINTERBOTTOM J.M. & DYER R.A. (ed.). *Marion and Prince Edward Islands. Report on the South African Biological and Geological expedition 1965/1966*; A.A.Bolkema (Cape Town): 411–423, 89 photos [TE0014].
- GROSPIETSCH T. (1972): Wechseltierchen (Rhizopoden). 3., verb. Aufl., 73 Abb., 4 Taf. — (Franckh) Stuttgart: 1–87 [TE0016].
- GROSPIETSCH T. (1972): Neue Ergebnisse der Rhizopodenanalyse für die Moorforschung. — *Verh. Internat. Verein. Limnol.* **18**: 1031–1038 [GP1871].



Fig. 105– 108: Ralf MEISTERFELD and his wife Susanne (**105**) in the parc of the Biology Centre visting Linz in 2014. – **106:** MEISTERFELD's collection amounting to more than 14,000 separates, mainly on testate amoebae and ecology. – **107–108:** Cardboard maps of Theodor GROSPIETSCH exemplifying collective labelling (**107**) and storage at the depository Lindengasse (**108**).

GROSPIETSCH T. & GODEANU S. (1972): Informative Bulletin of Testacean Workers. **2**: 1–22 [TE0029].

GROSPIETSCH T. (1972): I. Protozoa. A. Testacea und Heliozoa: — In: ELSTER H.J. & OHLE W. (ed.): Die Binnengewässer; v. 26: Das Zooplankton der Binnengewässer, 1. Teil. Die Binnengewässer **26**: 1–30 [TE0015].

GROSPIETSCH T. (1975): Beitrag zur Kenntnis der Testaceen-Fauna des Lago Valencia (Venezuela). — Verh. int. Verein. theor. angew. Limnol. **19**: 2778–2784 [TE0020].

GROSPIETSCH T. (1975): Informative Bulletin of Testacean Workers. **3**: 1–24 [TE0019].

- GROSPIETSCH T. (1976): Rhizopodenanalytische Untersuchungen in zwei Mooren im oberbayerischen Jungmoränengebiet südlich des Starnberger Sees (Weidfilz und Schögenfilz). — *Telma* (Hanover) **6/4**: 25–34 [TE0021].
- GROSPIETSCH T. (1979): Informative Bulletin of Testacean Workers. **4**: 1–61 [TE0024].
- GROSPIETSCH T. (1979): List of the new species and subspecies (also new variations and forms) describes, a. til (sic) 1975; b. in 1976; c. in 1977; d. 1978. — Informative Bulletin of Testacean Workers **4**: 25–27 [TE0023].
- GROSPIETSCH T. (1979): Appendix: List of the slide collection made by E. PENARD which is deposited in the British Museum (Register numbers 20.12.8.1–706). — Informative Bulletin of Testacean Workers **4**: 30–61 [TE0022].
- GROSPIETSCH T. (1982): Untersuchungen über die Thekamöbenfauna (Rhizopoda Testacea) im Murnauer Moos. — *Entomofauna Suppl.* **1**: 57–88 [TE0028].
- GROSPIETSCH T. (1982): Informative Bulletin of Testacean Workers. **5**: 1–53 [TE0027].
- GROSPIETSCH T. (1982): The thermal lake of Héviz (Hungary) and its fauna of Rhizopod Testacea (Der Thermalsee von Héviz (West Ungarn) und seine Testaceen-Fauna). — *Arch. Hydrobiol.* **95**: 93–105 [PR7098].
- GROSPIETSCH T. (1988): Testaceen-Literatur (Nachtrag bis 1987). — Aus dem Max-Planck-Institut für Limnologie Plön: 1–15 [PR0023].
- MEISTERFELD R. (1973): Die Testaceengesellschaften des Zeller Lochs (Rhizopoda, Testacea). — *Beitr. Naturk. Osthessen* **5/6**: 81–104 [PR7097].
- MEISTERFELD R. (1977): Die horizontale und vertikale Verteilung der (Rhizopoda, Testacea) in *Sphagnum*. — *Arch. Hydrobiol.* **79**: 319–356 [TE6061].
- MEISTERFELD R. (1978): Die Struktur von Testaceenzönosen (Rhizopoda, Testacea) in *Sphagnum* unter besonderer Berücksichtigung ihrer Diversität. — *Verh. Ges. Ökol.* **7**: 441–450 [TE6060].
- MEISTERFELD R. (1979): Zur Systematik der (Rhizopoda, Testacea) in *Sphagnum*. Eine REM-Untersuchung. — *Arch. Protistenk.* **121**: 246–269 [PR2019].
- MEISTERFELD R. (1979): Clusteranalytische Differenzierung der Testaceenzönosen (Rhizopoda, Testacea) in *Sphagnum*. — *Arch. Protistenk.* **121**: 270–307 [TE6059].
- MEISTERFELD R. (1980): Die Struktur der Testaceenzönosen (Rhizopoda, Testacea) in Böden des Sollings. — *Verh. Ges. Ökol.* **8**: 435–447 [TE6058].
- MEISTERFELD R. (1981): The relation between generation time, temperature and cell size in testate amoebae (Rhizopodea). — *Progr. Protozool. Warschau*: 243, Abstr [PR5032].
- MEISTERFELD R. & SCHÜLLER R. (1982): Le genre Nebela. Une étude biométrique (Rhizopoda, Testacea). — *JoPr* **29**: Abstr. 183 [PR5035].
- MEISTERFELD R. & HEISTERBAUM M. (1983): The decay of empty tests of testate amoebae in soil (Rhizopoda, Protozoa). — In: LEBRUN et al. (ed.) *New trends in soil biology*. : 618–619 [TE6063].
- SCHÖNBORN W., FOISSNER W. & MEISTERFELD R. (1983): Licht- und rasterelektronenmikroskopische Untersuchungen zur Schalenmorphologie und Rassenbildung bodenbewohnender Testaceen (Protozoa: Rhizopoda) sowie Vorschläge zur biometrischen Charakterisierung von Testaceen-Schalen. — *Protistologie* **19**: 553–566 [FOI104].
- MEISTERFELD R. & HEISTERBAUM M. (1986): The decay of empty tests of testate amoebae (Rhizopoda, Protozoa). — *Symp. biol. Hung.* **33**: 285–290 [TE6065].
- MEISTERFELD R. (1986): The importance of Protozoa in a beech forest ecosystem. — *Symp. biol. Hung.* **33**: 291–299 [TE6064].
- MEISTERFELD R. (1989): Vertical distribution of *Diffugia hydrostatica* (Protozoa, Rhizopoda). — XXIV. Congr. Int. Ass. Theor. Appl. Limnol. Abstr. [TE0042].
- MEISTERFELD R. (1989): Die Bedeutung der Protozoen im Kohlenstoffhaushalt eines Kalkbuchenwaldes (Zur Funktion der Fauna in einem Mullbuchenwald 3). — *Verh. Ges. Ökol.* **17**: 221–227 [PR6078].
- ODGEN C.G. & MEISTERFELD R. (1989): The taxonomy and systematics of some species of *Cucurbitella*, *Diffugia* and *Netzelia* (Protozoa: Rhizopoda); with an evaluation of diagnostic characters. — *EJP* **25**: 109–128 [Z02246].
- ODGEN C.G. & MEISTERFELD R. (1990): The biology and ultrastructure of the testate amoebae, *Diffugia lucida* Penard (Protozoa, Rhizopoda). — *EJP* **26**: 256–269 [Z03205].
- MEISTERFELD R., DOHMEN C., MEYER A., PANFIL C. & WIENAND J. (1992): Influence of food quality and quantity on growth and feeding rates of testate amoebae (Testacealobosia). — *EJP* **28**: 351, Abstr. 94 [Z01830].
- WANNER M., ESSER S. & MEISTERFELD R. (1994): Effects of light, temperature, fertilizers and pesticides on growth of the common freshwater and soil species *Cyclopyxis kahli* (Rhizopoda, Testacealobosia), interactions and adaptations. — *Limnologica* (Berlin) **24**: 239–250 [TE6110].
- WANNER M. & MEISTERFELD R. (1994): Effects of some environmental factors on the shell morphology of testate amoebae (Rhizopoda, Protozoa). — *EJP* **30**: 191–195 [Z04900].

- FOISSNER W., WANNER M., AESCHT E., DARBYSHIRE J.F., GELTZER J.G. & MEISTERFELD R. (1995): Symposium 5 Protozoa of soil. — In: BRUGEROLLE G. & MIGNOT J.-P. (ed.): Protistological Actualities. Proc. 2nd Europ. Congr. Protistol. Clermont-Ferrand 1995: 128–135 [FOI351].
- MEISTERFELD R., COENEN H. & HEISTERBAUM M. (1995): Soil development on a reforested strip mining heap: protozoa as monitoring organisms. — EJP 31: 445–446, Abstr. 153 [Z01838].
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- MEISTERFELD R. (1997): Shell variability in testate amoebae—causes and taxonomic implications. — Progr. Abstr. 10th Int. Congr. Protozool., Sydney 21–25.7.1997: 144, Abstr [TE0040].
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- MEISTERFELD R. & TAN L. (1998): First record of testate amoebae (Protozoa: Rhizopoda) from Mount Buffalo National Park, Victoria: preliminary notes. Mount Buffalo Issue 115: 231–238 [PR6189].
- BEYENS L. & MEISTERFELD R. (2001): Protozoa: Testate Amoebae. — In: SMOL J.P., BIRKS H.J.B. & LAST W.M. (ed.): Tracking environmental change using lake sediments. Vol 3: Terrestrial, algal, and siliceous indicators. Kluwer Academic Pub. The Netherlands: 121–153 [PR7301].
- MEISTERFELD R., HOLZMANN M. & PAWLOWSKI J. (2001): Morphological and molecular characterization of a new terrestrial allogromiid species: *Edaphoallogromia australica* gen. et spec. nov. (Foraminifera) from Northern Queensland (Australia). — Protist 152: 185–192 [PR1205].
- MEISTERFELD R. (2001): Testate amoebae. — In: COSTELLO M.J., EMBLOW C.S. & WHITE R. (ed.): European register of marine species. A checklist of marine species in Europe and a bibliography of guides to their identification. Patrimoines naturels 50: 54–57 [PR8056].
- MEISTERFELD R. (2002): Order Arcellinida Kent, 1880. — In: LEE J.J., LEEDALE G.F. & BRADBURY P. (ed.): An Illustrated Guide to the Protozoa, 2nd ed. Allen Press, Lawrence Kansas, USA, vol. 2: 827–860 [TE0030].
- MEISTERFELD R. (2002): Testate amoebae with filopodia. — In: LEE J.J., LEEDALE G.F. & BRADBURY P. (ed.): An Illustrated Guide to the Protozoa, 2nd ed.. Allen Press, Lawrence Kansas, USA, vol. 2: 1054–1084 [TE0031].
- WYLEZICH C., MEISTERFELD R., MEISTERFELD S. & SCHLEGEL M. (2002): Phylogenetic analyses of small sub-unit ribosomal RNA coding regions reveal a monophyletic lineage of euglyphid testate Amoebae (Order Euglyphida). — JEM 49/2: 108–118 [PR4091].
- SCHLEGEL M. & MEISTERFELD R. (2003): The species problem in Protozoa revisited. — 6th GfBS Annual Congress Abstr.: 47 [TE0037].
- SCHLEGEL M. & MEISTERFELD R. (2003): The species problem in protozoa revisited. — European Journal of Protistology 39: 349–355 [PDF190].
- PORTER S.M., MEISTERFELD R. & KNOLL A.H. (2003): Vase-shaped microfossils from the neoproterozoic chuar group, Grand Canyon: a classification guide by modern testate amoebae. J. Paleont. 77(3): 409–429 [TE0032].
- MITCHELL E.A.D. & MEISTERFELD R. (2005): Taxonomic confusion blurs the debate on cosmopolitanism versus local endemism of free-living protists. — Protist 156: 263–267 [PDF001].
- MEISTERFELD R. & BADEWITZ H.-J. (2006): A redescription of *Amphizonella violacea* (Amoebozoa: Arcellinida). — AcPr 45: 167–173 [TE0039].
- ADL *et al* [+ MEISTERFELD R.] (2007): Diversity, nomenclature, and taxonomy of protists. — Syst. Biol. 56: 684–689 [PR1216].
- LARA E., HEGERA T.J., MITCHELL E.A.D., MEISTERFELD R. & EKELUNDD F. (2007): SSU rRNA reveals a sequential increase in shell complexity among the euglyphid testate amoebae (Rhizaria: Euglyphida). — Protist 158: 229–237 [TE0035].
- TODOROV M., GOLEMANSKY V. & MEISTERFELD R. (2010): Is *Diffflugia nebeloides* (Amoebozoa: Arcellinida) really a *Diffflugia*? Re-description and new combination. — Acta zool. bulg. 62: 13–20 [TE0038].
- HEGER T.J., BOOTH R.K., SULLIVAN M.E., WILKINSON D.M., WARNER B.G., ASADA T., MAZEI Y., MEISTERFELD R. & MITCHELL E.A.D. (2011): Rediscovery of *Nebela ansata* (Amoebozoa: Arcellinida) in eastern North America: biogeographical implications. — J. Biogeogr. [TE0034].
- GORDON D.P., DIGGLES B.K., MEISTERFELD R., HOLLIS C.J. & BUCHANAN P.K. (2012): [Chapter] fifteen Phylum Cercozoa. — In: New Zealand inventory of biodiversity.: 1–9 [TE0033].
- MEISTERFELD R., STEPHENSON S.L., SHIEL R., TAN L. & CHARLESTON (2012): [Chapter seven] Phylum Amoebozoa. — In: New Zealand inventory of biodiversity.: 91–102 [TE0036].
- CHATELAIN A.P., MEISTERFELD R., ROUSSEL-DELIF L. & LARA E. (2013): Sphenoderiidae (fam. nov.), a new clade of euglyphid testate amoebae characterized by small, round scales surrounding the aperture. — Protist 164: 782–792 [PR1281].

Series 3 Unpublished material: none.

Series 4 Documentation

Together with colleagues at least 10 genera have been established: *Edaphonobiotus* SCHÖNBORN, FOISSNER & MEISTERFELD, 1984, *Edaphoallogromia* MEISTERFELD, HOLZMANN & PAWLOWSKI, and in 2003 by PORTER, MEISTERFELD & KNOLL (*Bombycion*, *Bonniea*, *Cycliocyrellium*, *Hemisphaeriella*, *Melicerion*, *Palaeoarcella*, *Trachycyrellium*, *Trigonocyrellium*).

MEISTERFELD was honoured by three species; *Clypeolina meisterfeldi* BADEWITZ, 2011. *Nebela meisterfeldi* HEGER & MITCHELL, 2012 and *Heterometopus meisterfeldi* FOISSNER, 2016.

Future prospects

- Evaluation of slides concerning durability and if possible community structure
- Completing bibliographies and taxa lists

Maria MULISCH (*1952)

Curriculum Vitae

- Born 28 August 1952 in Braunschweig/Niedersachsen, Germany
- 1973–1974 Studies on philosophy, University Heidelberg
- 1974–1980 Studies on biology, University Heidelberg
- 1983 Ph. D., University Heidelberg
- 1985–2000 Scientific assistant, Division of Protozoology, Institute of Biology, University of Berlin and Cologne
- 1993 Habilitation, University of Cologne
- Since 2001 Head of the central microscopy, University Kiel

Additional bibliographic (& other) sources

HAUSMANN K. & RADEK R. (2006): Festschrift 25 Jahre Deutsche Gesellschaft für Protozoologie. — Schweizerbart'sche Verlagsbuchhandlung, Stuttgart 1–277 [EVB356].

Primary contributions:

- Researcher on life cycles of folliculinids and chitin formation in unicellulars
- Experienced practitioner and teacher of light and electron microscopic techniques as well as immunological methods

Contents of collection

Original equipment for electron microscopy, negatives of investigations and 30 portfolios with protocols, photographic negatives and paper positives on light- and electron microscopy as well as experiments..

Series descriptions: period 1980s–2014

Series 1 Prepared organisms:

About 800 slides, mainly on folliculinid ciliates.

Series 2 Publications

As there exists no complete bibliography, papers on protistology and microscopy are given here.

HAUSMANN K. & MULISCH M. (1981): Das Epiplasma des Ciliaten *Pseudomicrothorax dubius*, ein Cytoskelett. — Arch. Protistenk. **124**: 410–416 [CI2227].

MULISCH M., BARTHOLOTT W. & HAUSMANN K. (1981): Struktur und Ultrastruktur von *Eufolliculina* spec. Schwärmer und sessiles Stadium. — Protistologica **17**: 285–312 [CI2297].

MULISCH M. & HAUSMANN K. (1982): Inorganic components in the organic lorica of the ciliate *Eufolliculina*. — Naturwissenschaften **69**: 448 [CI5200].

MULISCH M. & PATTERSON D.J. (1983): *Eufolliculina uhligi* n. sp., a new member of the Folliculinidae (Ciliophora), with some comments of the genus *Eufolliculina* HADZI, 1951. — Protistologica **19**: 235–243 [CI1241].

MULISCH M. & HAUSMANN K. (1983): Lorica construction in *Eufolliculina* sp. (Ciliophora, Heterotrichida). — JoPr **30**: 97–104 [CI3255].

MULISCH M., HERTH W., ZUGENMAIER P. & HAUSMANN K. (1983): Chitin fibrils in the lorica of the ciliate *Eufolliculina uhligi*: Ultrastructure, extracellular assembly and experimental inhibition. — Biol. Cell **49**: 169–178 [CI2277].

- MULISCH M. & HAUSMANN K. (1984): Structure and ultrastructure of the oral apparatus of *Eufolliculina uhligi* (MULISCH and PATTERSON 1983. — *Protistologica* **20**: 415–429 [CI2093].
- MULISCH M. (1985): Die Flaschentierchen (Folliculiniden): Interessante Bewohner des Meeres. — *Mikrokosmos* **74**: 39–43 [CI8013].
- MULISCH M. & HAUSMANN K. (1985): Ciliary resorption and membrane retrieval during morphogenesis in the ciliate *Eufolliculina uhligi*. — *J. Ultrastruct. Res.* **90**: 145–162 [CI3291].
- HERTH W., MULISCH M. & ZUGENMAIER P. (1986): Comparison of chitin fibril structure and assembly in three unicellular organisms. — In: MUZZARELLI R., JEUNIAUX C. & GOODAY G.W. (ed.) *Chitin in nature and technology*. Plenum Press, N.Y.: 107–120 [CI2357].
- MULISCH M., HARRY O.G., PATTERSON D.J. & WYATT C. (1986): Folliculinids (Ciliata: Heterotrichida) from Portaferry, co down, including a new species of *Metafolliculina* DONS, 1924. — *Ir. Nat. J.* **22**(1): 1–7 [CI1366].
- HAUSMANN K. & MULISCH M. (1987): Determination of body shape in protists by cortical structures. — In: BEREITER-HAHN J., ANDERSON O.R. & REIF W.-S. (ed.) *Cytomechanics. The mechanical basis of cell*. — Springer Verlag, Berlin: 169–182 [CI2098].
- MULISCH M. & PATTERSON D.J. (1987): Stomatogenesis during cell division in the loricate ciliate *Eufolliculina uhligi*. A scanning electron microscope study. — *EJP* **23**: 193–201 [CI3256].
- MULISCH M. (1987): Stomatogenesis during metamorphosis of *Eufolliculina uhligi* (Ciliophora, Heterotrichida). — *EJP* **23**: 56–65 [CI3001].
- MULISCH M. (1988): Perinuclear organization in the heterotrich ciliate *Stentor coeruleus*. — *Protoplasma* **143**: 170–175 [CI2094].
- MULISCH M. & HAUSMANN K. (1988): Transmission electron microscopical observations on stomatogenesis during metamorphosis of *Eufolliculina uhligi* (Ciliophora: Heterotrichida). — *JoPr* **35**: 450–458 [CI2298].
- MULISCH M. & HAUSMANN K. (1989): Localization of chitin on ultrathin sections of cysts of two ciliated protozoa, *Blepharisma undulans* and *Pseudomicrothorax dubius*, using colloidal gold conjugated wheat germ agglutinin. — *Protoplasma* **152**: 77–86 [CI2095].
- MULISCH M., NIELSEN J. & HAUSMANN K. (1989): Freeze fracture study of the plasma membrane of the marine loricate ciliate *Eufolliculina uhligi*: morphology and distribution of intramembrane particle aggregates in the swarmer and in the lorica secreting cell. — *Biol. Cell* **67**: 263–270 [CI2096].



Fig. 109: Klaus EISLER, who later cared for the GRELL collection, and Maria MULISCH at the 6th meeting of “German Society for Protozoology” (DGP) in Blaubeuren, Germany in 1987. At that times the discussions of beginners in taxonomy, fine structure and/or ontogenesis of the diverse working groups has been very intense.

- MULISCH M. & HAUSMANN K. (1990): WGA (wheat germ agglutinin)-gold labelling of chitin fibrils in extracellular structures of different ciliate species. — *JoPr (suppl.)* **37**: 58 (Abstr.) [Z08098].
- MULISCH M. (1990): Transient microtubules in the ciliate *Eufolliculina uhligi*, and their possible role in morphogenesis. — *NATO ASI Ser.* **H42**: 499–504 [CI2356].
- AESCHT E., FOISSNER W. & MULISCH M. (1991): Ultrastructure of the mycophagous ciliate *Grossglockneria acuta* (Ciliophora, Colpodea) and phylogenetic affinities of colpodid ciliates. — *EJP* **26**: 350–364 [FOI236].
- MULISCH M. (1991): Ultrastructure and membrane topography of special ciliary organelles in the ciliate *Eufolliculina uhligi* (Protozoa). — *Cell Tiss. Res.* **265**: 145–150 [CI2097].
- MULISCH M. & HAUSMANN K. (1991): Rapid lipid intussusception into the plasma membrane of the heliozoon *Actinophrys sol* during phagocytosis. — *Naturwissenschaften* **78**: 232–233 [PR5036].
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Series 3 Unpublished material

Diploma and doctoral theses of students in Cologne; laboratory protocols of experiments and 30 portfolios with protocols, photographic negatives and paper positives on light- and electron microscopy as well as experiments.

Series 4 Documentation

Fragmentary.

Digitized content: none.

Future prospects

- Restauration of the models
- Recording of the figures and correspondence with the literature

Acknowledgment

In a manner appropriate to one's age, viz. over 60, the desire to facilitate the work of a successor – never to be taken granted in modern, turbulent times – as curator of all invertebrates except insects led me to sum up this extended paper. This report points out the structure and continuity in the development of the collection as well as still open fields of completion and refinement. The financial and infrastructural support of this museum's division by nearly a dozen regional authorities of the Federal State of Upper Austria from 1992 until now is greatly acknowledged. I am indebted to the manual and/or organizational help of personal of the Upper Austrian Museum, viz. ERZSEBET BODNAR, RENATE TAUBNER, ANITA PERTLWIESER, WALTRAUD STANDHARTINGER, MICHAELA MINICH, GÜNTHER HARTL, WALTRAUD FAISSNER, MAGDALENA WIESER, DR. GERHARD AUBRECHT and Mag. FRIEDRICH GUSENLEITNER, on several occasions over the years.

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Fig. 110: Long-term support of the intimate other self has been and is essential during all the years responsible for the “diverse invertebrates”. Ludwig HARTINGER and me during a one-month travel through China in 2008.

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