

**GUIDE to the NOMENCLATURE and FORMAL  
TAXONOMIC TREATMENT**

**of**

**OXYPHOTOTROPH PROKARYOTES**

**(Cyanoprokaryotes)**

**PROPOSAL**

**The proposal of this „Cyano-Guide“ was initiated in the frame of the 8<sup>th</sup> IAC Symposium in Kastanienbaum, Switzerland, in 1979 (the main theme of this symposium was „Cyanophyta vs. cyanobacteria, principles and problems in taxonomic treatment of natural populations vs. axenic cultures“), and the 9<sup>th</sup> IAC Symposium in Kastanienbaum and Dübendorf in 1983 (main theme: „Recommendations for a unified approach to the taxonomy of cyanophytes“). Because the proposal of special nomenclatoric rules for cyanophytes/ cyanobacteria seemed to be not acceptable in that time, the preparation of a „Cyano-Guide“ respecting nomenclatoric prescriptions of both, Botanical and Bacteriological Codes, was recommended. The main part of the present Guide was prepared in the period 1983-1990, and from that time not published. However, the urgent need of principles of the nomenclatoric treatment of cyanobacteria increases with intense development of cyanobacterial research in last years, and therefore we send for discussion this proposal (with several recent corrections) as a first step to solve the theory of cyanobacterial nomenclature. The main premises are respected: (i) the rules must be acceptable for both, ecologically and experimentally (bacteriologically) oriented scientists; (ii) the binomial nomenclature can not be avoided (latin names can not be eliminated). Please, read also our „Foreword“ and „Preamble“, where our approach to this difficult problem is more explained.**

**We shall be thankful for all comments, critical remarks and proposals.**

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The used abbreviations:

ICBN = International Code of Botanical Nomenclature

ICNB = International Code of Nomenclature of Bacteria

Art. = Article of this Guide

art. (in connection with ICBN or ICNB) = article in concerning Code

Cyano-Guide = this "Guide to the nomenclature treatment of oxyphototroph Prokaryotes".

## FOREWORD

The progress in the Cyanophyte/Cyanobacterial (Cyanoprokaryote) research led to the enormous increase of our knowledge of this group of oxyphototroph microorganisms in last decades. Their bacterial cell structure was recognized in detail and the plant ecological and biochemical properties (presence of chlorophyll a and phycobilins, presence of photosystem II, etc.) were intensely studied. Moreover the group of Prochlorophytes (Chloroprokaryotes) with analogous prokaryotic cell structure and ecological function, but with chlorophylls a and b and without phycobilins was discovered, and appeared closely related to Cyanobacteria.

The "Cyanophytes" were traditionally classified as "Blue-green Algae", with respect to their morphological diversity and size corresponding to other microalgae, as well as to their function in natural biotopes. Therefore, they were for a long period in the field of interest of botanists (phycologists) and ecologists, and treated as microscopic plant organisms. The detailed cytological and biochemical studies performed by bacteriologists with the use of pure culture strains and of biochemical and el-microscopic procedures, led to the proposal to change the common name of these organisms ("Cyanobacteria" instead of "Cyanophyceae"), and to the opinion, that they should be classified as bacteria and nomenclatorically ruled by the Code of Nomenclature of Bacteria. The introduction of important model strains into the laboratory practice supported this approach.

However, this proposal could not be commonly accepted by scientists in spite of the clear prokaryotic character of cells. The populations of cyanoprokaryotes grow in various niches of the biosphere and play an important role in different biotopes belonging to the important oxyphototrophic producers, and the field ecologists are in actual need of orientation in their phenotype system. The possibility to keep a restricted number of known Cyanoprokaryota species in cultured strains in characteristic morphotypes, and the difficulties in culturing of a row of ecologically extreme ecotypes, complicate the simple application of the International Code of Nomenclature of Bacteria (ICBN). However, the International Code of Botanical Nomenclature (ICBN) adopted mainly for vascular plants (or, at least, for eucaryotic plant organisms), is not quite convenient for Cyanoprokaryote as well.

From this situation and from the endeavour to come to any compromise of the bacteriological and botanical approaches, several proposals leading to the compatible nomenclatoric procedures using the both bacteriological and botanical Codes were published. The important steps in this endeavour are the compromising proposals of FRIEDMANN et BOROWITZKA (Taxon 31, p. 673-683, 1982) and, recently, the corresponding chapters in the both editions of Bergey's Manual of Systematic Bacteriology (Vol. 3, CASTENHOLZ et al. 1989, p. 1712-1714; CASTENHOLZ et al. 2001, p. 1710-1806), from which the majority of proposed principles should be accepted in the nomenclature treatment of Cyanophyta/Cyanobacteria. There exist now two Codes of Nomenclature (ICNB and ICBN), which are applicable for oxyphototroph prokaryotes, however, none without obstacles. This Guide to the Nomenclature Treatment of Oxyphototroph Prokaryotes (Cyano-Guide) was elaborated during last years, respecting prescriptions of both Codes, and discussed in several taxonomic sessions of cyanobacteriologists in the frame of the IAC-symposia from 1988 (International Association for Cyanophyte/Cyanobacterial Research) and the grant EU MIDI-CHIP. In particular, we are indebted for valuable comments to: Konstantinos Anagnostidis (Athens), Christopher Boutte (Liège), Richard W. Castenholz (Eugene, Oregon), Pierre Compère (Meise), Lucien Hoffmann (Luxembourg), Jeffrey R. Johansen (Cleveland), John W.G. Lund (Ambleside), Aharon Oren (Haifa), Pirjo Rajaniemi (Helsinki), Kaarina Sivonen (Helsinki), Stefano

Ventura (Bologna), Annick Wilmotte (Liège). There was decided to coincide the text with mentioned proposals of FRIEDMANN et BOROWITZKA 1982, CASTENHOLZ et WATERBURY 1989 and CASTENHOLZ 2001, as much as possible. We tried to prepare the Guide, therefore, in a form respecting the modern knowledge about this group, all applicable prescriptions of both mentioned Codes and to keep it opened to the possible useful changes. We accept the opinion, that the nomenclature is conventional and must help to taxonomists, ecologists and experimental scientists in the orientation in the system, and not to complicate their work. Moreover, the unification of the opinions of "bacteriologist" and "botanists" as much as possible, is quite indisputable. This Guide is not yet accepted as a "Code", but the principle "pacta sunt servanda" is valid in any nature human community and we hope, that it will be corrected, adapted and accepted by all, who like to work with the fascinating oxyphototroph prokaryotes, cyanophytes, cyanobacteria or prochlorophytes.

In Třeboň and Boston, January 1<sup>st</sup>, 1990.

Jiří Komárek, Třeboň  
Stjepko Golubić, Boston

## PREAMBLE

The algal vs. bacterial characters of oxygenic photosynthetic prokaryotes, i.e., cyanoprokaryotes (Cyanoprokaryota, Cyanophyceae, Cyanobacteria, blue-green algae) and chloroprokaryotes (Chloroprokaryota, Prochlorophyceae, Prochlorales) have been intensely studied particularly from 1960 and discussed in the past decades. The prokaryotic nature, bacterial type of cell structure of these organisms, or the fact that they carry out oxygenic (plant type) photosynthesis possessing chlorophyll a are, of course, not disputable, however, differences in taxonomic and nomenclatorial approaches and practices, that originated from different scientific traditions, remain unsettled. The arguments put forward by representatives of different approaches to taxonomy of Cyanoprokaryota are formidable, but the willingness to resolve the problem by consensus, and thus prevent a creation of at least two separate treatments with separate nomenclatural jurisdiction, remains to be equally strong.

Protagonists of both school of thought, one phycological with ecological concerns, and the other bacteriological in tradition and concerned with pure cultures and experimental approaches have been meeting and collaborating. The possibilities to arrive to a unified approach to taxonomy of Cyanoprokaryota and Chloroprokaryota has been evaluated. Among other problems, it has been stated that the elimination of the traditional binomial nomenclature referring to genera and species of Cyanoprokaryota as they are encountered in nature in favor of a taxonomy based on pure cultures alone is unacceptable, because of the difficulties in culturing of many, sometimes ecologically extremely important species, and because of difficulties to establish the identities of those taxa which are present in pure cultures as to the natural taxa of their origin.

The International Code of Nomenclature of Bacteria (ICNB) did satisfy all the requirements identified by taxonomists active in ecological settings of Cyanoprokaryota. On the other hand, the International Code of Botanical Nomenclature (ICBN), which was largely adapted from practices developed for and applied to "higher plants" has been criticized by both phycologically (ecologically) and bacteriologically (laboratory) inclined researchers. One of the suggestions mentioned was the possibility to prepare a separate Nomenclatorial Code specially for the needs of Cyanoprokaryota and Chloroprokaryota. Such a Code might satisfy the needs originating from the prokaryotic nature of these organisms as well as those originating from their ecological significance as primary producers. However, the acceptance of such a Code is justifiable only in the case, if it has to be accepted by all researchers, who work with this group, as well as by the whole scientific world. We do not believe that the situation among all cyanophytologists and cyanobacteriologists is prepared enough for it; therefore we elaborated at least the Guide for the nomenclatorial treatment of Cyanoprokaryota and Chloroprokaryota, respecting prescriptions of both Codes as much as possible, and following the endeavours expressed in the last editions of Bergey's Manual as well.

Thus, this Guide is not in contradiction to the Bacteriological, Botanical and other Codes of Nomenclature, but it coincides with them and respects all their articles, however, respecting also the specific character of Cyanoprokaryota and Chloroprokaryota. This Guide synthesizes all the valuable rules and recommendations of both mentioned Codes, with the aim to enable the reproducible work with organisms in question in all possible fields, and to create the basis for their correct cytomorphological and biochemical classification. The principles of species concept are respected, but modified according to cyanoprokaryotic nature of cyanobacteria.

Cyanoprokaryota represent a phylogenetic old prokaryotic group, the common structure of which was retained without substantial changes from the Precambrian period. The set of their genotypes with variation possibilities (stages during life cycles, ecomorphoses, morphotypes, status, pigment ratio modifications, diversity in various areas, potential variation races, etc.) and biological specificities (combination of bacterial cell with oxyphototroph photosynthesis, heterocytes and nitrogen-fixation, toxicity, gas-vesicles, ecological adaptations, facultative presence of microtubuli, different mutagenic press and genotypic stability in different species, etc.) comprises the group of phototrophic microorganisms, the knowledge of which is very important, and still far from to be cleared out. Cyanoprokaryota were probably the first autotrophs, which influenced the climate of Earth and participated in the accumulation of calcareous sediments in the whole noosphere. Their wide occurrence in all possible biotopes and adaptability to extreme conditions (high or low temperatures, salinity, desiccation, utilization of aqueous liquids, etc.), adaptation processes, biology, biochemistry and cell structure are of special value for understanding the origin of phototrophic life. Their systematic classification is, therefore, quite unavoidable as the basis for their future research.

All nomenclatural prescriptions are conventional. The use of any name, "Cyanophyta" or "Cyanobacteria", does not guarantee the modern approach, correctness and quality of a scientific work. Both the classifications of Cyanoprokaryota and Chloroprokaryota into the not taxonomically unique group Bacteria (based on prokaryotic cell structure and nucleotide base sequences) or Algae (defined as non vascular, oxyphototroph producers with all their consequences) are quite justifiable. The use of verbal names for designation of cyanoprokaryotic taxa is quite necessary; the orientation in cyanobacterial diversity by mere numbers or strain symbols is impossible. The name itself express not the characteristic feature of a taxon; the taxonomic designation is a symbol of a set of all its known characters, morphological, cytological (structural), biochemical, with special cell- and life-cycles, ecophysiological.

With the increasing knowledge of different taxa and with revisions of their taxonomic values are naturally changed their contents and ranges, and their names must be consequently changed. The purpose of giving a name is, therefore, to symbolize in one word (or binome) all the characters, history (if possible), and taxonomic rank (relation to other taxa) of any studied and classified organisms. Moreover, the horizontal transfer of genes in populations and rapid acclimation processes (RUDI et al. 1997, 1998, 2000, HAGEMANN 2002, KOMÁREK & ANAGNOSTIDIS 2005), leading to the origin of new morphotypes and genotypes in changing habitats, presuppose the continual origin of new cyanobacterial entities in the biosphere. Their characterization is necessary. The nomenclatoric treatment of Cyanobacteria exclusively after ICNB or ICBN is unusable without numerous exceptions. This Guide aims, therefore, a stable method of naming taxonomic groups and taxa respecting to the prescriptions of both, Bacteriological and Botanical Codes (ICNB and ICBN) as much as possible, avoiding and rejecting the use of symbols (names) which may cause errors and ambiguities. It contains the explanations of rules, according to which the designation of Cyanoprokaryota and Chloroprokaryota should be named and classified in the form, usable for any management with them.

## CHAPTER 1 .

### **GENERAL CONSIDERATIONS**

#### **Section 1.**

##### PRINCIPLES

#### **Principle 1.**

The progress in the knowledge of prokaryotic phototrophs can be furthered only by a continually precised system and by nomenclature following the system, accepted by the majority of specialists of all nations. Taxonomic classification is the only method for reviewing of natural diversity of any organisms, and nomenclatural treatment is the method to the unique designation of biological units. To prevent the incorrect identifications and misinterpretations of taxa and to achieve order in nomenclature, it is essential that the scientific names are regulated by internationally accepted Rules (in ICBN and ICNB), which aim their stability, avoid or reject the use of names which may cause errors or confusions, and avoid the useless creation of names. The accepted Rules must be adjust to the classification necessities following from the nature of organisms in question, no other rules can be applied without objections. This Cyano-Guide contains modification and explanation enabling the application of both Rules on cyanobacteria. The Rules are retroactive, except where exceptions are specified.

#### **Principle 2.**

This Guide applies to all organisms possessing the characters of Cyanoprokaryota (Cyanophyta/Cyanobacteria) and Chloroprokaryota (Prochlorophyta/Prochlorobacteria); the nomenclature of certain other microbial groups is provided for by other Codes: bacteria by the International Code of Nomenclature of Bacteria (ICNB), fungi and eucaryotic algae by the International Code of Botanical Nomenclature (ICBN), protozoans by the Zoological Code, and viruses by the Virological Code.

#### **Principle 3.**

This Guide does not ignore and eliminate the historical and well-tried rules from other Codes (particularly of the ICBN and ICNB), but it explains them to be in accordance with the present knowledge of Cyanoprokaryota and Chloroprokaryota, using all the possible existing practical and acceptable traditions and useful prescriptions. The other nomenclature rules are respected only to such a degree that the names must be rejected, if they are identical with the names of bacteria, plants and animals (with except if they have priority). All names of Cyanoprokaryota (Cyanophyta, Cyanobacteria) and Chloroprokaryota (Prochlorales) are valid, if they are validly published under the Bacteriological Code (ICNB) as Cyanobacteria **or** under the Botanical Code (ICBN) as Cyanophytes. It means, that all cyanobacterial taxa, validly described according to ICNB and ICBN to December 31<sup>st</sup> 2004 should be accepted into the common system of Cyanobacteria; their nomenclature should be treated according to this Cyano-Guide from January 1<sup>st</sup> 2005, as valid taxa according to this Cyano-Guide.

#### **Principle 4.**

The scientific name does not indicate itself the character or history of the taxon, but represents the set of all knowledges concerned and characters of taxa.

#### **Principle 5.**

Each taxon can bear only one correct name, the earliest that is in accordance with the Rules of ICBN and/or ICNB (and with this Cyano-Guide), or if it is included into the approved lists of conserved names in Cyano-Guide. If more names for one taxonomic type exist, the correct one must be selected according to common Rules of ICBN and ICNB; if one name for more taxonomic types exist, it must be retained only for taxon, which received this name at first. The name of a taxon should not be changed without sufficient reason being in contrary to the Rules (Articles) of ICBN or ICNB; the name, which is in contrary to the Rules of ICBN and ICNB, must be replaced by a correct name. The designations of strains must be used according to the corresponding rules and must not be altered (see Chapter 2, Section 5).

#### **Principle 6.**

The classification in taxonomic categories (units), i.e., species, genera, families, etc., is derived from the natural stage of organisms and from the used practice. The taxonomic units with their real contents are **taxa** (real species, genera, etc.). The hierarchy of taxonomic units (ranks) is given in Chapter 2, Section 4.

#### **Principle 7.**

The basic taxonomic units are: **genus**, delimited clearly genotypically and phenotypically, and **species**, the limitation of which is given by any provable, stable hiatus within the genotypes (distinct stable phenotypes and ecotypes with ecophysiological/biochemical properties, different between two groups of organisms, which are able to reproduce and retained their characters in succeeding generations).

#### **Principle 8.**

Rules of nomenclature do not govern the delimitation of taxa nor determine their relations. They are primarily for assessing the correct names applied to taxa defined by other (taxonomic) methods. They prescribe the technical procedures for creating, proposing and using the names and strain designations.

#### **Principle 9.**

For the taxonomic hierarchy (hierarchical position of taxa) is accepted the monothetic principle of classification. It means, that the taxon is regarded as a sum of all its subordinate taxa (if any), and all the subordinated taxa must possess the diagnostic features of the nearest superior taxon (species of superior genus, genera of superior family, etc.). In this sense, the nomenclatoric type is one (typical) part of the whole content of a taxon, with which the name is connected.

#### **Principle 10.**

The application of names of taxa is determined by means of nomenclatural types; the commented Rules of typification referred to in ICBN and ICNB see in Chapter 2, Section 6.

### **Principle 11.**

The naming of taxa is based on valid publications, legitimacy and priority of publication. The names of well known taxa are stabilized by including them into the approved lists of conserved names of taxa (Chapter 3); the lists and changes in the lists are accepted by the procedure, given in the Chapter 1, Section 2.

### **Principle 12.**

This Guide is divided in 3 chapters:

- (1) "General Considerations". - The general principles explain the basis of both Codes (ICBN and ICNB); the articles and recommendations are derived from them.
- (2) "Comments to Rules and Recommendations". - The articles, notes, recommendations and examples make effective the principles and explain the sense of prescriptions (rules) of both Codes (ICBN, ICNB). They propose the methods for the handling with names in Cyanoprokaryota and Chloroprokaryota taxonomy. The articles summarize and comment the rules of both Codes and must be followed. The notes explain and precise the prescriptions of articles. The recommendations do not have the force of rules, but they are intended to be guides to desirable practice in taxonomic nomenclature.
- (3) "Conservations". - The lists of approved names should to serve to the conservation of familiar names of taxonomically clarified genera and species. The conserved names are listed without their respective taxonomic value and their content can be not accepted from the point of view of taxonomy, but not changed and misinterpreted.

All three chapters are of the same value within Cyano-Guide. The "Register" supplements the Cyano-Guide.

### **Principle 13.**

From practical reasons are recommended the names **Cyanoprokaryota** and **Chloroprokaryota** as designations of the highest ranks (classes) of both respective groups of microorganisms, to avoid the reservations against the "algal" or "bacterial" approaches of Cyanophyta/Cyanobacteria, and to express the similarity of both oxyphototroph prokaryotic groups. If any other alternative synonyms at the same taxonomic levels are preferred and used from any reason (Schizophyceae, Myxophyceae, Cyanophyta, Cyanophycota, Cyanobacteria, Oxyphotobacteria, Prochlorophyta, Chroobacteria, Prochlorobacteria, etc.), the nomenclatural Rules must be kept retained.

**Note P13a:** In the history, the classification of "Cyanophytes" was several times included into higher taxonomic unit (division) together with bacteria (Schizophyta COHN 1872, Archaiphyta VILHELM 1923, and others). In respect to the recent knowledge, this classification is not necessary (comp. also CASTENHOLZ et WATERBURY, Bergey's Manual 1989, p. 1911).

**Note P13b:** They are not recommended as taxonomic names the terms:

- Schizophyceae, Myxophyceae, Cyanophytes, Cyanophyta, Cyanophyceae, Prochlorophytes, Prochlorophyta (because the endings -phytes, -phyta, and -phyceae support the plant character, ignoring the bacterial structure of cells);
- Blue-green algae (because the term "algae" does not represent the taxonomic, but biological and ecological taxonomically heterogeneous group of lower, mainly plant organisms, ignoring the bacterial structure of cells);
- Cyanobacteria ("bacteria" represent the taxonomic group, but this was established and traditionally used for group of microorganism without oxyphototroph plant metabolism and with different ecological function; the recent casualistic synonymization of "bacteria" with "prokaryotes" is rather artificial, and not acceptable).

**Note P13c:** They could be used as non-taxonomic names the terms "cyanophytes" or "cyanobacteria" or the national terms expressing the specificity of this groups of microorganisms (e.g., blue-green algae, Blaualgen, algues blue-vertes,"sinice" in some slavic languages) in scientific literature.

**Principle 14.**

The only acceptable and recommendable method for modern taxonomic evaluation of cyanoprokaryota is the combined (polyphasic) approach with use of phenotype, ultrastructural, ecological, biochemical and molecular methods.

**Principle 15.**

This Cyano-Guide is not dogmatic and should be continually supplemented, revised and corrected according to accepted provisions, summarized in section 2.

## Section 2.

### ORGANIZATION (For discussion!)

#### **Provision 1.**

For any necessary changes in this Guide and for their interpretation in doubtful cases have been established the permanent "International Committee of Oxyphototroph Prokaryotes Nomenclature" (ICOPN), which acts under the guidance of IAC (International Association for Cyanophyta Research) [or IUBS and/or IAPT ... discussion!]. This committee is 12-membered and the members should be elected and nominated of parity by both botanically and bacteriologically oriented scientists. The ICOPN selects itself among the nominated members the head and the secretary of ICOPN. The membership in ICOPN is ceased by the remove by the supervision organisation, by one's request or by death. The new member is elected by the corresponding organization.

**Note PV1/a:** Qualification for membership in ICOPN:

- (a) The membership in IAC or IUMS (International Union of Microbiological Sciences);
- (b) The practice in taxonomy of Cyanoprokaryota (Cyanophyceae/ Cyanobacteria) or Chloroprokaryota (Prochlorophyta) documented by papers in this field.

**Note PV1/b:** Qualification for voting in plenary sessions:

- (a) The membership in IAC or IUMS;
- (b) The practice with Cyanoprokaryota (Cyanophyceae/Cyanobacteria) or Chloroprokaryota (Prochlorophyta) documented by papers in this field.

**Note PV1/c:** Both nomenclatoric communities IAPT and IUBS will be continually and immediately informed about all conclusions and proposal of ICOPN.

#### **Provision 2.**

The head and the secretary of ICOPN are responsible for the organization of the preparation of all activities of ICOPN, particularly for the preparation of materials for the sessions of ICOPN, for holding of terms and organization of sessions with the presence of all members of ICOPN; from the absent members of ICOPN in regular sessions their opinions and votes expressed in letters are necessary.

**Note PV2/a:** For voting in ICOPN the votes of 90% of members are necessary.

**Note PV2/b:** The proposals for ICOPN (changes in Cyano-Guide, new "nomina conservanda", etc.) should be send to the secretary of ICOPN, who prepares regular information for all members of ICOPN.

**Note PV2/c:** The voting of proposed changes can be organised by electronic mail. The accepted proposals should be discussed definitely according to Provision 4.

#### **Provision 3.**

In the absence of relevant solution or where the consequences of the explanation of any rule of Cyano-Guide are uncertain, a summary in which all pertinent facts are outlined should be submitted to the ICOPN. Alternations to Cyano-Guide can be proposed by anybody to the secretary of ICOPN.

#### **Provision 4.**

The plenum of IAC [for discussion ...!] is the top arbiter for all the changes in the Cyano-Guide, particularly in approved lists of conserved names. The proposals, recommendations and decisions have to be ratified by the IAC plenum (at its regular symposia or additionally plenary sessions), in (at least) 3 years intervals. Any changes and proposals can be accepted only when accepted by more than 90% of participants. [Discussion!]

**Note PV4/a:** It is recommended to organize the nomenclatoric sessions during the regular IAC symposia and/or IUBS congresses.

**Note PV4/b:** For the voting practice the list of members of IAC and IUBS (phototrophic section?) is necessary. For membership in these lists is necessary the practice in taxonomy, ecology or biology of Cyanoprokaryota or Chloroprokaryota, documented by papers in this field. The list of members of IAC and .... has to be completed particularly by the bacteriologically oriented researches in cyanoprokaryotes.

**Note PV4/c:** The members of IAC who are not familiar with the voted matter, are recommended to vote positively for new propositions. [Discussion!]

#### **Provision 5.**

The nomenclatoric sessions of ICOPN should be organised before the regular IAC symposia or additional plenary sessions IUBS minimally 6 months before, and minimally once per 3 years. The secretary of ICOPN is responsible for the preparation of identical materials for voting in the plenary sessions. For each plenary session a special report and the respective proposed changes in rules and additions to the approved lists with the commentary and recommendation should be prepared. The materials ICOPN should be presented to all members of (IAC and .....) at least 3 months before the sessions.

#### **Provision 6.**

The proposals should be accepted and recommended in ICOPN when 3/4 majority of votes is reached. The proposals in plenary sessions are accepted when the 90% of votes are reached. The current plenary session is ready to vote if at least 1/3 of members is present. If not, voting by letters (or better by e-mail?) before the sessions is possible.

**Note PV6/a:** No accumulation or transfer of personal votes is permissible in any voting.

**Note PV6/b:** The periodic leaflet "Cyanonews" is proposed to be an official publishing information bulletin of ICOPN, and should be send regularly to all members of IAC.

#### **Provision 7.**

The recommendations of ICOPN, accepted by plenary sessions of IAC will be transferred to the responsible editors of ICBN and ICNB for legalization, in 6 months after their acceptance. [Discussion!]

#### **Provision 8.**

New taxa are recommended to be published in journals, included in the Appendix 7. Lists and citations of new taxa published in the current years should be reviewed in the periodic leaflet "Cyanonews" and in the journals "Taxon" and "International Journal of Systematic Bacteriology".

## CHAPTER 2.

### COMMENTS to RULES and RECOMMENDATIONS

#### Section 3.

#### DEFINITIONS

##### Article 1.

Taxonomic groups of any rank (categories, units) with their real content are referred to as **taxa** (singular: taxon).

**Examples:** - "*Chroococcus turgidus*" is taxon of the category "species"; "*Chroococcus*" is taxon of the category "genus"; etc.

##### Article 2.

Main terms (exclusive taxa) of Cyano-Guide are used in the following sense:

basionym - the name or epitheton connected with the original diagnosis of a taxon; it is a part of protologue and determines the correct name;

binome - see "epitheton";

clone - a strain originating from one individual or from one parental pair;

correct name - a name, which must be accepted in accordance with both ICBN and ICNB;

definition - characteristics of a taxon based on the diagnosis, completed by the later recognized characters, defining the limiting and diacritical features;

description - completed and variously widened and concipated definition (comp. Note A24/e); description is continually corrected by current investigations;

deviation - morphological or physiological stage (population), recognizably differing from the typical specimens defined by the diagnosis, but belonging into the variation range of a taxon (genus, species); deviations are reversible and without any taxonomic value;

diagnosis - original description of a taxon containing important and defining (differential, diacritical) features, distinguishing a new taxon from other taxa within the nearest superior taxon (comp. Notes A27/a, A24/e); diagnosis can not be changed;

diagnostic (diacritical) features - characters defining a taxon;

differential features - characters distinguishing two related taxa;

ecomorpha - unstable modification caused by ecological adaptation;

efarrosa - see "ecomorpha";

effective (publication) - in printed matter made generally available to the scientific community, effected under ICBN and/or ICNB by making generally available (comp. Art. 47, 48 in Cyano-Guide);

epitheton - name of species or subspecific taxon, written always with small initial letter and used in connection with the name of superior taxon as specific binome or intraspecific trinome;

fluctuations - spontaneous unstable deviations developing irregularly in one population under the same ecological conditions;

homonyms - the same names or epithets applied to different nomenclatural types; they are: **primary** - arise by descriptions of different taxa, or **secondary** - arise after combinations;

iconotype - drawing or photo of the originally described (type) taxon (illustrating the diagnosis and showing the diacritical characters);

illegitimate - in contrary to ICBN or ICNB;

involution form - regularly occurring monstrous cell forms, developing obligatory under special (usually suboptimal) conditions; without any taxonomic value;

legitimate - in accordance with ICBN and/or ICNB;

modification - common term for any deviation, the registration of which is useful from any reason; without a taxonomic value; modifications occurring regularly in a limited geographic area are **local modifications**;

monotypical taxon - contains only one subordinate taxon of a nearest lower taxonomic rank (genus with one species, etc.);

monstrosity - anomalous deviation in the shape of cells, caused under environmental influence; it is unstable and without any taxonomic value;

morpha - transitional morphological deviation from the diagnosis, within the range of morphological variation; it is reversible, without any taxonomic value; ecologically caused morphes are ecomorphoses or ecomorphs;

name - each scientific name of any taxon; specific and subspecific names, used in adjective form and written in binomes or trinomes in connection with the name of superior taxon, are epithets;

population - set of specimens of the same taxonomic rank, developed in the same time in the continual, limited biotope;

rank - see "taxonomic category";

stage (developmental) - morphologically and/or developmentary defined part of a life cycle or of a cell cycle;

status - periodically repeated, morphologically characterized adaptation, regularly caused by environmental conditions, usually consequently with changed seasonal periods;

strain - cultured, monospecific population of the same genotype;

strain deviation - modification occurring in different isolated strains of the same taxon;

synonyms - different names or epithets applied to one nomenclatural type; nomenclatoric synonyms arise by the re-naming of a taxon from any reason, taxonomic synonyms arise by the joining of described taxa;

taxonomic category (rank) - common designation of any taxonomic level (variety, species, subfamily, family, etc.);

taxonomic type - any population (or from it derived higher taxon) fully corresponding to the (nomenclatural) type;

type (nomenclatural) - type specimen and its documentation (protologue), after which was established (described) the corresponding taxon by the prior author;

type strain - a strain, accepted as typical one, i.e., corresponding to the highest degree with the protologue of a species (or subspecific taxon) or serving as a material to its diagnosis;

valid (publication) - effectively published name of a taxon accompanied by a diagnosis, or with the reference to its description and certain other requirements.

**Note 2A/a:** Definitions of not included terms in Art. 2 are explained in later Articles or Recommendations of Cyano-Guide (comp. also Register).

## Section 4.

### RANKS of TAXA

#### **Article 3.**

Each cyanoprokaryotic or chloroprokaryotic organisms is treated as belonging to the obligatory hierarchy of taxonomic categories of consecutively subordinate ranks, among which the rank of species (lat. **species**) is the basic. The given hierarchy of ranks must not be altered.

#### **Article 4.**

The principal ranks of obligatory taxonomic categories in descending sequence are:

class (**classis**)

order (**ordo**)

family (**familia**)

genus (**genus**)

species (**species**)

Thus each species has to belong to all these categories.

**Note A4/a:** Content and limits of taxonomic categories can vary with individual opinions, but the given hierarchy must not be altered in any classification system.

#### **Recommendation 4A.**

The following contents of principal taxa are recommended:

**class** - the highest taxon, limited by special oxyphototroph metabolism (i.e., biochemically and genetically: special pigment composition, metabolites) without transitions in cytological, morphological and reproductional characteristics to other classes; represents a special, isolated evolutionary line;

**order** - represents a special evolutionary step within the class, it means that between the orders exists the probable direct phylogenetic consequence, but they differ in the type and organization of the morphological, cytological (structural) and reproductional characters;

**family** - the unit within the order, characterized by the special cell-and thallus morphology and by a special modification of the same reproduction process without transitions to other families;

**genus** - the genetically delimited cluster representing the unit within a family (group of strains and species), delimited by the same and genetically fixed morphological modification (one cluster identified by molecular sequencing), in spite of the similar reproduction type with other genera; genus is the basic classification unit in cyanobacteria, defined by genotype **and** phenotype criteria;

**species** - morphological type characterized by (at least) one feature within the genus (genotype), without transitions to other types; hiatuses between the specific features must be genetically fixed and independent on the outer influences; species is more conventional unit, based on stable morphological **and** ecological criteria, recognizable in nature and in culture;

**Examples:** - The classes Cyanoprokaryota and Chloroprokaryota differ in the composition of photosynthetic pigments and in the quality of metabolites.

- The order Pseudanabaenales has cells organized - connected - into "trichomes", in which the cytophysiological and structural connection exists, and represents the unique phylogenetic and phenotypic line.
- The cells in coccoid families Synechococcaceae and Merismopediaceae divide regularly in 1 or 2 perpendicular planes to one another in succeeding generations, or irregularly in Chroococcaceae; the family Chamaesiphonaceae is characterized by polarized cells, which divide asymmetrically in their upper parts; etc.
- From the family Merismopediaceae, the cells of two genera, *Aphanocapsa* and *Merismopedia* divide in two perpendicular planes in succeeding generations, however, they live irregularly spread in mucilaginous colonies in *Aphanocapsa* and in regular plate-like colonies in *Merismopedia*.
- The species *Anabaena flos-aquae* and *Anabaena lemmermannii* differ in the shape of cells (spherical/barrel-shaped) and in the position of akinetes (distant from heterocytes/at both sides at heterocytes), etc.

### **Article 5.**

Need of acceptance of additional obligatory taxonomic categories on genus – and subgeneric levels follows from the nature of cyanobacteria and state of the knowledge of their diversity. The following categories are defined:

**genus** – validly described monophyletic cyanoprokaryotic cluster confirmed by molecular methods (mainly 16S rRNA sequencing), and supported by phenotype uniformity of important characters;

**form-genus** – validly described cyanoprokaryotic genus, not confirmed by molecular methods;

**species** – validly described species confirmed by both molecular (genetic) and phenotype methods (characterized by both genetic and phenotypic uniformity);

**genospecies** – genetically distinct taxonomic unit on species level, phenotypically not recognizable;

**morphospecies** – validly described species, not confirmed by molecular methods, but characterized by stable morphological markers (cf. Recom. 5A);

**ecospecies** – validly described species not confirmed by molecular methods, but characterized by ecological separation (cf. Recom. 5A).

**Note A5/a:** Genus and form-genus are parallel and of the same rank value taxonomy; morpho- and eco-species are substituted to the category species, but have the same species rank (value).

**Note A5/b:** Both generic categories and all three specific categories are nomenclatorically of the same value, and all are treated by the same rules, valid for corresponding category (genus, species).

**Note A5/c:** All previously, validly published names (taxa) on the generic and specific level, which were not yet confirmed by genetical methods, should be considered for form-genera, or morphospecies and ecospecies respectively.

**Note A5/d:** Designations “form-genus”, “morphospecies” and “ecospecies” should be used in all studies in which the authors consider it as useful. Their use is highly resommendable in taxonomic studies.

- Examples:**
- The genera *Planktothrix* and *Tychonema* were described according to cytomorphological criteria (separated from the traditional genus *Phormidium*) and later were found forming unique clusters in 16S rRNA-sequenced phylogenetic trees. They should be designated as “genera”. The heterogeneous genus *Phormidium* is not yet confirmed by molecular methods, but characterized by morphological features; it should be designated as form-genus, till the revision based on genetic method will be realised.
  - The genus *Cyanobacterium* Rippka et Cohen Bazire 1983 was decribed according to biochemical criteria, but later confirmed by sequencing, and it is also clearly defined phenotypically and cytomorphologically. It should be designated as genus within cyanobacteria.
  - The planktic *Anabaena*- and *Aphanizomenon*-species were found closely related according to 16S rRNA sequencing, but they differ distinctly by morphological characters without transitions; they could be designated as form-genera.
  - The genera *Limnothrix* and *Halomicronema* differ genetically and ecologically, but they do not differ morphologically; they must be designated as different genera and ecology should be used as character for identification. The similar case represent the genera *Cyanothece* and *Euhalothece*, etc.

- The genus *Spirulina* forms clearly delimited cluster according to both phenotype and genetic markers (by 16s rRNA sequencing), and several units (subclusters – species) within this cluster were recognized.
- The species *Aphanothece stagnina* and *A. castagnei* are distinctly distinguishable (morphologically and ecologically) in nature, but not in culture (their colonies disintegrate); They were not evaluated yet by genetic methods, and they should be classified as morpho- and/or ecospecies.
- In planktic populations of the genus *Nodularia* from Baltic Sea several morphospecies are recognizable (*N. baltica*, *N. spumigena*, *N. litorea*), not distinguishable ecologically and genetically.
- From the group of *Phormidium autumnale* sensu lato several taxa were described, very similar morphologically, but distinguishing clearly ecologically (*P. autumnale*-typical, *P. vulgare*, *P. attenuatum*, *P. pseudopristleyi*, and others); they are typical ecospecies.
- In several, morphologically characterized species (*Nodularia spumigena*, *Anabaena circinalis*, etc.) were found genetic subclusters in populations from distant regions (without transitions) and slightly different ecologically; they could be designated as ecospecies.

### **Recommendation 5A.**

The following content of categories morphospecies and/or ecospecies is recommended. Group of populations (and/or strains) which (i) belong to one genotype (genus), (ii) is characterized by stabilized phenotype features (definable and recognizable, with distinct limits of variation), and (iii) has identical (similar) ecological demands. These characters should occur repeatedly (in time) in various localities with the similar ecological conditions.

### **Recommendation 5B.**

All generic categories (genus/form-genus) and all species categories (species/genospecies/morphospecies/ecospecies) should be treated nomenclatorically according to the same rules, prescribed by this Cyano-Guide for categories genus and species. Designation of these taxa can be by the common term „genus“ and „species“, or by special terms („form-genus“, „morphospecies“, etc.), if necessary.

### **Recommendation 5C.**

Main criteria for classification of genera: (i) 16S rRNA clustering should be a main genetic marker; resulting clusters should be characterized also by phenotype markers; (ii) other genetic criteria, proving the genetic differentiation can be used (DNA/DNA hybridization, distinct differences in G/C complex, etc.).

### **Recommendation 5D.**

In the case of two clusters clearly separated phenotypically (two subclusters of one genotype) is possible to use the categories „form-genera“.

### **Recommendation 5E.**

Old genera traditionally described in literature in past, not (yet) supported by molecular analyses should be designated as „form-genera“.

**Note A5/e:** Genetically clearly different clusters indistinguishable morphologically must be considered as genera.

### **Recommendation 5F.**

The classification of subgeneric diversity must be in respect to previous prescriptions more conventional. Therefore, in definition of taxa on the species-level should be accepted following criteria:

- morphological diversity (cytomorphological characters)
- ecological specificity
- and from this following geographic distribution.

## **Article 6.**

If a greater number of ranks of taxa higher as species is required, the supplementary (additionally) units can be applied by adding the prefix **sub-** to the taxonomic terms denoting the ranks: **subordo**, **subfamilia**, **subgenus**. The supplementary units may be added provided that confusion or error is not thereby introduced. If these categories are applied, they must be treated as other categories with respect to their prescribed position in their hierarchy.

**Note A6/a:** Additional categories are usually based only on a distinct stable phenotype characters.

- Examples:**
- The families within the order Chroococcales are grouped according to the polarity of cells and nanocyte formation into several groups (suborders): Microcystinae, Chamaesiphoninae and Xenococcinae.
  - Within the family Oscillatoriaceae exist two groups of genera, defined by one special feature each: Oscillatorioideae (long trichomes and motile hormogonia), Plectonematoideae (obligatory false branching); classified as subfamilies.
  - Within the wide genus *Anabaena* exist two groups of species, classified as subgenera: the subgenus *Eu-Anabaena* (growing in mats, cells without gas vesicles), and the subgenus *Dolichospermum* (trichomes solitary or in clusters, cells with gas vesicles).
  - Within the genus *Schizothrix* are two groups of genetically probably related species, which differ by the ability of precipitation of calcium carbonate in colonies (calcification); they could be classified as two subgenera (subg. *Eu-Schizothrix* and *Inactis*).

## **Recommendation 6A.**

It is recommended to write the names of additional taxonomic categories in parentheses behind the corresponding superior taxon.

- Example:**
- Two ecologically and morphologically different clusters are included in the genus *Chroococcus* (subg. *Eu-Chroococcus* and *Limnococcus*); their genetic separation is expected. The corresponding species should be designated as, e.g., *Chroococcus (Chroococcus) turgidus* and/or *Chroococcus (Limnococcus) dispersus*.

## **Recommendation 6B.**

If taxa of the ranks of family and genus are required to be divided according to one feature (or few features), the taxonomic value of which is problematical (stable morphological deviations), but enabling to distinguish the taxon in two or more distinctly recognizable groups from practical reasons, the informal (facultative) terms tribe (**tribus**, within family) or section (**sectio**, within genus) are permitted. Such categories are not regulated by the Rules of ICBN of ICNB. **[Discussion, are needed these categories for cyanobacteria?]**

- Examples:**
- GOMONT (1892) divided the family "Hormogoneae THURET", subfamily "Hormocysteeae BORNET et FLAHAULT" in two tribes, Vaginarieae and Lyngbyeae, which differ by the taxonomically worthless feature, number of trichomes in a sheath.
  - In the genus *Gloeocapsa* KÜTZING 1843 exist the sections *Hyalocapsa*, *Chrysocapsa*, *Rhodocapsa* and *Cyanocapsa*, based on the taxonomically worthless feature, colour of mucilaginous envelopes.
  - The form-genera *Aphanizomenon* and „*Dolichospermum*“ (= planktic *Anabaena*- species) were found closely related genetically (GUGGER et al. 2002a, 2002b, ITEMANN et al. 2002, RAJANIEMI et al. 2004), but differ clearly morphologically without transitions. If now genetic markers will be found between both groups, the classification as form-genera is more appropriate (the classification to sections is superfluous). **[Discussion!]**

## **Article 7.**

Within species could be taxonomically classified only the stable, genetically fixed and repeatedly recognizable deviations as subspecific additional taxa. If accepted, they must be classified as varieties (**varietas**) and/or forms (**forma**). **[Discussion!; not usable?]**

**Note A7/a:** The category subspecies, used as the only subspecific taxon in bacteria and sometimes as a subspecific category with special geographical limitation in higher plants, is in respect to the mentioned diversity in sense and to the lack of tradition in the classification of oxyphototroph Prokaryotes superfluous.

**Note A7/b:** Between the diacritical features of varieties and forms can the transitional types occur, but the stable existence of them must be provable by a statistical or any other method in more populations.

**Note A7/c:** The category **variety** could be used in the cases of differentiation in one remarkable or more features, usually combined with ecological or phytogeographical deviation. The category **form** could be applied for a stable, recognizable deviation without ecological specificity.

**Examples:**

- *Cylindrospermum muscicola* KÜTZING ex BORNET et FLAHAULT occurs in its typical variety (var. *muscicola*) in soils in the temperated zone; its var. *kashmiriensis* BHARADWAJA grows in shallow waters with water plants in tropical and subtropical zones.
- The both farms of *Microcystis aeruginosa* KÜTZING ex LEMMERMANN, typical f. *aeruginosa* and f. *flos-aquae* ELENKIN grow in the same biotopes and possess the same area of distribution (freshwater reservoirs all over the world with exception of polar regions).

### **Article 8.**

The unstable, not genetically fixed deviations (induced variation) within species must not be classified as taxa.

### **Recommendation 8A.**

The recommended terms for not-taxonomic deviations: modification (**modificatio**), state (**status**), ecomorph (**ecomorpha**), local modification, developmental stage, strain deviation, involution form, monstrosity (**monstrositas**); (comp. Chapter 2, Section 3, Art. 2).

**Examples:**

- In *Coelomoron pusillus* (VAN GOOR) KOMÁREK, two unnamed modifications occur, described from Europe and from Caribbean district (local modifications; KOMÁREK 1989); they are recognizably morphologically different.
- BRAND (1900), NOVÁČEK (1934), JAAG (1945), GOLUBIĆ (1967) and others described many status of aerophytic species of Cyanophytes (Cyanoprocyota), mainly from the genus *Gloeocapsa*, caused by ecological factors (status).
- KOMÁREK described (1972) several strains of *Phormidium autumnale*, which differ one from another in their morphological variation ranges; they cannot be classified as taxa.
- In the collection CCAP (Windermere) are kept (1988) three strain-deviations of *Synechococcus capitatus*, differing slightly morphologically and in their colouration (phycobilins-ratio).
- GEITLER (1960) describes filamentous (in *Synechococcus elongatus*) and irregular (in *Synechococcus aeruginosus* = *Cyanothece aeruginosa*) involution forms, which have not any taxonomic value.
- *Nodularia spumigena* was found in Baltic Sea in two main morphological forms, ± straight and irregularly spirally coiled. They are identical ecologically, no genetic differences were detected between them, and they probably transfer one to another. They can not be distinguished taxonomically.
- Morphologically and genetically uniform *Phormidium retzii* occurs in distant areas in localities with slightly different ecological parameters. Such populations are different ecomorphoses without taxonomic value (if no other features will be found).
- In populations of *Limnothrix redekei* were found many types differing in quantitative relations of photosynthetic pigments (chlorophyll *a*: phycocyanin : phycoerythrin ratio), which can be stabilised in cultures. Such modifications can not be taxonomically classified (KOHL & NICKLISCH 1981).

## Section 5.

### NAMING OF TAXA AND STRAINS

#### **Article 9.**

Each taxon of any rank must bear only one correct name. The correct name must be (i) **validly** published in any **effective** publication (according to prescriptions included in Section 9), and (ii) the earliest legitimate one in accordance with Rules of ICBN or ICNB, in respect to the corresponding starting points (Art. 28) and to the lists of nomina conservanda (Appendix 1 and 2).

**Note A9/a:** The name of a taxon is connected with the nomenclatural type (Section 6) and can not be changed by any alteration (change, misinterpretation) of characters.

**Note A9/b:** The legitimate names are not always correct, e.g., after transfer in another taxon, in the case of synonyms, etc.

**Note A9/c:** Names, which are in contraversion with any Article of both ICBN or ICNB, must be rejected. The names, which are in contraversion with any Recommendation, have not to be rejected.

#### **Recommendation 9A.**

To form new names (and epithets), authors are advised as follows:

- Avoid names that are difficult to pronounce;
- latinize the names in the correct form;
- avoid combining words from different languages ("hybrid names") ;
- adopt unpublished or invalid names only in cases of simplification of nomenclature and taxonomy; to avoid the names leading to the complications or which can be source of errors;
- give the etymology of a new name;
- use only the names that are correct in respect to both ICBN and ICNB for accepted taxa;
- to indicate by the name, if possible, the typical characters or affinities and analogies to other taxa; in specific names to choose a name giving indication of a property or of the source of the species;
- avoid the names expressing the common character of the superior taxon;
- avoid the names which are very much alike, especially those that differ only in one or few letters;
- avoid the use of the genitive and the adjectival forms of the same specific epithet within the same genus (*kuetzingii*, *kuetzingianus*);
- not to dedicate the genera or species to persons quite unconnected with botany and microbiology or at least with natural sciences;
- not to use the names identical with other terms used in biological sciences ("*Trichoma*", "*Arthrospora*", "*Endospora*", etc.);
- to use phantasy in the creation of names.

#### **Article 10.**

For the names of taxa from the taxonomic category **species** is prescribed binomial combination of the superior generic name and of the specific epithet. The names of taxa from the **supraspecific categories** are univocal, in a substantive form or having the form of plural adjectives used as substantives; when suprageneric, their rank is characterized by the special suffixes. The epithets of **subgeneric categories** are univocal in an adjective form and must be written in connection with superior generic or specific names (in the form of binomes or trinomes).

#### **Article 11.**

The names of **classes** should be derived from the character of outstanding importance of the taxon or from the combination of such characters, combined with the suffix **-prokaryota**. The principles

of priority and typification (Section 6) are not applied for this category, the convenient name is recommended by ICOPN.

**Note A11/a:** The names "Cyanophytes", "Cyanobacteria", "Prochlorophytes", "Blaualgen", "blue-green algae", "sinice", etc. can be used arbitrarily as not-taxonomic (national resp.) terms.

**Example:** - Class "Cyanoprokaryota".

### **Article 12.**

The names of **orders** and **families**, and (if necessary) of **suborders** and **subfamilies** are formed by the addition of the appropriate suffix to the stem of the name derived from the corresponding type genus (Art. 24). The suffixes are as follows:

Rank	Suffix	Example
Order	-ales	Chroococcales
Suborder	-ineae	Chroococcineae
Family	-aceae	Chroococcaceae
Subfamily	-oideae	Chroococcoideae
The examples are derived from the type genus <i>Chroococcus</i> NÄG. 1849		

**Note A12/a:** When a name of a taxon included in Art. 12 has been published in an another rank but with correct suffix, or with an improper termination, but the rank was clearly expressed, the name is acceptable and the rank and ending (suffix) must be automatically changed in accordance with this rule, without change of authority. However, when the rank is changed by a later author, his name is then cited according to the rules for combinations (Art. 43).

**Examples:** - The family Phormidiaceae ANAGN. et KOM. 1988 (type-genus = *Phormidium* KÜTZ. ex GOM. 1892) comprises 3 subfamilies: Phormidioideae (type-genus = *Phormidium* KÜTZ. ex GOM. 1892), Microcoleoideae HANSG. 1892 (sub "subf. Microcoleae"; type-genus = *Microcoleus* DESM. ex GOM. 1892), and Spirulinoideae GOM. 1892 (as subtribus; type genus = *Spirulina* TURP. ex GOM. 1892).  
- The Merismopediaceae ELENK. 1933 were described as a family with the correct suffix **-aceae**. If this taxon is combined into the rank of subfamily, it must be cited "Merismopedioideae (ELENK.) KOM. et ANAGN. 1986".

### **Article 13.**

The name of a **genus** is taken from any source and may even be composed in an arbitrary manner. It must be a noun (univerbal, in a substantial form).

**Examples:** - *Oscillatoria* (according to type of motility); *Cyanonephron* (combined from the higher taxonomic classification within "Cyanophytes", and the form of cells); *Rivularia* (according to ecology); *Schizothrix* (according to morphology of filaments); *Geitleria* (after the name of the famous specialist in Cyanophytes, Prof. L. GEITLER); *Microcystis* (after character - size of cells); *Spelaeopogon* (combined from ecology and form of thallus); etc.

### **Article 14.**

The names of the supplementary taxon **subgenus** are made in the same manner as those of genera or as epithets in a substantive form, but they must be joined to the generic names by a term (or its

abbreviation) denoting their taxonomic rank (subg.). The same subgeneric names can not be used in different genera even when they are based on different nomenclatural types.

**Examples:** - *Pseudanabaena* subg. *Ilyonema* ANAGN. et KOM. 1987: The name "*Ilyonema*" used within the genus *Pseudanabaena* in the rank of subgenus should not be used for the designation of any other taxon based on another type, even within another genus. It must be cited always only in connection with generic name (or in shortened citation with, at least, the abbreviation of its rank, i.e., "*Pseudanabaena* subg. *Ilyonema*" or "subg. *Ilyonema*", or in parentheses in connection with corresponding generic and specific name – see Rec. 6A.). Only in the case of a change of its rank (e.g., in the respective transfer of *Ilyonema* to the generic rank) this name can be retained, but written with the combining author(s).

### **Article 15.**

Valid publication of any subgeneric and supraspecific taxon, which does not include the nomenclatural type of the corresponding genus, automatically circumscribes a second taxon of the same rank, which possess as its nomenclatural type the type of the higher taxon (typical taxon). Such typical subgenus containing the type species of the correct name of the genus to which it is assigned, repeats the name with the prefix **Eu-**, but without citation of any author's name. The other subgeneric names within the same superior taxon must be validly described and cited with author's names. If the division of the genus into subgeneric units is abandoned, the name of the typical taxon with the prefix "Eu-" automatically becomes extinct. **[Discussion]**

**Note A15/a:** The "typical" subgeneric taxon with the prefix *Eu-* must not be taken into consideration for purposes of priority.

**Note A15/b:** The names of subgenera and sections must not be cited if not necessary.

**Note A15/c:** All subordinate taxa within any superior taxon, including the "typical" one, are taxonomically of the same value.

### **Recommendation 15A.**

When it is desired to indicate the name of a subgenus to which a particular species belongs in connection with the generic name and specific epithet, its epithet should be placed in parentheses between the two; when necessary, its rank is also indicated.

**Examples:** - The genus *Pseudanabaena* LAUTERB. 1915 contains now: subg. *Eu-Pseudanabaena* ("typical"), subg. *Ilyonema* ANAGN. et 1988, and subg. *Skujanema* ANAGN. et KOM. 1988. The typical subgenus *Eu-Pseudanabaena* (containing the type species of the genus *Pseudanabaena*, *P. catenata*) was created automatically by the description of the genera *Ilyonema* and *Skujanema* by ANAGNOSTIDIS & KOMÁREK (1988).

- The genus *Chamaesiphon* A.BRAUN 1864 (type species = *Ch. confervicola* A.BR.) is divided in two subgenera, *Eu-Chamaesiphon* (type species = *Ch. confervicola* A.BRAUN 1864) and *Godlewskia* (JANCZ.)GEITL. 1925 (type species = *Ch. aggregatus* (JANCZ.)GEITL. 1925).

- Citations: *Pseudanabaena* (subg. *Eu-Pseudanabaena*) *limnetica*; *Pseudanabaena* (subg. *Ilyonema*) *galeata*; *Pseudanabaena* (*Ilyonema*) *galeata*; *Gloeocapsa* (sect. *Rhodocapsa*) *sanguinea*.

### **Article 16.**

The names of non-taxonomic additional units **tribus** (within family) and **section** (within genus) are univocal and express mainly one striking (distinctive), but taxonomically not important character, and can be in substantival or adjectival (plural) form. They are written without citation of the author. Their designations do not compete with the names of taxa in relation to priority, homonymy and typification.

**Examples:** - GOMONT (1892) described in the family "Hormogoneae" (= Oscillatoriaceae) two tribes, *Vaginarieae* and *Lyngbyeae*.

- Within the genus *Oscillatoria* were described the sections *Aequales*, *Attenuatae*, *Heteroscillatoria*, *Margaritaceae*, *Principes*, etc., according to different significant morphological features, but without any taxonomic value.

### **Article 17.**

The epithet of a **species** may be taken from any source and may even be composed arbitrarily, but it can not repeat the superior generic name (to be a tautonym). No specific or subspecific epithets within the same genus may be the same if based on different types. The specific epithet is univocal, in an adjectival form, or as a substantive in an adjectival sense. The specific epithets, when adjectival in form and not used as a substantive, agree grammatically with the generic names.

**Examples:** - Specific names (binomials): *Nostoc commune*; *Anabaena flos-aquae*; *Chamaesiphon niger* - *Oscillatoria nigra* - *Phormidium nigrum*; *Scytonema drilosiphon*.  
- Specific names derived from personal and geographic names: *Lyngbya kuetzingii* - *Coelosphaerium kuetzingianum*; *Raphidiopsis mediterranea*; *Anabaena augstumalis*; *Chamaesiphon polonicus*; *Anabaena saaremaaensis*.

### **Article 18.**

Epithets of taxa below the rank of species (infraspecific taxa), i.e., **varieties** and **forms**, are univocal, and are formed as those of species. When adjectival in form and not used as substantives, they agree grammatically with the generic (and specific) names. The infraspecific epithets must be cited together with the corresponding specific name always with the introducing abbreviation of its rank (**var. nigra**, **f. nigra**) as a ternary combination. The same epithet may be used for infraspecific taxa within different species and those within one species may bear the same epithets as other species. Two infraspecific taxa within the same species, even if they are of different rank, can not bear the same infraspecific epithet unless their names are based on the same type; when they occur, the prior name must be selected as correct.

**Note A18/a:** Because the subspecific taxa are probably not usable, the subspecific taxonomic categories are used only in old cited names.

**Examples:** - *Oscillatoria bornetii* f. *tenuis* SKUJA, var. *intermedia* VORONICH., f. *intermedia* (VORONICH.) ELENK.; *Oscillatoria amphibia*: var. *tenuis* ANISIM., f. *tenuis* (ANISIM.) ELENK.; *Phormidium valderiae* f. *tenuis* (VORONICH.) ELENK.; *Phormidium subtruncatum* f. *constrictum* CLAUS [not "f. *constricta* CLAUS", see in STARMACH 1966]; *Aulosira planctonica* var. *cylindrica* APT.; *Anabaena variabilis* f. *tenuis* POPOVA; *Chamaesiphon amethystinus* f. *africanus* (SCHMIDLE) KOM. et ANAGN.; *Chamaesiphon incrustans* var. *cylindricus* (BOYE-PETERS.) KOM. et ANAGN.; *Chamaesiphon confervicola* var. *elongatus* (NORDST.) KANN.

### **Article 19.**

Valid publication of any subordinate subspecific taxon which does not include the nomenclatural type of the higher taxon automatically circumscribes a second (typical) taxon of the same rank, which has as its nomenclatural type the type of the higher taxon. In the name of this typical infraspecific taxon which includes the nomenclatural type of the epithet of the next higher taxon, the epithet of this higher taxon must be repeated unaltered without citation of an author's name. This epithet can no longer be used when that of the next higher taxon is changed; it must be changed in accordance with the new correct name. The infraspecific taxa based on another type as the next superior taxon must bear different name from it, with the citation of author's name.

**Note A19/a:** The typical infraspecific taxon is automatically used, when the first another subspecific taxon of the same rank is erected. It is not longer be used, when all other taxa of the same rank are abolished.

**Note A19/b:** The typical subspecific taxon (repeating the epithet of superior taxon) must not be taken into consideration for purposes of priority.

- Examples:**
- The later description of the var. *tenuis* BHARADW. 1935 within the species *Microchaete tenera* THUR. ex BORN. et FLAH. 1886 created automatically the var. *tenera* (written without author's names), containing all the specimens corresponding to the original diagnosis.
  - In the species *Anabaena solitaria* KLEB. 1895 were described three forms, f. *solitaria* (typical, written without author), f. *smithii* KOM. 1958, and f. *planctonica* (BRUNNTH.) KOM. 1958. If we consider the two latter forms as taxonomically incorrect, the typical form (f. *solitaria*) is also automatically abolished.

### **Article 20.**

When none of the published names are correct in the sense of ICBN or ICNB (synonyms, homonyms, rejected names, etc.), a new name must be selected. This new name, when first published, must be followed by the words "nomen novum" (**nom. nov.**).

**Note A20/a:** In the case of "nomen novum" is written only the authority (creator) for this new name, i.e., without citation of the original author's name (it is different from a new combination - see Art. 43).

- Examples:**
- "*Oscillatoria rosea* UTERM. 1925" is a later homonym of "*Oscillatoria rosea* CROUAN ex GOM. 1892"; because there does not exist any other valid epitheton for UTERMOHL's species, the new name (nomen novum) "*Oscillatoria utermoehliae* DE TONI 1939" was established; not "*Oscillatoria utermoehliae* (UTERM.) DE TONI!"
  - KANN (1972) recognized, that the species *Chamaesiphon fuscoviolaceus* STARM. 1969 is a later homonym of *Chamaesiphon fuscoviolaceus* (HANSG.) MARG. 1952. She published, therefore, a new epithet in the correct form, "*Chamaesiphon starmachii* KANN nomen novum".
  - GAY (1891) published "*Desmonema Wrangelii* (AG.) BORN. et FLAH. f.", without a name for this form. GEITLER (1932) designated this form incorrectly "var. *maior* (GAY) GEITL. nov.nom."; it must be cited "var. *maior* GEITL. 1932", i.e., without the name of GAY.

### **Article 21.**

**Unstable deviations** (modifications, status, morphae, ecoforms, anomalies, monstrosities, etc.) can be marked by a special univocal symbol (term, name), but without any taxonomic value (i.e., without the citation of author's name, subordination of the priority, etc.).

**Note A21/a:** If such designation (mainly status) is elevated to the level of a taxon, it must be automatically transferred from the informal category to a taxon subordinated to the Rules, and must be newly validly described.

### **Recommendation 21A.**

The designations of subspecific units of non taxonomic value should be written in quotation marks ("), not by italics or by any other graphical manner reserved for taxa, particularly if they are univocal.

- Examples:**
- NOVÁČEK (1934) described several status from *Gloeocapsa magma* and *Gloeocapsa sanguinea*, as "status familiaris coloratus", "status perdurans", "status solutus", "status familiaris simplex", "status familiaris lamellosus", etc.; i.e., by Latin terms (univocal or binomial), but without graphical designation as taxa (by "normal" letters) and without authors' names; see sec. GEITLER (1932, p. 1164).
  - GOLUBIĆ (1967, p. 39) presented several status from *Gloeocapsa sanguinea*; their designations ("st. familiaris", "st. simplex", "st. lamellosus", "st. coloratus") are cited without direct connection with older designations of NOVÁČEK (1934) and other authors; written by italics, but correctly without citations of authors and without strict acceptance the univocal epithets ("st. lamellosus coloratus"). The better form of presentation of status does not use italics (status "familiaris", status "lamellosus coloratus").

## **Article 22.**

Isolated (cultured) **strains** must be denoted by a special manner, independent of taxonomic names; this designation must not be changed in different collections and laboratories and must be abolished if the strain is abolished or lost. All authors must follow the original designation of strains without any change in any later publication.

**Note A22/a:** The strain designations must be retained unchanged also in cases of taxonomic and nomenclatoric re-evaluations of the strain or of the species, to which the strain belongs.

**Note A22/b:** The strain designation should be cited in lists of strains of all collections, even (parallelly) if the special own designation system is used also.

**Note A22/c:** The strains should be designated at least by the official acronym-abbreviation indicating collection (McGOWAN et SKERMAN ed., 1982, World Directory of Collections of Cultures of Microorganisms) and by the number of the collection from which it was obtained.

**Note A22/d:** The unified strain designation must be retained, particularly for type strains.

**Note A22/e:** The list of recommended strain collections for cyanobacteria (including "type-" and "reference-strains") is cited in Appendix 5.

## **Recommendation 22A.**

Previously isolated strains should be designated by their first original symbol. If exist different designations in different collections and laboratories, the citation of the source of strain and "synonymy" of designations are necessary.

## **Recommendation 22B.**

Newly isolated strains should be designated according to Note A22/c and added by the name of the isolator, year of isolation, and the number given by the isolator. This designation should be cited unchanged in all collections and later experimental works, to avoid errors and confusions.

## **Recommendation 22C.**

All strains of the same species, isolated from the same locality, should be distinguished by help of small alphabetical letters added to the symbol. All strains derived from the same isolate and changed in culture by any mutagenic process should be distinguished by Greek letters, added to the original designation.

## **Recommendation 22D.**

The strains should not be marked purely (i) by the Latin (scientific) name, (ii) by the pure arbitrary number which is used by authors for their own experimental use and differing from any designation in culture collections, and (iii) by the number peculiar to a given collection (which can be different in another collection).

**Examples :**

- Examples of strain designations
- Examples of different designations of one strain from different collections
- [Cyanothecae, not identifiable]
- Examples of published strains outside collections [Chinese strains, MTPP]

[Will be added]

## Section 6.

### TYPIFICATION, STARTING POINTS, PRIORITY

#### **Article 23.**

The valid publication (definition) of any new taxon must contain the level of the taxonomic category, proposed scientific name, the Latin diagnosis or description, defined diagnostical features in English (acc. to Appendix 8), wide description in English with all characteristic markers and the designation of the nomenclatoric type; in the case of species and of subspecific taxa moreover ecological data, designation of the original locality, the drawn iconotype **and** photographic documentation proving the diagnostical features.

**Note A23a:** The original Latin diagnosis contains only the diacritical features and is connected with the original name (binome); it must be respected unchanged by later authors. The description contains all possible information about the taxon and is changed, widened, added and corrected by any later found facts concerned. The diagnosis serves for the typification, the description mainly for the characterization of the taxon in identification keys, monographs and for ecological and experimental purposes.

**Note A23b:** The diagnostical features must comprise at least the indication and minimal information, which distinguish the new taxon from the others, particularly from the closely allied.

**Note A23c:** In the pagination of a new described taxon in later citations must be cited the page of new name followed by Latin diagnosis.

**Note A23d:** Several necessities of a new taxon, prescribed in Art. 25, e.g., iconotype, can be altered by the univocal citation from the previous literature.

**Note A23e:** The description of the phenotype must contain cytological and morphological features (derived from nature and/or from culture), and indication where the respective herbarium type-specimen and/or type strains are deposited (if such exist). Follow Art. 24-29 and Appendix 5.

#### **Article 24.**

The application of names with a particular circumscription, position and rank, of the rank of order or below, is determined by means of nomenclatural types. The nomenclatural type (**typus**) is that element of a taxon, to which the name of the taxon is permanently attached, whether as an accepted name or as a synonym.

#### **Article 25.**

For taxa above the genus up to order are nomenclatural types (standards) the selected taxa of the generic category (for orders, suborders, families and subfamilies it is the genus); for genus and respectiv subgeneric and supraspecific taxa is the nomenclatural type the species.

**Note A25a:** Typus must be designated by the author of any taxon. If not, in monotypically described taxa become to be a typus automatically the corresponding originally described subordinate taxon, in taxa with more described subordinate taxa must be followed the type selection of the first author, who done it.

**Note A25b:** If the taxon is restricted or divided, the original typus remains connected with the most typical part in the sense of the original diagnosis. The separated taxa must be newly typified. If more taxa are joined, the resulting taxon must bear the name valid according to this Guide and must be typified by the corresponding nomenclatural type, attached to this valid name.

**Note A25c:** The type species of a conserved generic name should not be changed without irrefutable evidence in support of such action.

**Note A25d:** The subordinate taxa (subgenus – genus – subfamily – family – etc.) must share the same type.

**Note A25e:** The nomenclatural status of a name included in the Approved list of generic names (supraspecific names, Art. 31; Appendix 1), is the same as that of new names. Taxa the names of which are included in the Approved list must be typified according to protologue (Art. 26) of the conserved name.

- Examples:**
- JAO (1944) described several genera and species from south China. In his paper that the "type specimens of new algae are kept in the Herbarium of the Institute of Zoology and Botany, Academia Sinica". They must be accepted for typification of new JAO's taxa.
  - The genus *Aphanothece* NÄG. 1849 was originally described with two species, but with designation of nomenclatural type, *A. microscopica* NÄG., which must be followed.
  - From the genus *Hormathonema* ERCEG. 1929 were described till now 6 species. However, this genus was originally described with only one species, *H. paulocellulare*, which bears automatically the nomenclatural type of the genus *Hormathonema*. If this species is transferred to the genus *Solentia* as *Solentia paulocellularis* (ERCEG.) LE-CAMP. et GOLUB., the genus *Hormathonema* is automatically synonymized with *Solentia* ERCEG. 1927 and a new valid generic name must be selected for the rest the species of *Hormathonema*.
  - The majority of filamentous cyanophyte genera were not typified by their original authors, including in the starting points (BORNET & FLAHAULT 1886, GOMONT 1892). GEITLER (1942, in Engler & Prantl, Nat. Pfl.-Fam., 2. ed., lb) typified many genera as the first author and must be therefore followed.
  - GOMONT defined in 1892 (starting point for oscillatoriacean cyanophytes) the genera *Arthrospira* STIZENB. ex GOM. and *Spirulina* TURP. ex GOM., both with several species, without type selection. GEITLER (1925) joined both genera and selected (1942) as the type species *Spirulina maior* KÜTZ. ex GOM. which placed into the original genus *Spirulina*. After both genera were, on the basis of re-evaluated features, again separated (ANAGNOSTIDIS & KOMÁREK 1988), the type *Spirulina maior* must be accepted for the genus *Spirulina* and for the genus *Arthrospira* a new nomenclatural type must be selected.
  - When the genus *Borzia* COHN ex GOM. 1892, typified by *B. trilocularis* COHN ex GOM. (GEITLER 1942) was divided in two genera, *Borzia* and *Hormoscilla* (ANAGNOSTIDIS & KOMÁREK 1988), the name *Borzia* must be accepted for this genus, to which *B. trilocularis* belongs.

## **Article 26.**

The species is typified according to **protologue**, which contains the all possible summarized material connected with the original definition of that species (diagnosis, original description, dried [exsiccate] or preserved type material [which has holotypic or lectotypic character], strain [designated as "type-strain"], iconotype [illustration derived from the type specimens], original microphoto, description of fine structure, sequencing data, etc.).

**Note A26a:** The protologue is here defined in a different sense as in ICBN, where it differs from the type material. The obligatory elements of protologue are defined in Art. 27.

**Note A26b:** The nomenclatural type (protologue) does not contain necessarily the whole variation range of a taxon: it is merely that complex of elements, to which the name is permanently associated.

**Note A26c:** The species without any preserved material (available from herbaria) or without any isolated type strain, are typified according to protologue without these components.

**Note A26d:** The nomenclatural status of a name included in the Approved list of specific names (Art. 31, Appendix 2), is the same as that of new names. Taxa, the names of which are included in the Approved list must be typified according to the protologue of the conserved name.

**Note A26e:** Definitions of the acceptable terms used in the characterization of protologue, prescribed for the future definitions of taxa:

**diagnosis** – original verbal description of diacritical and differential features of a new taxon, validly published in Latin by the first author;

**description** – author's original definition of a new taxon, completed particularly with the variation range of diagnostic features; the description can be added to or corrected by later authors;

**holotype** – one specimen or other element used by the author or designated by him as the type of a described taxon; it can be a herbarium specimen (exsiccate, slide, or preserved material); for so long as holotype is extant it automatically fixes the application of the named concerned;

**isotype** – duplicate of the holotype;

**lectotype** – later (subsequently) designated or selected nomenclatural type from the original material (or from syntype) when the holotype was not designated by the original author;

**neotype** – later chosen typical specimen, when the holotype was not designated and the selection of lectotype is not possible for some reasons; the neotype must be in clear coincidence with the protologue, e.i. with all materials involved in the original concept of the taxon concerned, but it is not a part of protologue (with exception of type strain, Art. 29);

**iconotype** – author's illustration of the new defined taxon and respective details of its essential characters important for definition (drawing and photo); iconotype must be derived from the type material, according to which the diagnosis was defined;

**merotype** – a part of a specimen (or only one developmental stage) or one status, used for typification; the identity of the merotype with the typical taxon must be, however, beyond doubt;

**syntype** – type selected from (composed of) two or more elements, belonging to the same taxon.

**Note A26f:** All information, published in one place (article), concerning the new taxon, should be automatically included into the protologue. However, several parts should be explicitly designated as type material (iconotype, type specimen, type strain, etc.). Such components (particularly exsiccates, dried specimens, strains) must be particularly mentioned if exists, with their deposition place.

**Note A26g:** The type may consist of more than one individual (e.g., from more drawings, different developmental stages, etc.), which ought to be derived conclusively together from one population, collected in the same time (syntype). If it is later proved that such a syntype contains more than one taxon, the name must remain attached to that part (lectotype), which corresponds most nearly with the original description (if it is possible to make such a selection), and/or with other parts of the protologue. If it is not possible so to do, the name must be considered as “nomen ambiguum” and rejected (Art. 59).

**Note A26h:** The change of a name does not justify a change of type. When a new name (nomen novum) is published (Section 5, Art. 20), the nomenclatural type of the old name is automatically that of the new one.

**Note A26i:** The explicit enumeration of all elements of protologue of a new species by authors is ruled by Art. 27.

### **Recommendation 26A.**

Comparison of the new taxon with the most closely allied taxa is strongly recommended.

### **Recommendation 26B.**

Whenever the type material (protologue) of a taxon is heterogeneous, the lectotype should be so selected as to preserve current usage unless another element agrees better with the original description and/or figure (in protologue). If the elements of a protologue do not coincide so as to define a single taxon, the hierarchy should be accepted: (i) exsiccate, preserved material or the type strain (if they exist), (ii) diagnosis, (iii) iconotype, (iv) holotype, (v) lectotype.

**Examples:**

- The protologue of *Chroococcus splendidus* JAO 1944 consists (i) of the specimens with more individuals deposited in the Herbarium of the Institute of Zoology and Botany, Academia Sinica, (ii) the diagnosis and notes of JAO 1944 (p. 75), and (iii) the original drawing (JAO 1944, Pl. 1: 10-11).
- The protologue of the genus *Coleodesmium* BORZI ex GEITL. 1960 (= the later valid name of the invalid *Desmonema* BERK. et THW. ex B. et FL. 1886) is based on the protologue of the type species of the genus *Desmonema*, i.e., *D. wrangelii*, and consists (i) of the diagnosis in BORNET et FLAHAULT (1887, p. 127), and (ii) on the exsiccate from the THURET's herbarium, which is cited by BORNET et FLAHAULT.
- The type species of the genus *Oscillatoria* VAUCH. ex GOM. 1892 is *O. princeps* VAUCH. ex GOM. This species must be selected also for the typification of the family Oscillatoriaceae and of the order Oscillatoriales.

### **Recommendation 26C.**

They are highly recommendable the preservation of a part of the lectotype material or of a part of a type strain (preferably as a dry or preserved specimen or permanent slide if possible, deposited in a permanent institution – herbarium), the large description of cytomorphological features, addition of photomicrographs and drawings, the information about the original ecology, and if the species was cultivated (designation of type strain).

### **Recommendation 26D.**

It is highly recommendable to isolate a type specimen (living pure clonal axenic or at least monospecific culture) from the original (holotype) material and to deposit it in permanently established reputable culture collections (Art. 29).

### **Recommendation 26E.**

The etymology of a new name or epitheton should be given when the meaning of this is not obvious.

### **Recommendation 26F.**

The Latin diagnoses should be elaborate using the publication: STEARN W.T. (1978), *Botanical Latin*, David et Charles, Newton Abbot, 566 pp., or any later edition of this book. [\[Discussion\]](#)

### **Recommendation 26G.**

The electron microscopical documentation of a new taxon and its physiological and genetic characteristics (obtained from type culture) are highly recommendable.

## **Article 27.**

Within the description (protologue) should be **obligatory** included the following characters and elements (compare CASTENHOLZ & WATERBURY, *Bergey's Manual of Systematic Bacteriology*, 1989):

- **Cell morphology:** cell shape, polarity; dimensions (diameter, length x width); character of sheaths or mucilaginous envelopes; cell inclusions (granules and their location, aerotopes and their location); shape of terminal cells; variability in cell morphology.
- **Colony or trichome morphology:** growth habit, colony or thallus shape (colonies: solitary – fascicles – clusters – mats – crusts – tufted – mucilaginous – spheres), polarity; trichome form and type (tapered, straight, helical); presence of a sheath, sheath description, number of trichomes in a sheath; type of branching (true, false, morphology); terminal hair formation; trichome structure (location and pattern of prominent cells, polarity, metamery, symmetry, subsymmetry); form and characters of hormogonia, type of hormogonia formation; constrictions at cross-walls.
- **Growth form:** planktic adaptations, thallus, diversified thallus, colonies.
- Presence, form (morphology, dimensions) and location of **prominent cells:** heterocytes, akinetes, necridic cells.
- **Cell division:** number and regularity of planes of fission, symmetry of division; binary and multiple fission, nanocyte and baeocyte formation; exocyte formation; akinete germination patterns.
- **Reproduction strategy:** presence form characters and liberation of reproduction cells and hormogonia; akinetes, dormant stages.
- **Ecology** (general description): marine – brackish – freshwater – terrestrial; oligotrophic – eutrophic – dystrophic – saline; flowing – stagnant waters; planktic – sessile – metaphytic – epiphytic – epilithic – endolithic – benthic, etc.; temperature dependences, light conditions;

depth; aerobic – anaerobic – atmophytic; associated organisms, symbiotic type of life; extreme biotopes.

- **Type:** character and respective localization (institution); “icona typica”.

Other characters are **highly recommendable**:

- **Cytology** (ultrastructure): visibility of chromatoplasm and thylakoid arrangement; cell wall structure and appearance; cell inclusions (form, type and localization, part. various types of granules, storage granules and gas vesicles); sheath structure; pore patterns in cell walls; structure of nucleoids (DAPI).
- **Genetic characters:** partial or complete sequence data for 16S rRNA; DNA base composition (mol% G+C), DNA/DNA or DNA/RNA hybridization data with other, variously related taxa; complete sequences for 16S rDNA.
- **Culture conditions:** type strain history (incl. original morphology and ecology); substrate used (specificities of medium, light intensity, temperature); colour of suspension, mats and clusters; growth characteristics; pH range and tolerance.
- **Physiology, ecophysiology:** color of cells and cell suspension, pigment analysis (incl. carotenoids), absorption spectrum, variation and types in pigment (phycobilins) content – capacity of chromatic adaptation; carotenoids, sheath pigments; temperature optimum and limits; trophic level (nutrition); capacity for dark chemoheterotrophy (aerobic vs. anaerobic) and photoheterotrophy; motility (type); salinity tolerance; vitamin requirements; morphological responses (presence of prominent cells) to deficiencies of phosphate and nitrogen supply; use of nitrates, ammonia and urea as nitrogen sources; nitrogen fixation (presence of *nif*-genes), growth and/or acetylene reduction in aerobic or anaerobic conditions; sensibility to soluble sulfide; calcium carbonate deposition (type) or boring activity.
- **Biochemistry:** oxygenic or anoxygenic photosynthetic capacity; isoenzymes; fatty acids composition; lipid profile; vitamin requirements.
- **Habitat:** distribution, type locality (obligatory in taxa described according to natural material), “locus classicus”.
- **Etymology** of the scientific name.

### **Article 28.**

If any taxon has been divided into subordinate taxa, one of them must be selected as the typical one, which bears the nomenclatural type of the superior taxon. Its nomenclature is ruled according to the corresponding nomenclatural type, its taxonomic value is, however, equal to other units of the same level.

**Note A28a:** Valid publication of any subordinate taxon, which does not include the nomenclatural type of the higher taxon, automatically circumscribes a second typical taxon of the same rank which has as its nomenclatural type the type of higher taxon and bears the same epithet (compare Section 5, Art. 15 and 19).

**Examples:** - When the genus *Pseudanabaena* LAUTERB. 1915 was divided into three subgenera by ANAGNOSTIDIS et KOMÁREK (1988), the nomenclatural type of this genus, *P. catenata*, must typify also the typical subgenus *Pseudanabaena*, and for the other subgenera other types must be selected.

### **Article 29.**

The **type strain** is not obligatory, but highly requested part of a protologue. It must be isolated from the original material, which is used to the original diagnosis and description, and from which are selected the respective other parts of protologue. When exists such original isolated (clonal, or at least monospecific) living strain of any species, the author should mark it in the original description as a type strain (holotype or lectotype), corresponding by their characters in all diagnostic features

to the protologue. The type strains (original) become automatically the part of the protologue. The type strain, if it lost appropriate characters, can be abolished, or changed after selection of more appropriate (lectotype or neotype) strain. This strain should be designated as **reference strain**. As reference strain can be designated each selected later strain, which corresponds both genetically and phenotypically to the protologue.

**Note A29a:** The type strains are designated and determined by authors (including the selection of corresponding culture collections). The abolishing and/or selection of reference strain must be accepted by ICNC [or ICSB, or ? – to discussion]. In each type strain must be cited the collection(s) or laboratory(ies), responsible for the keeping of the type strain.

**Note A29b:** The list of collections responsible for keeping the cyanoprokaryote type and reference strains is a part of this Guide (Chapter 3, Appendix 5) and can be corrected and added by the corresponding committee.

**Note A29c:** The abolishing of type strain, or installation of later reference strain must be proposed before the current plenary session of the corresponding committee. The acceptance of a new reference strain must be accepted by 90% of members of the committee. The list of (novelized) type and reference strains will be published by committee in three months after their acceptance. The list of type and reference strains is also a part of this Guide (Appendix 4).

**Note A29d:** The proposal of reference strain must contain the complete comparison and documentation (description, cytomorphological characters, strain history, iconography, all parameters available), proving the identity with the protologue.

**Note A29e:** The character of the species can be verified and accomplished by characters, found in the type strain (not reference strain), but not changed in respect to other components of a protologue.

**Note A29f:** The list of type and reference strains must contain the binome of a taxon, stable designation of the strain (according to Art. 22), the data concerning origin of the strain, mainly the name of isolator, date of isolation, ecological characters of the original material, the collection of its deposition, and references of the designations in other collections.

**Note A29g:** The type strain can be holotypic (when selected by the original author contemporary with the collection of type material and definition of the taxon); the reference strain is always lectotypic or neotypic.

**Note A29h:** If the type strain has become unsuitable due to changes in the characters (in phenotype or genotype), or for other reasons, it must be eliminated from the list of type/reference strains and can be replaced by another reference strain. The procedure of rejection or change is the same as in Notes A29a and A29c.

**Note A29i:** A reference strain must correspond fully to the protologue and to the type strain. They can be several in one taxon, if their taxonomic unity is proved. A reference strain has no standing in nomenclature, but can be used for comparative studies as representable material of the respective taxon (similarly as various populations of one and the same taxon).

**Note A29j:** The type and reference strains, deposited in the selected permanent collections, must be revised at the beginning of the author of the species (if possible), and later periodically (at least once per year), at least by two specialists, to control the genotype and phenotype identity with the protologue. The curators of collections are responsible. This procedure is highly recommendable before the each use of the strain before any experimental study. If the genotype identity is hesitated, the status of “type” or “reference” strain must be abolished.

### **Recommendation 29A.**

The accepted type strains should be clearly designated and deposited minimally in three from selected reputable strain collections or laboratories. It is recommended to try to keep also the type strain permanently preserved in a metabolically inactive state by lyofilization or immobilization. The strain collections should be selected from the list in Appendix 5.

### **Recommendation 29B.**

The presentation of the cytomorphological characters and the drawing or photographic documentation of any strain used to any experiments (in experimental papers) or of any population mentioned in ecological studies, is highly recommended, additionally to their taxonomic identification.

### **Article 30.**

The oldest (prior) from validly and effectively published synonymous names or epithets (connected with the same taxon) must be used (as legitimate) even if a later one is described better, more characteristic or better known. The **priority** of names (or epithets) from order below is valid from the date of monographs designated as **starting points**. New starting points can be selected from later monographs 50 or more years after their valid publication, provided that any such proposal is passed in the corresponding Nomenclatoric committee by at least a 90% majority.

Starting points for Cyanoprokaryota (cyanophytes/cyanobacteria):

- **Chroococcales:** GEITLER L. (1932), *Cyanophyceae*, Rabenhorst's *Kryptog.-Flora* 14, 1196 pp., Leipzig. [Not in accordance with ICBN.]
- **Oscillatoriales:** GOMONT M.M. (1892), *Monographie des Oscillariées (Nostocacées homocystées)*, *Ann. Sci. Nat. Bot.*, Ser. 7, 15: 263-368, 16: 91-264. [In accordance with ICBN.]
- **Nostocales, Stigonematales:** BORNET E. et FLAHAULT C. (1886), *Revision des Nostocacées heterocystées*, *Ann. Sci. Nat. Bot.*, Ser. 7, 3: 323-381, 4: 343-373, 5: 51-129, 7: 171-262. [In accordance with ICBN.]

**Note A30a:** The proclamation of the special starting point for Chloroprokaryota (prochlorophytes) is not necessary. The recent dates of descriptions of the genera *Prochloron*, *Prochlorococcum* and *Prochlorothrix*, definition of the division "Prochlorophyta" by LEWIN R.A. (1976), *Nature* (London) 261: 697-698, and the close relationships with cyanobacteria indicated by genetic analyses, eliminates any present need for a starting point of chloroprokaryotes.

**Note A30b:** The different parts of the selected starting points were issued in different years. For the purpose of priority the date of January 1st of the years, in which the first parts of these publications were issued, are accepted as valid for the each publication concerned.

**Note A30c:** The names published before the date of the corresponding starting points are automatically rejected. When validated, they must be newly typified in a new sense.

**Note A30d:** For any taxon described after the date of a starting point, the correct name is the earliest available legitimate, validly published in the same rank. The priority in the same taxonomic rank must be preferred before the absolute priority from another rank.

**Note A30e:** The date of a name or epithet is that of its valid publication. For purposes of priority, only legitimate names and epithets are taken into consideration.

**Note A30f:** The priority of taxa (mainly genera), described as other organisms (animals, bacteria, algae) is valid from the date of their original definition, not from the date of their transfer to Cyanoprokaryota or Chloroprokaryota.

**Note A30g:** The principle of priority does not apply to names of taxa above the rank of order.

### **Recommendation 30A.**

If the pre-starting point name or invalidly published name was found valid, it should be validated by a new publication in the original concept, by the addition of the world "validisatio" (**valid.**) to the validated name, and by the addition of the diagnosis, description and (in species) of iconotype (or of

its citation). This solution has priority before a new created name. The validity of this name is kept from the date of validation.

**Note R30A/a:** The pre-starting point name, which was used later in an another sense and newly typified, can not be validated, and for the corresponding taxon a new legitimate name must be selected.

**Examples:**

- NÄGELI (1849) described exactly several chroococcal genera (with their typification) and species. However, if GEITLER (1932) is accepted as the starting point for this group of Cyanoprokaryota, for all NÄGELI's taxa (as well as all other taxa of chroococcal genera and species) January 1<sup>st</sup> 1932 becomes the valid date of publication.
- GEITLER (1925) established the name *Chroococcus mipitanensis* (WOLOSZ.) GEITL. for one tropical species, but omitted it in 1932; therefore by all later authors it was also not accepted. If this species is accepted, it must be newly validated.
- *Synechocystis didemni* LEWIN 1975, described originally as a cyanophyte-species, was later recognized as a member of Prochlorophyta (= Chloroprokaryota). Its priority as the species is valid from the year 1975, in spite of the official definition of "Prochlorophyta" in 1976.
- The genus *Hassallia* BERK. ex BORN. et FLAH. 1886 was defined in starting point and this date is valid for it in spite it was not taxonomically accepted commonly for almost 100 years. On the other hand, the genus *Fischerella* (BORN. et FLAH.) GOM. 1895, used as a name for subgenus in the starting point, was validated by its GOMONT's (1895) transfer to the generic rank only.
- The pre-starting point name *Blennothrix* KÜTZ. 1843 was validated by ANAGNOSTIDIS et KOMÁREK (1988) in the original KÜTZING's sense, and typified by the KÜTZING's type species *B. vermicularis* (from 1843). However, for the purpose of priority must be accepted the date of ANAGNOSTIDIS et KOMÁREK's validisation (1988).
- The name *Arthronema* was applied before starting point by HASSALL (1845), probably for *Coleodesmium*, and never accepted later. The same name was selected in 1988 by KOMÁREK & LUKAVSKÝ for another genus, typified by another material. This selection is acceptable, because the pre-starting point names are treated as invalidly published, they have no force for nomenclatural purposes and, if newly used, effectively become names of new taxa.

### **Article 31.**

In order to avoid disadvantageous changes in the nomenclature of principal taxa (Art. 4) by the strict application of the rules, and especially of the principle of priority, in Chapter 3 are provided the "Approved lists" of conserved starting point and post-starting-point names ("nomina conservanda", **nom. cons.**) which must be retained if the corresponding taxa are accepted. These names are preferably such as have come into general use in the 50 years following their publication.

**Note A31a:** The conserved names have themselves the status of starting points for corresponding taxa.

**Note A31b:** The rejected names can not be used as valid (re-validated), also if their nomenclatoric types differ from conserved names.

### **Article 32.**

If two or more names (epithets) of one taxon are available, the absolute priority must be applied with respecting of Approved lists and Later starting points. The names of the same rank have priority before the names transferred from an another rank (Section 10, Art. 56-59). Any change of a name of which its original rank is changed, must be a new combination (Art. 43).  
of Botanical Nomenclature, Code of Bacteriological Nomenclature.

**Examples:** - If *Oscillatoria bornetii* f. *tenuis* SKUJA 1930 and *Oscillatoria bourrellyi* LUND 1955 are taxonomically united and included into a new genus *Tychonema* ANAGNOSTIDIS et KOMÁREK 1988, the correct name of the new established species must be *Tychonema bourrellyi*, because the epitheton *bourrellyi* was used in the rank of species, in spite of the absolute priority of the epitheton *tenuis* (used as a form).

- If *Gomphosphaeria aponina* var. *delicatula* VIRIEUX 1916 was transferred to the rank of species by KOMÁREK et HINDÁK (1988), the name *Gomphosphaeria delicatula* (VIRIEUX) comb. nova was not acceptable, because in the rank of species it was a later homonym to *Gomphosphaeria delicatula* SKUJA 1964 (in spite of the absolute priority of the VIRIEUX's taxon), and the new name (*Gomphosphaeria virieuxii*) had to be established.

## Section 7.

### ORTHOGRAPHY OF NAMES AND EPITHETS

#### Article 33.

Scientific names and epithets of taxa are treated as Latin regardless of their origin.

**Note A33/a:** The generic names are mainly derived from Greek, specific and subspecific epithets from Latin, but many exceptions exist (and are permitted). The grammar of all names must be used, however, in conformity with Art. 33.

**Note A33/b:** Greek or Latin words adopted as a generic name retain its gender. Generic names formed from two or more Greek or Latin words should take the gender of the last. The gender of name, derived from any other language must be transliterated to Latin and should conform the classical usage, in spite of their origin. Arbitrarily formed generic names or vernacular names or adjectives used as generic names, whose gender is not apparent, should take the gender assigned to them by their original authors.

**Note A33/c:** The gender of main endings used in phycology and bacteriology for generic names are as follows:

- (i) masculine: -us, -os, -bacter, -calyx, -coccus, -pogon, -siphon;
- (ii) feminine: -a, -achne, -carpa, -capsa, -chaete, -chlamys, -ella, -gloea, -is, -e, -mene, -morpha, -myxa, -ne, -opsis, -pedia, -phila, -placa, -pora, -ptyche, -seira, -sira, -sphaera, -spira, -stipes, -tetras, -thece, -thrix;
- (iii) neuter: -um, -bactron, -carpon, -ceras, -chilos, -chilus, -colon, -dendron, -derma, -dictyon, -menon, -moron, -nema, -nephron, -phanon, -phoron, -stylon.

**Examples:** - Masculine: *Chamaesiphon polymorphus*; *Chroococcus turgidus*; *Gloeobacter violaceus*; *Spelaeopogon lucifugus*. - Feminine: *Anabaena lapponica*; *Aphanothece microscopica*, *Chlorogloea purpurea*; *Chroococcopsis gigantea*; *Cyanotetras fusca*; *Eucapsis alpina*; *Gloeocapsa sanguinea*; *Gomphosphaeria salina*; *Haliarachne lenticularis*; *Homoeothrix janthina*; *Katagnymene accurata*; *Microchaete tenera*; *Microcystis aeruginosa*; *Sipho-nosphaera pannonica*. - Neuter: *Aphanizomenon gracile*, *Coelomoron vestitum*; *Coelosphaerium minutissimum*; *Cyanodictyon endophyticum*; *Cyanonephron styloides*; *Geitleribactron periphyticum*; *Geitlerinema splendidum*; *Myxobactron salinum*; *Phormidium ambiguum*; *Rhabdoderma lineare*.

- The genus *Nostoc* is neuter, because it was used thus in starting point (BORNET et FLAHAULT 1886).

#### Article 34.

The original spelling of a name or epithet (in valid publication) must be retained except that capital letters in epithets (comp. Art. 38) and typographic or orthographic errors should be corrected (according to Art. 33; comp. Art. 39).

**Note A34/a:** The names incorrectly applied in respect to ICBN and/or ICNB (incl. grammatical errors, incorrect transcriptions, changes by later authors) and evident mistakes (erroneous grammatical suffixes, incorrect latinization, orthographic or polygraphic errors) must be automatically corrected without affecting their validity and original date of publication.

**Note A34/b:** The latinized consonants **w**, **y** and **k** foreign or rare in classical Latin are permissible in names. In any name drawn from words in which diacritic signs or diaeresis appear, the signs must be suppressed with the necessary transcription of letters according to the following scheme:

Original letters	Transcribed letters	Examples
á, â	a	( <i>Microcystis</i> ) <i>novacekii</i> [after NOVÁČEK]
Ä	ae	( <i>Woronichinia</i> ) <i>naegeliana</i> [after NÄGELI]
ö, ø, ő	oe	( <i>Spirulina</i> ) <i>schroederi</i> [after SCHRÖDER]
Ü	ue	( <i>Coelosphaerium</i> ) <i>kuetzingianum</i> [after KÜTZING]
é, è, ë, ê	e (ae)	( <i>Microcystis</i> ) <i>comperei</i> [after COMPÈRE]
Ñ	n	
Å	aa or ao	( <i>Heteroleibleinia</i> ) <i>nordgaardii</i> [after NORDGÅRD]
Ů	u	( <i>Woronichinia</i> ) <i>ruzicka</i> [after RŮŽIČKA]
Ž, z	z (sh)	<i>Ercegovicia</i> [after ERCEGOVIĆ]
Č, č, c	c	
Š, š	s (sh)	
T	t	
Ř	r	
Ý	y	
‘A (spiritus asper)	excl.	<i>Ammatoidea</i> (not " <i>Hammatoidea</i> ")

**Note A34/c:** The incorrect terminations of epithets and suffixes (-i/-ii, -ae/-iae, -anus/-ianus) or incorrect endings in respect to generic names are treated as orthographic errors, which must be automatically corrected.

**Note A34/d:** The use of v/w, i/j, i/y, c/k, c/z, ae/oe/e must be accepted according to the original version.

**Note A34/e:** The existing names which were derived from personal or geographic names and used by authors in English or German (or other) transcription, should be accepted in the original form.

### Recommendation 34A.

In synonymies are preferred the citations in the original form and spelling, without corrections.

- Examples:**
- HORECKÁ et KOMÁREK (1979) described the species "*Aphanizomenon tropicalis*"; because the suffix *-menon* is neuter, the name must be written automatically correctly "*Aphanizomenon tropicale*".
  - DUTT et al. (1982) derived a new generic name "*Coleodesmiumopsis*" from the previous genus "*Coleodesmium*"; in such case (addition of the suffix *-opsis*) must be according to the Latin grammar the stem (substantivum) transferred into the genitive form and the resulting name must be "*Coleodesmiopsis*".
  - The correct transliteration of the name of the Russian algologist "Воронихин" is "VORONICHIN"; in spite of it, the generic name "*Woronichinia*" must be written with "W", according to the original description.
  - *Nostoc caeruleum* must be written with "ae" in the epitheton, because it corresponds to the original description in the BORNET et FLAHAULT's (1886) starting point.

### Article 35.

If the univocal supraspecific or intraspecific names or specific epithets are composed from two or more words, they must be written united and the gender of the last component must be taken. If the epithet is clearly composed from two separated words, the hyphen is permitted (also when not so joined when originally published).

**Note A35/a:** The formation of names and epithets, in which are combined two or more Greek or Latin words, must be written in accordance with classical usage.

### **Recommendation 35A.**

The combination of names, the origin of which is derived from different languages, is not recommended. If the arbitrarily formed generic names occur, the Latin gender corresponding to their endings should be used.

**Examples:** - Composed generic names: *Cyanodictyon*, *Gomphosphaeria*, *Planktothrix*; composed specific epithets: *Gloeotheca fusco-lutea*, *Microcystis flos-aquae*, *Nodularia sphaerocarpa*.

### **Article 36.**

Names of men and women and also countries and localities used as bases for specific epithets may be substantives in the genitive or adjectives. The substantives in the genitive must bear the correct suffix.

**Note A36/a:** The names derived from the names of persons should be formed in the following manner:

(i) For genus, subgenus and section:

- When the name of the person ends in vowel (except -a), the letter "a" is added (examples: *Borzia* [after BORZÌ]; *Wollea* [after WOLLE]);
- the names ending by -a, or derived from the names of women, are ended by the suffixes -ella or -ia (examples: *Skujaella* [after SKUJA]; *Snowella* [after SNOW]; *Tildenia* [after TILDEN]);
- when the name ends in consonant (except -er), the suffixes -ia, -ea, -ella or -iella are added (examples: *Woronichinia* [after VORONICHIN]; *Starría* [after STARR]; *Westiella* [after WEST]);
- when the name ends in -er, the letter "a" is added (examples: *Kerneria* [after KERNER]; *Staniera* [after STANIER]); however, if this name is latinized in the form with ending -ius [STANIERIUS], the form of the generic name with ending -ia is permissible: *Staniera*);
- names of the same person may be accompanied by different prefixes or suffixes, or to be modified by anagram, abbreviation or addition of another word; in such cases they are considered as different names (examples: *Westella/Westiella/Westiellopsis* [after WEST]; *Geitleria/Geitleriella/Geitleribactron/Geitlerinema* [after GEITLER] ; *Johannesbaptistia* [after JOHANNES BAPTISTE DE-TONI] ).

(ii) For specific or subspecific epithets:

- When the name of the person ends in vowel (except -a), the letter "i" is added (example: *meneghinii* [after MENEGHINI]; *hortobagyi* [after HORTOBÁGY]);
- when the name ends in -a, the letter "e" is added (example: *skujae* [after SKUJA], not "skujai");
- when the name ends in consonant (except -er), the letters "ii" are added (examples: *ehrenbergii* [after EHRENBERG]; *golubicii* [after GOLUBIĆ]);
- when the name ends in -er, the letter "i" is added (example: *keneri* [after KERNER]);
- when the epithet is derived from the name of a woman, the ending -ae is always used (examples: *kosinskajae* [after EKATERINA KONSTANTINOVNA KOSINSKAJA]; *kosteræ* [after JOSEPHINE TH. KOSTER]; *rayssæ* [after TSCHORNA RAYSS]);
- the epithets can have also an adjectival form (examples: *kuetzingianus*, *naegelianum*).

**Note A36/b:** The syllables not modified by the prescribed manner retain their original spelling (examples: *kossinskajae* [after KOSINSKAJA]; *schirschovii* [after ШИРШОВ = transliterated ŠIRŠOV]).

**Note A36/c:** If the personal name is already of Latin or Greek origin, the appropriate Latin genitive should be used (example: *Borzia perikleii* [after PERIKLES]).

**Note A36/d:** The genitive and adjectival forms of personal names are treated as different epithets (example: *naegeliinaegelianus*).

### **Article 37.**

An epithet derived from a geographic name is an adjective and should take the terminations -ensis, - (a)nus(-a,-um), -inus(-a,-um), -ianus(-a,-um), or -icus(-a,-um).

**Examples:** - (*Anabaenopsis*) *kulundinensis*, (*Romeria*) *leopoliensis*, (*Homoeothrix*) *Juliana*, (*Raphidiopsis*) *mediterranea*, (*Schmidleinema*) *cubanum*, (*Schizothrix*) *turicensis*, (*Eucapsis*) *alpina*, (*Chamaesiphon*)

- carpaticus*, (*Coccolopia*) *turkestanica*, (*Microcystis*) *holsatica*, (*Pulvinularia*) *suecica*, (*Plectonema*) *tauricum*, (*Scytonema*) *javanicum*.
- *Coleodesmium sagarmathae* is named after the geographic name ("Sagarmatha" is the Nepalese name of Mt. Everest), but in this case is the epithet derived from personificated designation of a mountain.

### **Article 38.**

All supraspecific (univerbal) names must be written by capital initial letters. All specific and subspecific epithets must be written with small initial letters even when derived from the names of persons and geographical names, or from former generic names.

**Note A38/a:** The capital initial letters for epithets used by former authors in diagnoses or papers must be automatically corrected.

**Note A38/b:** When the epithet has substantive form (given by original author), it must be accepted, but treated as other epithets and written by small initial letters.

**Examples:**

- *Cyanobacterium stanieri* (but *Stanieria*), *Microcystis novacekii*, *Tychonema bourrellyi*, *Plectonema schmidlei* (but *Schmidleinema indicum*), *Schizothrix bosniaca*.
- Epithets in substantive form: *Anabaena flos-aquae*, *Gloeotrichia pisum*.

### **Article 39.**

When two or more generic names derived from one or more personal names or from other sources differ only in transliteration into Latin, in their grammatical correctness, or if they are so similar that they are likely to be confused because they are applied to related taxa or for any other reason, they are to be treated as orthographic variants, which are homonyms when they are based on different types. The same applies to specific epithets within the same genus and to intraspecific epithets within the same species.

**Note A39/a:** From the configuration of letters must clearly follow the difference. Usually at least 2 letters should be different (but exceptions are permitted).

**Note A39/b:** For orthographic variants should be considered particularly:

- Presence or absence of single consonants ("h" before vowel, "c" before "t", etc.);
- different transcriptions of personal names, derived from the name(s) of one or different persons (with exception of differences in genitive and adjective forms);
- change of vowels and their combination;
- change of consonants, their combinations and doubling ("hof[f]man[n]ii"), without change of the sense of the name (epithet);
- use of slightly different suffixes.

**Examples:**

- Names treated as orthographic variants: *Anabaina/Anabaena*, *Stanieria/Staniera*, *Oscillaria/Oscillatoria*.
- Names not likely to be confused: *Scytonema/Scytonematopsis*, *Cyanotheca/Cyanothece* (here is different only one letter, but there is difference in the sense: theca = cup [from Greek], thece = envelope [from Greek]).
- Epithets treated as orthographic variants: *bernardinensis/bernardiensis*, *varians/varium*, *cohaerens/cohaereus*, *radiatum/radiosum*, *brunneum/bruneum*, *aquaticus/aquatilis*, *planktonica/planctonica/planctica*, *sinensis/chinensis*, *chalybaeum/chalybeum*, *caeruleum/coeruleum*.
- Epithets not likely to be confused: *microspora/microscopica*, *batrachospermi/batrachospermorum*, *utermoehlii/utermoehliana*, *thermalis/thermarum/thermophilum*.
- Orthographic error: The epitheton of "*Anabaena augstumalis*" is derived from the town Augstum and must be written in the original form; all other modifications are wrong, particularly sometimes used "*autumnalis*" which changes completely the sense.

## Section 8.

### CITATION OF AUTHORS AND ADDITIVE ABBREVIATIONS

#### **Article 40.**

For the indication of the name of a taxon to be accurate and complete, and in order that the original description and additional data may be readily verified, it is necessary to cite the name of the author(s) who first published the name concerned and (as recommendation) the year of publication; the prescribed connection words and abbreviations are used in the authors' citations, if necessary.

**Note A40/a:** The names of authors and/or the year of publication can be omitted in titles of articles, if the name is repeated in continual text, in lists and tables and diagrams of any kind, in texts in which the precise taxonomic identification is not necessary, and in popular articles.

**Note A40/b:** The taxa can not be anonymous. If the author is unknown, the name is invalid.

#### **Recommendation 40A.**

Authors names put after names of taxa should be abbreviated unless they are short. For this purpose, particles are suppressed unless they are inseparable part of the name and the first letters are given without any omission. If the name has two or more syllables, the first syllable (or two first syllables) is given and the first letter of the following one is added (or two when consonants). The abbreviation of the author's name can be applied only when confusion with other similar name (abbreviation) is impossible. Abbreviations (first letters) of given names should be applied, if the authors of the same familiar name occur.

**Note R40A/a:** Other abbreviations at authors' names are permissible, if they are necessary (f. = filius, s. = senior, etc.).

#### **Recommendation 40B.**

The list of abbreviations of names of common authors in Cyanophyte research is included in the App. 6. The names of several commonly used authorities are to be abbreviated as follows:

Linnaeus ..... L.  
De Candolle ..... DC.  
W.West et G.S.West ..... W. et W. (only in this connection)  
Bornet et Flahault ..... B. et FL. (only in this connection)

#### **Recommendation 40C.**

In full citations of names of taxa in taxonomic papers, synonymies and in monographs, the shortened but univocal citation of the place of publication between the the name of the author and the year of edition could be included (shortened title of book or journal, tome or volume with the number [if necessary], pagination).

**Examples:** - *Plectonema tenuissimum* GARDN. 1927, *Phormidium tenuissimum* VORONICH. 1930, *Oscillatoria salina* ALTEN 1913, *Oscillatoria salina* BISWAS 1927.  
- Authors' names abbreviations: LEMM. (Lemmermann), EHRENB. (Ehrenberg), NÄG. (Nägeli), J.G.AG. (J.G.Agardh), C.A.AG. (C.A.Agardh), HUB. -PEST. (Huber-Pestalozzi), WEB.-BOSSE (Weber van Bosse), H.SCHWABE (H.Schwabe), S.H.SCHWABE (S.H.Schwabe) .  
- Full citations: *Plectonema indicum* DIXIT Proc.Ind. Acad. Sci. 3(1): 99, 1936; *Oscillatoria perornata* SKUJA Nova Acta Reg. Soc.Sci.Upsal., ser.4, 14(5): 47, 1949; *Lyngbya lacustris* LEMM. Bot.Cbl. 76: 154, 1898; *Anabaena catenula* KÜTZ. ex B. et FL. Ann. Sci. Nat. -Bot. 7: 232, 1886 [start.point].

### **Article 41.**

When a name has been proposed but not validly published by one author (or validly published before starting point, but not later included in accepted starting point), and is subsequently validly published and ascribed to him by another author, the name of the former author followed by the connecting word **ex** must be inserted before the name of the later author.

**Examples:** - *Plectonema phormidioides* HANSG. 1887 was not accepted in GOMONT's (1892) starting point, but was later validated by FORTI (1907); it must be cited "*Plectonema phormidioides* HANSG. ex FORTI 1907".  
- *Oscillatoria princeps* VAUCH. 1803 was accepted by GOMONT (1892) in his monograph (starting point of oscillatorialean genera) and must be cited "*Oscillatoria princeps* VAUCH. ex GOM. 1892".

### **Article 42.**

An alteration of the diagnostic characters or of the circumscription of a taxon (whatever considerable) without the exclusion of the type does not warrant the citation of the name of an author other than the one who first published its name. When the different interpretation, alteration or misinterpretation (misidentification, incorrect determination) exclusive typo should be indicated (e.g., in synonymies), the word **sensu** must be used to connect the name of the misidentifying author to the previous correct author.

### **Recommendation 42A.**

Behind the citation of names can be used different other abbreviations (additive words) explaining the nature of the change of taxonomic content of the name, as "amplificavit" (**ampl.**), "auctorum" (**auct.**), "emendavit" (**emend.**), "exclusive" (**excl.**), "exclusive descriptio" (**excl.descr.**), "exclusive typo" (**excl. typo**), "**false**", "for instance" (**e.g.**, in synonymies with following citation), "inclusive" (**incl.**), "mutatis characteribus" (**mut. charact.**), "nomen ambiguum" (**nom. ambig.**), "nomen nudum" (**nom. nudum**), "pro parte" (**p.p.**) "pro synonymum" (**pro syn.**) "secundum" (**sec.**), "**sensu amplo**", "**sensu lato**", "sensu originali" (**sensu orig.**) etc. Such abbreviations are never a part of the name and of its author's citation.

**Note R42A/a:** The additive words indicate another concept of diagnostic features, another range of a taxon, errors in the description, etc. They do not concern changes leading to the change of a name with its author's citation (the nomenclatural type remains unchanged). The author, who made such changes, must be cited (if it is useful) only behind the full citation of a corresponding taxon, behind the corresponding abbreviation.

**Note R42A/b:** If the taxonomic determination in a later publication is not univocal, the additive abbreviations or marks at names of taxa are recommendable (**cf.**, **?**, **aff.**, etc.) in their citations.

**Note R42A/c:** The emendation (correction, changing of diagnostic features, amplification of features, connection of two or more taxa, separation of taxa, etc.) can be made either **inclusive typo** or **exclusive typo**. In the first case the addition of later (correcting) author by means of the word "emendavit" (emend.) is superfluous, in the latter case it is a misinterpretation and the rule of Art. 42 must be applied. The word "emendavit" can be applied only as an additive word in the sense of Rec. 42A, not as a part of author's citation.

### **Recommendation 42B.**

When two identical names based on different nomenclatural types exist, it is recommended to add to the full citation of the correct (accepted) name also the name of the author of the later (not accepted) concept (name) behind the word **non** (or **nec** respectively).

### **Recommendation 42C.**

If the name is accepted as nomen conservandum, the abbreviation **nom. cons.** should be added to the full citation. If for the conserved name was selected another nomenclatural type than in the original paper, the name of the author of conservation must be cited behind the original author's name by help of the connecting word **sensu**.

- Examples:**
- The genus *Microcystis* was described by KÜTZING 1833, the type of which is an *Euglena*-species. The traditional cyanophyte genus *Microcystis* was, however, conserved in the sense of LEMMERMANN 1907 and should be therefore cited "*Microcystis* KÜTZ. sensu LEMM. 1907 nom. cons."
  - The name of the benthic species *Arthrospira platensis* (NORDST.) GOM. 1892 (originally described as "*Arthrospira jenneri* f. *platensis* NORDST. nov.var." - sic!) was later used by RICH (1931) to the designation of the planktic species *Arthrospira fusiformis*; the RICH's name must be cited in synonymies of *Arthrospira fusiformis* as "*Arthrospira platensis* (NORDST.) GOM. sensu RICH 1931".
  - ELENKIN (1938) revised the genus *Microcystis* (eliminating *M. elabens*, including several *Aphanocapsa* species, etc.), but without change of the type species (i.e., inclusive typo). Several later authors cite the genus "*Microcystis* KÜTZ. emend. ELENK." (e.g., MEREŽKO 1969). The ELENKIN's correction does not differ from other taxonomic studies concerning this genus (TEILING 1941, HUBER-PESTALOZZI 1938, KONDRATEVA 1968), and the citation "KÜTZ. emend. ELENKIN" is incorrect; it could be cited merely "*Microcystis* KÜTZ. sensu LEMM. Kryptog.-fl. Mark Brandenb. 3: 45, 72, 1907, nom. cons.; emend. ELENKIN 1938 ... (joined *Aphanocapsa*)" etc.
  - The generic name *Dermocarpa* is invalid, because contains several species from the genera *Cyanocystis*, *Chamaecalyx* and *Xenococcus*, the type exsiccate contains several different species from the mentioned genera, and recently was used by different authors in different senses; when cited, must be designated "*Dermocarpa* CROUAN 1858, nom. ambig.", or "*Dermocarpa* CROUAN 1858 p.p., excl. typo", etc.

### **Article 43.**

When the name of a taxon from order below is altered in any another rank or transferred to any other superior taxon with or without change of its rank, its name must be retained, if this retention is not in contradiction to another article of ICBN or ICNB (priority, later homonyms, etc.) and only the respective suffix is automatically changed. The author of the alteration (new combination) must introduce the new combination by the abbreviation of the new rank, mark the name of taxon within the changed rank by the words "**gradus novus**" (in suprageneric taxa) or "**combinatio nova**" (comb. nova) (in genera and subgeneric taxa). In this case the author who first published this as a legitimate name or epithet must be later cited in parentheses (with a year of publication respectively), followed by the name of the author (and the year) of the alteration. The same holds when a taxon of lower rank than genus is transposed to another taxon, with or without alteration of its rank.

**Note A43/a:** If the name of the superior taxon (genus or species) is changed, all the included subordinate taxa (species or subspecific taxa) must be also recombined into this genus without change of their epithets.

**Note A43/b:** Bibliographic and graphical errors do not invalidate the publication of a new combination.

### **Recommendation 43A.**

If the name of a taxon higher than genus is altered in an another rank, its name should be retained, if this retention is not in contradiction to another Art. of ICBN or ICNB. The author of the alteration should mark the same name of taxon within the changed rank by the words "gradus novus", change the prescribed suffix according to the Art. 11 and Art. 12, and add the univocal citation of the original definition of this taxon (basionym, see Art. 49). The citation of such changed name is according to the Art. 43.

- Examples:**
- The species *Oscillatoria rubescens* DC. ex GOM. 1892 was transferred into the genus *Planktothrix* without change of its rank as "*Planktothrix rubescens* (DC. ex GOM.) comb. nova" and must be cited as "*Planktothrix rubescens* (DC. ex GOM.) ANAGN. et KOM. 1988".

- *Gomphosphaeria aponina* var. *multiplex* NYG. 1926 was transferred into the rank of species of the same genus and must be cited "*Gomphosphaeria multiplex* (NYG.) KOM. 1989".
- The family Merismopediaceae ELENK. 1933 was transferred into the rank of subfamily and must be cited as "subf. Merismopedioideae (ELENK.) KOM. et ANAGN. 1986".
- ELENKIN (1938) revised the genus *Microcystis* without change of its rank and without transfer into another superior taxon. The citations "*Microcystis* (KÜTZ.) ELENK." by several later authors (comp. HOLLERBACH et al. 1956, KONDRATEVA et al. 1984, etc.) are therefore incorrect.

#### **Article 44.**

If a taxon must be transferred (combined) from any reason into another superior taxon and its original name (basionym) is not acceptable, the author must select another correct, most appropriate and oldest valid synonymum, or, if does not exist, create a new name according to Art. 20, connected with the original type. Behind this name must be cited **only** the name of its author.

- Examples:** - For the species with the invalid name *Oscillatoria rosea* UTERM. 1925 was created a new name (nomen novum) *Oscillatoria utermoehlii* DE-TONI 1939 (comp. Art. 20). Because this change of epithet is not the combination, behind *O. utermoehlii* is written only the name of DE-TONI.
- The species *Oscillatoria priestleyi* W. et W. 1911 was combined from the genus *Oscillatoria* to the genus *Phormidium*. Because the epitheton "*priestleyi*" is within the genus *Phormidium* later homonym to *Phormidium priestleyi* FRITSCH 1910, the new name (nomen novum) "*Phormidium pseudopriestleyi* ANAGN. et KOM. 1988" was established (without citation of "W. et W." in parentheses).
  - *Myxosarcina thermalis* HIND. 1978 is a later homonym of *Myxosarcina thermalis* THOMAS et GONZALV. 1965. The name *Myxosarcina hindakii* BOURR. 1985 was established therefore HINDAK's species and this epithet is valid within the genus *Myxosarcina*. However, when the HINDAK's species is recombined into the genus *Cyanosarcina*, the prior epithet must be: *Cyanosarcina thermalis* (HINDÁK 1978) KOVÁČIK 1988, not *Cyanosarcina hindakii* (BOURRELLY 1985) comb. nova.

#### **Article 45.**

When two authors describe together the same taxon, the both are cited behind the name of the described taxon and connected by the word **et**. When three or more authors describe together one taxon, only the first one is cited with the addition of the words "et alii" (**et. al.**) . When the taxon is described by one author in the paper of another author(s), only the name of the describing author is cited, but in full citation with addition by the name of the second author(s) with help of the word **in**.

#### **Recommendation 45A.**

In full citations is recommended the citation of all describing authors (without abbreviation "et al.").

- Examples:** - *Lyngbya shackletonii* W. et W. 1911, *Lyngbya calcifera* BRÜHL et BISW. 1923, *Cyanosaccus* LUKAS et GOLUB. 1981, *Hyella kalligrammos* ANAGN. et PANTAZ. 1988. *Trichodesmium tenue* WILLE in HENSEN 1904, *Gloeobacter* RIPPKA et al. 1974.
- In the full citation of the genus *Gloeobacter* is recommended the mode "*Gloeobacter* RIPPKA, WATERB. et COHEN-BAZIRE Arch. Microbiol. 100: 435, 1974".

## Section 9.

### VALID PUBLICATIONS

#### **Article 46.**

The new names of any cyanoprocaryote or chloroprocaryote taxa are valid, if they are published in an effective publication. Publication is effective only by distribution of printed matter to the general public or at least to the scientific institutions and accessible to scientists generally. [Or in selected journals – to discussion!]

**Note A46/a:** The publication is not effective by communication at public meetings, in abstracts, in labels and catalogues of any living or preserved collections, manuscripts and typescripts even reproduced by some mechanical or graphic processes, in microfilms, microcards, or reproduced by similar method, in (annual) reports, newsletters, newspapers or not scientific periodicals, and in patents.

**Note A46/b:** The date of a name of any taxon is valid from the date of its valid publication. The names published effectively but invalidly before their validisation can be changed by their validisation; they should be designed before validisation by the words "provisional name" (abbrev. **provis.**). For the nomenclatural purposes (priority, typification, protologue, etc.) is in each case valid only the date of the effective **and** valid publication.

#### **Recommendation 46A.**

Authors are particularly urged to avoid publishing new names and descriptions in ephemeral publications, in popular periodicals, in any publication unlikely to reach the general public, in those produced by such methods that their permanence is unlikely, in abstracting journals and in local journals written in not world languages. The commonly known international journals should be preferred for the descriptions of new taxa.

#### **Recommendation 46B.**

Authors should avoid publishing invalid names, if they are not convinced about their correctness and later validation, or if the persons responsible for these names have not formally authorized their publication or do not use them themselves.

**Examples:** - KOMÁREK & ANAGNOSTIDIS (1985) have used in their list of coccal Cyanophytes the name "*Cyanosarcina* KOVÁČ. 1986 provis." However, this name was used firstly by KOVÁČIK in their PhD. Theses in 1984 (invalid presentation), and later validly described by KOVÁČIK only in 1988; this name must be therefore cited "*Cyanosarcina* KOVÁČ. 1988".

#### **Article 47.**

The date of effective publication is the date of the printed matter which is most connected with the description. When the date of reprints from periodical or a book differs from the date of the periodical or other work in which the separate was originally included, the date of the periodical or book is accepted as the date of effective publication (unless if there is evidence that it is erroneous).

**Note A47/a:** If two homonyms have the same date (year) of publication, the priority must be solved by the information, elucidating the prior actual publication.

**Note A47/b:** The date of acceptance of an article for publication (if given in a publication) does not indicate the effective date of publication and has no significance in the determination of the priority of publication of names.

**Note A47/c:** In the case of difference between the date of the title page of a periodical and the date of the real edition (written or not published), the date of the title page of a periodical must be used.

**Note A47/d:** The years having the character of annual reports and indicating the past year of annual reports, reviews or proceedings, can not be changed instead of the years of their real editions; the first ones have no significance for the determination of priority.

### **Recommendation 47A.**

Authors should indicate precisely the dates of publication of their works. In a work appearing in parts the precise dates of edition of all parts should be indicated.

**Note R47A/a:** The exception are the data of edition of different parts of starting points (see Art. 28), the edition of which is dated by the year of edition of their first part (for the purpose of priority).

**Note R47A/b:** If two names (homonyms) have the same date (year) of publication and their priority is not possible to indicate, the validity of one of them must be determined by the conservation.

**Examples:** - The species *Cylindrospermum eballiisporum* KOM. was published in the journal "Nova Hedwigia" in 1978, but in the title page is given the year 1975; the validity of this name is from 1975.  
- The priority of synonymous generic names *Agmenellum* BRÉB. 1839 and *Merismopedia* MEYEN 1839 is not solved. The commonly used name "*Merismopedia*" is therefore proposed as nomen conservandum.

### **Article 48.**

The valid and effective publication of a name (or epithet) of any taxon must contain the proposed name, the appropriate designation of the rank of a new taxon or its clear abbreviation ("ordo novus/nov.", "familia nova/fam. nov.", "genus novum/gen.n.", "species nova/spec.nova or sp. n.", etc.) and components according to Art. 27. Any from these components can be altered by a citation and reference (direct or indirect) to a previous and effective publication. In subgeneric (and subspecific) taxa must be joined the generic name (or specific binome), to which is described taxon allied.

**Note A48/a:** The Art. 48 is valid also for monotypic taxa, in which the diacritical features for both superior and lower taxa must be specified.

**Note A48/b:** All abbreviations and terms behind scientific names of taxa (usually printed in italics), which do not belong to the name, must be printed by another type of letters as the scientific name.

**Examples:** - "Family Pseudanabaenaceae fam. nova" (cited from ANAGNOSTIDIS & KOMÁREK 1938).  
- M. WATANABE described (1987) the monotypic genus *Umezakia*; in his paper are correctly separated the both generic and specific diagnoses with separation of generic and specific features.

### **Article 49.**

A new transfer or combination of any taxon of any rank is not validly published unless the shortened but univocal citation of the original definition of this taxon (basionym, i.e. the name-bringing or epithet-bringing synonym) is clearly indicated. A combination is not validly published unless the author definitely indicates that the epithet concerned is to be used in that particular combination.

**Note A49/a:** For the future must be cited univocally the basionym at the name of a new combination, or must follow univocally from the given consequences. Basionym must be cited with a full reference to its author and original publication, or by the direct reference to the original publication.

**Examples:** - ANAGNOSTIDIS et PANTAZIDOU (1988, p. 236) combined the a var. *maxima* GEITL. 1928 of *Hyella fontana* into the rank of species; they designated correctly the combination with the citation of basionym.

- HICKEL (1985) combined *Anabaena compacta* (NYG.) HICKEL from *Anabaena spiroides* var. *minima* f. *compacta* NYG. 1949 without designation of basionym, but with its clear citation; the combination is correct and validly published.
- BOURRELLY 1970 combined several species in text to the figures, without citation of basionyms, which, however, are mostly clearly determinable from the citations in text; in spite of these indirect citations the combinations are acceptable, particularly in the case of the citation of the name of basionym in parentheses and of the full citation in text [*Cyanostylon sinica* (LEY) BOUKR., and others].
- LI (1989) combined *Lyngbya saxicola* FILARSZ. 1900 = *Filarszkoa saxicola* (FILARSZ.) FORTI in DE-TONI 1907 into the genus *Borzia* as "*Borzia saxicola* (FORTI) comb. nov."; this designation is incorrect, must be "*Borzia saxicola* (FILARSZ.) LI", because FILARSZKI is the author of the basionym; this error must be automatically corrected, because the combination is valid (added by the clear and univocal citation of basionym).

### **Article 50.**

A new name (or epithet) is not validly published (i) when the hesitation of author is expressed (by an abbreviation "cf.", question mark, etc.), (ii) if the name is marked by any way as "provisional", (iii) when lacks any component prescribed in Art. 27 and Art. 49, (iv) when it is merely cited as a synonym, (v) unless the name of superior taxon is not known or validly described, (vi) if the rank of the taxon is not clearly indicated, (vii) when two or more names are proposed alternatively (simultaneously) for the same taxon without preference one of them ("nomen alternativum"), (viii) if the name is in contradiction with any other article of ICBN and/or ICNB. The later validisation of such names must be published in coincidence with Art. 27, 42 and 49. The date of publication of the validisation must be accepted in this case

- Examples:**
- KÜTZING used commonly the alternative names in synonymies (e.g., *Sphaerothrombium* KÜTZ. 1832" in synonyms of the genus *Micraloa* BIAS. 1832; see in KÜTZING 1833); such names are acc. to the Art. 50 invalid.
  - SKUJA (1948, p. 58) described "*Pseudanabaena pallida*", but the iconotype (Taf. 5: 3) is designated as "*Ps. hyalina*". This case is possible to explain as typographic error or "nomen nudum", and to accept the epithet "*pallida*" as valid name.

### **Article 51.**

The combinations are validly published, even if they are based on incorrectly determined material.

- Examples:**
- PROŠKINA-LAVRENKO (1962) established a new combination "*Aphanizomenon issatschenkoi* (USAČ.) comb.n.", but from her documentation follows that she made this on the basis of specimens of *Aphanizomenon elenkinii* KISEL. 1951; she put really this latter species into the synonymy of *Aphanizomenon issatschenkoi*. Even in the case that both mentioned species are taxonomically accepted, the combination "*Aphanizomenon issatschenkoi* (USAČ.) PROŠK.-LAVR. 1962" is valid.

### **Article 52.**

If the authors validate the unvalidly published name, the description must be completed by the same necessities (new or cited), as in the case of a new description (Art. 41, Art. 48).

**Note A52/a:** An epithet originally published as part of an illegitimate name may be made legitimate later in another combination.

### **Recommendation 52A.**

Authors should avoid adoption of a name or an epithet which has been previously but not validly published for a different taxon and used in different senses.

## Section 10.

### RETENTION, CHOICE AND REJECTION OF NAMES

#### **Article 53.**

Any alteration, completing and change in diagnostic characters, and any recognized new facts of a taxon do not warrant a change in its name, except as may be required (i) by transfer of the taxon (Art. 43), or (ii) by its union with another taxon of the same rank the name of which has priority (Art. 55, 56), or (iii) by a change of its rank (Art. 57).

**Examples:** - The genus *Aphanocapsa* NÄG. 1849 was established on the diagnostic features (density of spherical cells in colonies) which were later recognized as taxonomically worthless; the genus *Aphanocapsa* was therefore united with "*Microcystis* KÜTZ. 1833" (= *Microcystis* KÜTZ. sensu LEMM. 1907 nom.cons.) and the name "*Microcystis*" was accepted for this united genus (ELENKIN 1938). If the taxonomic important new differential features were recently recognized between the type species of the original genera *Aphanocapsa* and *Microcystis* (different types of cell division, presence of gas vesicles), both the names must be used for both revised genera, in spite they are based on different differential features, not known in the time of their first description.

#### **Article 54.**

When a taxon is divided into two or more taxa of the same rank, the original name must be retained for this resulting taxon, which contains the original nomenclatural type. For other taxa must be select other names according to the rules of icnb and/or ICBN.

**Note A54/a:** This Article must be respected also in the case that the common name is applied after such a division to the less common or less known taxon.

**Examples:** - The order Chroococcales comprised in the sense of GEITLER (1932) two families, Chroococcaceae and Entophysalidaceae. If this order was divided recently into 8 families on the basis of new criteria by KOMÁREK & ANAGNOSTIDIS (1985), the name Chroococcaceae must be retained for this family, which comprises the nomenclatoric type of Chroococcales and of the family Chroococcaceae, i.e. the genus *Chroococcus*, in spite that it is one from the "smallest" families within the order.

- If the genus *Gomphosphaeria* is divided into 4 genera (*Coelomoron*, *Snowella*, *Woronichinia*, *Gomphosphaeria*), the name *Gomphosphaeria* must be retained for the genus comprising the type species of *Gomphosphaeria* (*G. aponina*).

- If the species *Nodularia spumigena* is divided in several species (*N. baltica*, *N. litorea*, etc.), the epithet "*spumigena*" must be retained for the species corresponding to the protologue (nomenclatural type) of originally described *N. spumigena* MERT. ex B. et. FL. 1886.

#### **Article 55.**

When two or more taxa of the same rank are united, the rule of priority must be applied and the oldest (prior) legitimate synonym (name or epithet) is retained; when two or more taxa bearing different valid names or of different ranks are united, the names of the final rank have priority and this name (epithet) must be used, which has priority within the final rank (but respecting the corresponding starting points and lists of conserved names - see Art. 64).

**Note A55/a:** In any rank the oldest legitimate name has priority; the names (epithets) of the same rank have the priority before the oldest names (epithets) of another rank.

**Note A55/b:** If the synonymized names (epithets) of the same rank are of the same date without possibility to solve the priority, the author, who first united the taxa has the right to choose one of them and his choice must be followed.

**Note A55/c:** Authors who have to choose the prior name of the unified taxa, must not be influenced (i) by the better knowledge of any name, (ii) by the name which is more familiar in any country, (iii) by the better description of any from the united taxa, (iv) by the number of subordinate taxa, and (v) by the name which better characterizes the nature of the taxon.

**Examples:**

- If the taxa originally described as *Oscillatoria bornetii* f. *tenuis* SKUJA 1930 and *Oscillatoria bourrellyi* LUND 1955 are united into one species within the genus *Tychonema*, the resulting name must be "*Tychonema bourrellyi* (LUND) ANAGN. et KOM. 1988", because the name of the final rank (specific) has priority.
- If the taxa *Anabaena flos-aquae* f. *aptekariana* ELENK. 1938, *Anabaena spiroides* var. *tumida* NYG. 1945 and *Anabaena perturbata* HILL 1976 are united into one taxon on the specific level within the genus *Anabaena*, the prior specific epithet "*perturbata*" must be applied for the final combination, e.i., *Anabaena perturbata* HILL 1976.
- If the taxa *Microcystis minutissima* W.WEST 1912, *Aphanothece pulverulenta* BACHM. 1921 and *Aphanothece clathrata* var. *brevis* BACHM. 1923 are united into one species of the genus *Aphanothece*, the combination *Aphanothece minutissima* (W.WEST) KOM.-LEGN. et CRONB. 1989, is valid, because the epithet "*minutissima*" has the priority in the rank of species; (however, in the rank of variety the epithet "*brevis*" must be used).

### **Article 56.**

When a taxon is transferred (combined) into another superior taxon without change of its rank, its name or epithet must be retained, if does not exist within the new superior taxon any older homonym based on another nomenclatural type, or if does not exist any earlier synonym based on the same nomenclatural type.

**Note A56/a:** If two or more homonymous names (epithets) of the same rank occur in one superior taxon, only the oldest one has the priority and the other must be changed. If any from these taxa are transferred again in another superior taxon, again the oldest possible synonym (not homonymous in a new superior taxon) must be used.

**Examples:**

- *Oscillatoria priestleyi* W. et W. 1911 was transferred into the genus *Phormidium* by ANAGNOSTIDIS & KOMÁREK 1988; the epithet had to be changed in regard of *Phormidium priestleyi* FRITSCH 1910; the correct name is *Phormidium pseudopriestleyi* ANAGN. et KOM. 1988.
- The taxa *Pseudanabaena crassa* VOŽŽEN. 1953 and *Phormidium mucicola* f. *crassum* SKUJA 1948 were transferred into the genus *Komvophoron* as two separated species. The epitheton "*crassum*" must be retained for the species of VOŽŽENNIKOVA because the same rank of species has the priority, and for the species based on the SKUJA's form had to be created a new name (nomen novum), *Komvophoron epiphyticum* ANAGN. et KOM. 1988.

### **Article 57.**

When a taxon is transferred (combined) into another superior taxon with change of its rank, the oldest available synonymous name (epithet) of the new rank (within the new superior taxon) must be retained, if does not exist within the new superior taxon any older homonym based on another nomenclatural type.

**Note A57/a:** When, on transference to another superior taxon, the name (epithet) has been applied erroneously in its new position (based on the specimens which do not correspond to the nomenclatural type), the new new combined name must be retained for the taxon, to which the name (or epithet) was originally applied.

**Note A57/b:** If two or more names of the same date are united, the author makes the choice of the most appropriate one and must be followed.

**Note A57/c:** When a supplementary taxon is changed in a principal taxon or vice versa, the original name should be retained, unless it is in contrary to the rules of Cyano-Guide.

**Note A57/d:** When a taxon of a rank higher than a genus is combined, the stem of the name must be retained and only the termination (suffix) is altered, unless the resulting name is in contrary to Cyano-Guide.

**Examples:** - If the var. *suspensa* PRINGSH. 1965 of *Oscillatoria agardhii* was transferred as a special species in the genus *Planktothrix*, the new combination "*Planktothrix suspensa* (PRINGSH.) ANAGN. et KOM. 1988" should be used, because within the genus *Planktothrix* does not exist other species (or synonym) bearing the epithet "*suspensa*". However, if *Gomphosphaeria aponina* var. *delicatula* VIRIEUX 1916 was combined by KOMÁREK & HINDÁK (1988) into the specific rank within the genus *Gomphosphaeria*, it was the later homonym to *Gomphosphaeria delicatula* SKUJA 1964, and the name had to be changed to *Gomphosphaeria virieuxii* KOM. et HIND. 1988 (in spite of the absolute priority of VIRIEUX's name: the rank of species has priority; and also in spite of the present classification of *Gomphosphaeria delicatula* SKUJA into the genus *Woronichinia*).

### **Article 58.**

A legitimate name or epithet must not be rejected merely (i) because it is inappropriate or disagreeable, (ii) because another name is more characteristic or better known, (iii) because it has lost its original meaning, (iv) if it was published under incorrect superior taxon, (v) when the diagnostic features were not defined correctly or were changed, or (vi) because it has the difficult pronunciation.

### **Article 59.**

A name or epithet must be rejected (comp. Art. 50) :

- (i) if it is invalidly published;
- (ii) if there exist an earliest legitimate name (or epithet) available for this taxon;
- (iii) if it is used by later authors in a sense excluding its nomenclatural type, or in more different senses ("**nomen ambiguum**"), and so has become a long-persistent source of errors;
- (iv) if it is based on a type consisting of two or more discordant elements belonging evidently to different taxa ("**nomen confusum**") and the determination of the correct type is not univocal;
- (v) when it is based on a monstrosity or on an undetectable part of the cell- or life-cycle ("**nomen dubiosum**");
- (vi) if it is "**nomen nudum**" (i.e., published without at least diagnosis or description);
- (vii) if it was nomenclaturally superfluous when published, i.e. if it included the type of another taxon of the same rank, described sooner, which should have been used;
- (viii) if it is a later homonym or synonym within the same superior taxon, even if the earlier homonym is illegitimate or synonymous to another name or epithet (the mere orthographic variants are treated as homonyms), when they are based on different types;
- (ix) if the taxonomic rank is not clearly expressed (gen.nov., spec.nova, etc.);
- (x) if the protologue is incomplete and poor in such a degree, that the taxon is indeterminable, and the corresponding taxon was not recognized or revised during 100 years [discussion] after description;
- (xi) if it is merely word not intended as a name or epithet of a taxon;
- (xii) if it is identical (later homonym) with any other name of any organism;
- (xiii) when it coincides with any technical term currently used in morphology ("*Hormogonium*", "*Endospora*", etc.);
- (xiv) if it coincides with any terms used in ICBN or ICNB (such as "**novus**", "**specificus**") or expresses their taxonomic value or position (such as "**typicus**", "**originalis**", "**genuinus**", "**tertius**") and purports to indicate the taxon containing the nomenclatural type of the next higher taxon; [discussion; recommendation?]
- (xv) when it is marked merely by a letter ("*Chroococcus* A").

**Note A59/a:** A specific epithet is not illegitimate merely because it was originally published under an illegitimate generic name, but must be taken in consideration for purposes of priority if the epithet and the corresponding combination are in other respects in accordance with the rules. In the same way an infraspecific epithet may be legitimate even if originally published under an illegitimate name of a superior species.

**Note A59/b:** Orthographic variants are considered as homonyms, if they are based on different nomenclatoric types.

**Examples:** - The generic name "*Dactylococcopsis* HANSG. 1888" must be rejected, because the type species, *D. rupestris*, is a green alga, in spite of the use of this name for a long time for a cyanophyte genus. For several other species of this genus, which are really Cyanophytes, was selected later valid name *Rhabdogloea* SCHRÖD. 1917.

- GRUIA (1964) described the genus *Ialomitzia*, which is identical with an imperfect fungus (BOURRELLY 1970); this name must be rejected from the system of cyanobacteria.
- The genus *Dermocarpa* is based on the nomenclatural type *D. violacea* CROUAN 1858. However, the type-specimen contains several different species (comp. FELDMANN & FELDMANN 1953, GINSBURG-ARDRÉ 1966, BOURRELLY 1970, WATERBURY & STANIER 1978, KOMAREK & ANAGNOSTIDIS 1986), and the typification is impossible. Moreover, the name "*Dermocarpa*" was used in several different senses in the last years (namely for the present genera *Chamaecalyx*, *Cyanocystis*, *Stanieria* and *Xenococcus*). GEITLER (1967) proposed therefore the rejection of this generic name.
- The type material of *Microcystis marginata* (MENEHGH.) KÜTZ. (originally "*Anacystis marginata* MENEHGH.") contains a species of the genus *Aphanothece* (comp. DROUET & DAILY 1956); the epithet "*marginata*" must be rejected, because of its use for about 50 years in another (KÜTZING's) sense (as a species of *Microcystis*) and never was applied for any known species of *Aphanothece*.
- The species with the correct name *Stichosiphon sansibaricus* (HIERON.) DR. et DAILY 1952 was described by different authors as *Chamaesiphon sansibaricus* HIERON. 1895, *Chamaesiphon willei* GARDN. 1927, and *Stichosiphon regularis* GEITL. 1932. The latter two names must be rejected in respect of the validity of the genus *Stichosiphon* GEITL. 1932, and of the priority of the epithet "*sansibaricus*" in the rank of species.

### **Article 60.**

If the name or epithet is rejected, the oldest available correct taxonomic name (synonym) must be applied (of the same rank or by combination if the rank is changed). If one exists, a new name or epithet must be chosen.

**Note A60/a:** When a new epithet is required, an author may adopt an epithet previously given to the taxon in an illegitimate name; it is then treated as new.

## CHAPTER 3.

### CONSERVATIONS

#### Section 11.

##### HANDLING WITH APPROVED LISTS OF NAMES

#### Article 61.

In order to avoid many changes in nomenclature of taxa, which are revised, commonly used and known, the approved lists of conserved (and rejected) generic names and specific epithets were elaborated. These lists can be changed (added) by the procedure given by Cyano-Guide (Chapter 1, Section 2),

**Note A61/a:** The lists of conserved names remain permanently open for additions. Any proposal of a new conserved name must be accompanied by a detailed statement of the cases both for and against the conservation. Such proposal must be sent to the ICOPN at least 6 months before the running official plenary session. The propositions are summarized and commented by ICOPN and sent to all members of ICOPN for preliminary voting. In plenary session they are accepted or rejected by the majority of at least 90% of votes. When a name has been approved for conservation, the authors are authorized to retain it.

**Note A61/b:** In the approved list of conserved cyanoprokaryotes names should be included names concerning this group, proposed in the Approved List of Bacterial Names and in the List of Nomina Conservanda in the Botanical Code, whenever they are not in contradiction to another Article of this Cyano-Guide.

#### Article 62.

The conserved names and epithets have the priority before all possible synonyms and homonyms within the nearest superior taxon. If the taxon with conserved name is divided, the conserved name must be used for the part containing the nomenclatural type.

**Note A62/a:** The conserved name ("nomen conservandum") is a known and commonly used name, which is protected against the strict application of some rules of ICBN or ICNB, and which must be used instead of earlier synonyms and homonyms. Rejected names must not be used to designate any other taxon.

**Note A62/b:** When a name has been conserved against an earlier synonym, the latter is not to be restored. A conserved name is conserved against all other names of the taxon whether these are cited in the corresponding list of rejected names or not, so long, as the taxon concerned is not united with another one bearing a legitimate name.

**Note A62/c:** If the conserved name is unified with another conserved name (epithet), the rule of priority must be applied. If the conserved name is unified with a not conserved name (epithet), it must be retained, omitting the priority. However, if it becomes to be homonymous by any transfer, the rule of priority must be applied.

#### Article 63.

In the list of the nomina generica conservanda (Appendix 1) are inserted the generic names, derived from starting points and/or described before more than 50 years, clearly revised and accepted by several authors. All the conserved names must be accompanied by a reference to an effectively published diagnosis and the type. They are accepted from the nomenclatural point of view, without

respect to their taxonomic value. The synonyms and homonyms, which are accepted as invalid for the same nomenclatural type (*nomina rejicienda*) are included in Appendix 3. As invalid are automatically also all synonyms, which are not used from the time of corresponding starting points. The status of *nomina rejicienda* automatically become all later appeared synonyms and homonyms of conserved names.

**Examples:** - The genus *Microcystis* KÜTZ. 1833, commonly used for about 100 years as a name for a genus of planktic Cyanophytes, is based on the exsiccate containing flagellates (probably Euglenophytes). Therefore, this name was conserved for Cyanophytes in the sense of LEMMERMANN 1907, and must be accepted and cited as "*Microcystis* KÜTZ. sensu LEMM. 1907 nom. cons.". It is conserved particularly against the correct prior name "*Diplocystis* TREVIS. 1848".  
- The generic name *Microchaete* THUR. ex B. et Ft. 1886 is a later homonym to the vascular plant genus *Microchaete* BENTH. 1845 (Compositae). The generic name *Fremyella* was therefore given to this genus by DE-TONI 1936. However, the THURET's original name was conserved and must be accepted against *Fremyella*.

#### **Article 64.**

In the list of the *nomina specifica conservanda* (Appendix 2) are inserted the specific epithets of taxa commonly used for more than 30 years, the taxonomic position of which was repeatedly revised and recognized, and which are univocally classified and recognizable by authors all over the world. The listed specific names are conserved against all synonyms, even when not included among the *nomina rejicienda* (Appendix 2).

**Note A64/a:** If a species, which has been included in the approved list, is transferred (combined) to another genus, the advantage of its conservation is missing. If its conservation within a new genus is required, it must be proposed *de novo*.

**Examples:** - Into the list of conserved specific epithets can be included only such commonly known species, the determination of which is possible without difficulties and can not be changed (*Aphanizomenon flos-aquae*, *Microcystis wesenbergii*, *Nostoc pruniforme*, *Cylindrospermopsis raciborskii*, *Planktothrix rubescens*, etc.). The including into the list of *nomina specifica conservanda* can not, however, avoid the incorrect determinations.  
- The generic name "*Anacystis*" of the commonly used model strain "*Anacystis nidulans*" is not acceptable, because it belongs into the genus *Synechococcus*; however, the specific binom "*Synechococcus nidulans* KOM. in BOURR. 1970" can be conserved against other synonyms.

#### **Article 65.**

In the list of rejected names and epithets (Appendix 3) are included (i) all names which were originally described as cyanophytes and later recognized as other organisms, (ii) the names of taxa, described insufficiently before more than 100 years and not recognized till now. This list should be continually added and revised.

**Note A65/a:** The rejected names can not be validised or used in an another sense. The pre-starting point names can be validised in a new sense, if they are not synonymous or homonymous to any valid name.

**Examples:** - The generic names *Merizomyria* POLL. 1817, *Exococcus* NÄG. 1847, *Calialoa* TREVIS. 1848, *Dermogloea* ZANARD. 1872, and others, which occurred among the cyanophyte genera in the last century, never have been revised, and their taxonomic content is unidentifiable, must be rejected.  
- The generic name *Cyanotheca* PASCH. 1929 must be rejected, because the type species is a bacterium (CLAUS 1961). -The generic name *Tetrapedia* REINSCH 1867 must be rejected, because the type species is a green alga (GEITLER 1942, CLAUS 1963). - The generic name *Marssoniella* LEMM. 1900 must be rejected, because the type species are the spores of the microsporidian genus *Gurleya* (KOMÁREK & VAVRA 1968).

**Article 66.**

The list of type strains contains the accepted typical strains, corresponding to the protologues of corresponding species and representing this species as living neotype. The list should be continually added, and the type strains can be changed by the procedures given by Cyano-Guide (Chapter 1, Section 2).

# Appendix 1

## Approved List of Valid (Conserved) Generic Names

### Explanations:

○ = sequenced, not confirmed by combined polyphasic approach

● = sequenced, genetically proved genus, confirmed by combined phenotype and molecular methods

without designation = all genera (form-genera) validly described according to morphology (Botanical Code)

**T** = type species

x = taxonomically problematic genus

To discussion: - In all genera should be cited reference-strains of the type species, if they exist.

- In several genera validised in later starting points were selected different types (e.g., Geitler 1942 and Drouet & Daily 1956); priority should be accepted in this case?

- ACARYOCHLORIS Miyashita et Chihara in Miyashita et al., 2003, J. Phycol 39: 1249.

Chroococcales, Chroococcaceae

**T** = *Acaryochloris marina* Miyashita et Chihara, 2003, l.c.: 1249.

ADRIANEMA De Toni, 1936, Noter. Nomencl. Algal. 8: 2.

Stigonematales, Mastigocladaceae, Brachytrichioideae

**T** = *Lithonema adriaticum* Ercegović, 1929 = *Adrianema adriaticum* (Ercegović) De Toni, 1936, l.c.: 2.

ALBRIGHTIA Copeland, 1936, Ann. New York Acad. Sci. 36: 85.

Stigonematales, Loriellaceae

**T** = *Albrightia tortuosa* Copeland, 1936, l.c.: 86.

- x ALTERNANTIA Schiller, 1954, Oesterr. Acad. Wiss., Math.-Nat. Kl., Sitzungsber., Abt.1, Biol. 163: 134.

Chroococcales, Synechococcaceae, Synechococcoideae

**T** = *Alternantia ramifera* Schiller, 1954, l.c.: 136.

AMMATOIDEA West & West, 1897, J. Roy. Microsc. Soc. London 1897: 506.

Oscillatoriales, Ammatoideaceae

**T** = *Ammatoidea normanii* West et West, 1897, l.c.: 506.

- ANABAENA Bory ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 7: 224;

[*Anabaina* = orth. mut.].

Nostocales, Nostocaceae, Anabaenoideae

**T** = *Anabaena oscillarioides* Bory ex Bornet et Flahault, 1886, l.c.: 308 (Geitler 1942);

[*Anabaina pseudo-oscillatoria* Bory, 1822, Dict. Class. Hist. Nat. 1: 308] ex Bornet et Flahault, 1886, l.c.: 235 = *Anabaina oscillarioides* Bornet et Flahault, 1888, l.c.: 233 (Drouet 1978).

- ANABAENOPSIS (Wołoszyńska) Miller, 1923, Arch. Russk. Protistol. Obšč. 2: 125.

Nostocales, Nostocaceae, Anabaenoideae

**T** = *Anabaenopsis elenkinii* Miller, 1923, l.c.: 125.

- APHANIZOMENON Morren [1836] ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 7: 241.  
Nostocales, Nostocaceae, Anabaenoideae  
T = *Aphanizomenon flos-aquae* [Linné] Ralfs ex Bornet et Flahault, 1886, l.c.: 241 (Geitler 1942); [*Aphanizomenon incurvum* Morren, 1836, Bull. Ac. R. Sci. Bruxelles 3: 430] ex Bornet et Flahault, 1888, l.c.: 242 (Drouet 1973).
  - APHANOCAPSA Nägeli, 1849, Neue Denkschr. Allg. Schweiz. Ges. Gesamten Naturwiss. 10(7):52.  
Chroococcales, Merismopediaceae, Merismopedioideae  
T = *Aphanocapsa testacea* (A. Braun) Nägeli, 1849, l.c.: 52 (Geitler 1942); *Aphanocapsa parietina* (Nägeli) Nägeli, 1849, l.c.: 52 (Drouet et Daily 1956).
  - APHANOTHECE Nägeli, 1849, nom.cons., Neue Denkschr. Allg. Schweiz. Ges. Gesamten Naturwiss. 10(7): 59.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Aphanothece microscopica* Nägeli, 1849, l.c.: 59.
- ARTHRONEMA Komárek et Lukavský, 1988, Algolog. Stud. 50-53: 266.  
Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
T = *Pseudanabaena africana* Schwabe in Schwabe et Simonsen, 1961: 259 = *Arthronema africanum* (Schwabe et Simonsen) Komárek et Lukavský, 1988, l.c.: 266.
- ARTHROSPIRA Stizenberger ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 16: 246.  
Oscillatoriales, Phormidiaceae, Phormidioideae  
T = *Spirillum jenneri* Hassall, 1845: 277 = *Arthrospira jenneri* Stizenberger [1854: 33] ex Gomont, 1892, l.c.: 247.
- ASTEROCAPSA Chu, 1952, Ohio J. Sci. 52(2): 97.  
Chroococcales, Chroococcaceae  
T = *Asterocapsa gloeotheciformis* Chu, 1952, l.c.: 97.
- AULOSIRA Kirchner ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 7: 256.  
Nostocales, Nostocaceae, Nostocoideae  
T = *Aulosira laxa* Kirchner ex Bornet et Flahault, 1886, l.c.: 256.
- BACULARIA Borzì, 1905, Nuova Notarisia 16: 21.  
Chroococcales, Synechococcaceae, Synechococcoideae  
T = *Bacularia coerulea* Borzì, 1905, l.c.: 21.
- x BARADLAIA Palik, 1960, Ann. Univ. Sci. Budapest Sect. Biol. 3: 283-284.  
Stigonematales, Nostochopsaceae  
T = *Baradlaia speluncaecola* Palik, 1960, l.c.: 283-284.
- BLENNOTHRIX Kützing ex Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 429.  
Oscillatoriales, Oscillatoriaceae  
T = [*Blennothrix vermicularis* Kützing, 1843: 226] = *Blennothrix vermicularis* Kützing ex Anagnostidis et Komárek, 1988, l.c.: 430.
- BORZIA Cohn ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 16: 198.  
Oscillatoriales, Borziaceae  
T = *Borzia trilocularis* Cohn ex Gomont, 1892, l.c.: 198.

- BORZINEMA De Toni, 1936, Noter. Nomencl. Algol. 8: 2.  
 Stigonematales, Borzinemataceae  
 T = *Diplonema rupicola* Borzi, 1917 = *Borzinema rupicola* (Borzi) De Toni, 1936, l.c.: 2.
- BRACHYTRICHIA Zanardini ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 4: 371.  
 Stigonematales, Mastigocladaceae, Brachytrichioideae  
 T = [*Nostoc quoyi* Agardh, 1824 = *Brachytrichia rivularioides* Zanardini, 1872] = *Brachytrichia quoyi* [Agardh] Bornet et Flahault, 1886, l.c.: 373.
- BRACHYTRICHIOPSIS Jao, 1944, Sinensia 15: 78-79.  
 Stigonematales, Loriellaceae  
 T = *Brachytrichiopsis filiformis* Jao, 1944, l.c.: 79.
- CALOTHRIX Agardh ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 3: 345.  
 Nostocales, Rivulariaceae  
 T = [*Calothrix confervicola* Agardh 1824] ex Bornet et Flahault, 1886, l.c.: 349.
- CAMPTYLONEMOPSIS Desikachary, 1948, Proc. Indian Acad. Sci., Sect. B, 18: 46.  
 Nostocales, Microchaetaceae, Microchaetoideae  
 T = *Camptonema lahorensis* Ghose, 1920, New Phytol. 19: 35 = *Camptonemopsis lahorensis* (Ghose) Desikachary, 1948, l.c.: 43.
- CAPSOSIRA Kützing ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 5: 79.  
 Stigonematales, Capsosiraceae  
 T = *Capsosira brebissonii* Kützing ex Bornet et Flahault, 1886, l.c.: 79.
- CHAMAECALYX Komárek et Anagnostidis, 1986, Algolog. Stud. 38-39: 199.  
 Chroococcales, Chamaesiphonaceae  
 T = *Dermocarpa swirenkoi* Širšov, 1929 = *Chamaecalyx swirenkoi* (Širšov) Komárek et Anagnostidis, 1986, l.c.: 199.
- CHAMAESIPHON A. Braun et Grunow, 1865, nom. cons., In: Rabenhorst, Fl. Eur. Algar. 2: 148.  
 Chroococcales, Chamaesiphonaceae  
 T = *Chamaesiphon confervicola* A. Braun in Rabenhorst, 1865, l.c.: 148.
- CHLOROGLOEA Wille, 1900, Nytt Mag. Naturvidensk. 38: 5.  
 Chroococcales, Entophysalidaceae, Entophysalidoideae  
 T = [*Palmella* (?) *tuberculosa* Hansgirg, 1893: 240] = *Chlorogloea tuberculosa* (Hansgirg) Wille, 1900, l.c.: 5.
- CHLOROGLOEOPSIS Mitra et Pandey, 1967, Phytos 5: 112.  
 Stigonematales, Chlorogloeopsaceae  
 T = *Chlorogloea fritschii* Mitra, 1950, Ann. Bot. London, n.s., 14: 457 = *Chlorogloeopsis fritschii* (Mitra) Mitra et Pandey, 1967, l.c.: 112-113.
- CHONDROCYSTIS Lemmermann, 1899, Abh. Naturwiss. Ver. Bremen 16: 353.  
 Chroococcales, Microcystaceae  
 T = *Chondrocystis schauinslandii* Lemmermann, 1899, l.c.: 353.

- CHONDROGLOEA Schmidle, 1901, In: Engler, Bot. Jahrb. Syst. 30: 247.  
Stigonematales, Mastigocladaceae, Mastigocladoideae  
**T** = *Chondrogloea africana* Schmidle, 1901, l.c.: 247.
- CHROOCOCCIDIOPSIS Geitler, 1933, Arch. Hydrobiol., Suppl. 12: 625.  
Chroococcales, Xenococcaceae  
**T** = *Chroococcidiopsis thermalis* Geitler, 1933, l.c.: 625.
- CHROOCOCCIDIUM Geitler, 1933, Arch. Hydrobiol., Suppl. 12: 624.  
Chroococcales, Xenococcaceae  
**T** = *Chroococcidium gelatinosum* Geitler, 1933, l.c.: 624.
- CHROOCOCCOPSIS Geitler, 1925, Arch. Protistenk. 51: 342.  
Chroococcales, Xenococcaceae  
**T** = *Chroococcopsis gigantea* Geitler, 1925, l.c.: 342.
- CHROOCOCCUS Nägeli, 1849, Neue Denkschr. Allg. Schweiz. Ges. Gesamnten Naturwiss. 10(7): 45.  
Chroococcales, Chroococcaceae  
**T** = [*Protococcus turgidus* Kützing, 1846: 5] = *Chroococcus turgidus* (Kützing) Nägeli, 1849, l.c.: 46 (Geitler 1942); [*Protococcus rufescens* Kützing, 1846: 9] = *Chroococcus rufescens* (Kützing) Nägeli, 1849, l.c.: 45 (Drouet & Daily 1956).
- CLASTIDIUM Kirchner, 1880, Jahresh. Ver. Vaterl. Naturk. Württemb. 36: 195.  
Chroococcales, Chamaesiphonaceae  
**T** = *Clastidium setigerum* Kirchner, 1880, l.c.: 195.
- COCCOPEDIA Troickaja, 1922, Bot. Mater. Inst. Sporov. Rast. Glavn. Bot. Sada RSFSR 1: 131.  
Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Coccpedia limnetica* Troickaja, 1922, l.c.: 131.
- COELOMORON Buell, 1938, Bull. Torrey Bot. Club 65: 379.  
Chroococcales, Merismopediaceae, Gomphosphaerioideae  
**T** = *Coelomoron regularis* Buell, 1938, l.c.: 379.
- COELOSPHAERIOPSIS Lemmermann, 1900, Abh. Nat. Ver. Bremen 16: 352.  
Chroococcales, Merismopediaceae, Gomphosphaerioideae  
**T** = *Coelosphaeriopsis halophila* Lemmermann, 1900, l.c.: 353.
- COELOSPHAERIUM Nägeli, 1849, Neue Denkschr. Allg. Schweiz. Ges. Gesamnten Naturwiss. 10(7): 54.  
Chroococcales, Merismopediaceae, Gomphosphaerioideae  
**T** = *Coelosphaerium kuetzingianum* Nägeli, 1849, l.c.: 54.
- COLEODESMIOPSIS (false "COLEODESMIUMOPSIS") Dutt, Datta et Gupta, 1982, Cryptog. Algol. 3: 180-181.  
Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = *Coleodesmiopsis fremyi* Dutt, Datta et Gupta, 1982, l.c.: 181.

- COLEODESMIUM Borzì ex Geitler, 1942, In: Engler et Prantl, Nat. Pflanzenfam., 2. ed., 1b: 154.  
Nostocales, Microchaetaceae, Tolypotrichoideae  
T = [*Thorea wrangelii* Agardh, 1812: 40] = *Desmonema wrangelii* [(Agardh) Bornet et Flahault, 1885: 2] ex Bornet et Flahault, 1887, Ann. Sci. Nat. Bot., ser. 7, 5: 127 = *Coleodesmium wrangelii* ([Agardh] Bornet et Flahault) Borzì ex Geitler, 1942, l.c., 5: 127.
- COLTERONEMA Copeland, 1936, Ann. N. Y. Acad. Sci. 36: 79.  
Stigonematales, Loriellaceae  
T = *Colteronema funebre* Copeland, 1936, l.c.: 80.
- CRINALIUM Crow, 1927, Ann. Bot. (London) 41: 165.  
Oscillatoriales, Gomontiellaceae, Gomontielloideae  
T = *Crinalium endophyticum* Crow, 1927, l.c.: 165.
- CYANOARBOR Wang, 1989, Acta Phytotax. Sinica 27(2): 129-131.  
Chroococcales, Entophysalidaceae  
T = *Cyanoarbor rupestris* Wang, 1989, l.c.: 129-130.
- CYANOBACTERIUM Rippka et Cohen-Bazire, 1983, Ann. Microbiol. (Inst. Pasteur) 134B: 32.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Cyanobacterium stanieri* Rippka et Cohen-Bazire, 1983, l.c.: 32-33.
  - CYANOBIUM Rippka et Cohen-Bazire, 1983, Ann. Microbiol. (Inst. Pasteur) 134B: 31-32.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Cyanobium gracile* Rippka et Cohen-Bazire, 1983, l.c.: 32.
- CYANOBOTRYS L. Hoffmann, 1991, Algolog. Stud. 64: 349-350.  
Stigonematales, Stigonemataceae  
T = *Cyanobotrys lambinonii* L. Hoffmann, 1991, l.c.: 350.
- CYANOCATENA Hindák, 1975, Algolog. Stud. 13: 334.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Cyanocatena planctonica* Hindák, 1975, l.c.: 335.
- CYANOCOMPERIA Hindák, 2001, Nova Hedwigia, Beih. 123: 81.  
Chroococcales, Synechococcaceae, Synechococcoideae  
T = *Cyanocomperia africana* Hindák, 2001, l.c.: 82.
- CYANOCYSTIS Borzì, 1882, Nuovo Giorn. Bot. Ital. 14: 314.  
Chroococcales, Dermocarpellaceae  
T = *Cyanocystis versicolor* Borzì, 1882, l.c.: 314.
- CYANODERMA Weber van Bosse, 1887, Nat. Verh. Holl. Maatsch. Wetensch. Haarlem, ser. 3, 5: 18.  
Chroococcales, Hyellaceae, Hyelloideae  
T = [*Pleurococcus bradypii* Kuhn in Welcker, 1866: 66] = *Cyanoderma bradypii* (Kuhn in Welcker) Weber van Bosse, 1887, l.c.: 18.

- CYANODERMATIUM Geitler, 1933, Arch. Hydrobiol., Suppl. 12: 627.  
Chroococcales, Hydrococcaceae  
T = *Cyanodermatium gelatinosum* Geitler, 1933, l.c.: 627.
- CYANODICTYON Pascher, 1914, Ber. Deutsch. Bot. Ges. 32: 351.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Cyanodictyon endophyticum* Pascher, 1914, l.c.: 351.
- CYANOGRANIS Hindák, 1982, Algolog. Stud. 32: 244.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Cyanogranis basifixa* Hindák, 1982, l.c.: 250.
- CYANOKYBUS Schiller, 1956, In: Gessner et Vareschi, Ergebn. Deutsch. Limnol. Venezuela-Exped. 1952, p. 202.  
Chroococcales, Chroococcaceae  
T = *Cyanokybus venezuelae* Schiller, 1956, l.c.: 202-203.
- CYANONEPHRON Hickel, 1985, Algolog. Stud. 38-39: 100.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Cyanonephron styloides* Hickel, 1985, l.c.: 100.
- CYANOPHANON Geitler, 1955, Österr. Bot. Zeitschr. 102: 269.  
Chroococcales, Chamaesiphonaceae  
T = *Cyanophanon mirabile* Geitler, 1955, l.c.: 269-270.
- CYANOSACCUS Lukas et Golubić, 1981, J. Phycol. 17: 225.  
Chroococcales, Hyellaceae, Podocapsioideae  
T = *Cyanosaccus piriformis* Lukas et Golubić, 1981, l.c.: 225.
- CYANOSARCINA Kováčik, 1988, Algolog. Stud. 50-53: 175.  
Chroococcales, Chroococcaceae  
T = *Cyanosarcina fontana* Kováčik, 1988, l.c.: 177.
- CYANOSTYLON Geitler, 1928, Arch. Protistenk. 60: 441.  
Chroococcales, Chroococcaceae  
T = *Cyanostylon microcystoides* Geitler, 1928, l.c.: 442.
- CYANOTETRAS Hindák, 1988, Preslia 60: 291.  
Chroococcales, Merismopediaceae, Merismopedioideae  
T = *Cyanotetras fusca* Hindák, 1988, l.c.: 291.
- CYANOTHAMNOS Cronberg, 1991, Algolog. Stud. 64: 63-65.  
Chroococcales, Synechococcaceae, Synechococcoideae  
T = *Cyanothamnos plankticus* Cronberg, 1991, l.c.: 65, 67.
- CYANOTHECE Komárek, 1976, Arch. Protistenk. 118: 146.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Synechococcus aeruginosus* Nägeli, 1849, Gatt. einzell. Algen, p. 56 = *Cyanothece aeruginosa* (Nägeli) Komárek 1976, l.c.: 150.

- **CYLINDROSPERMOPSIS** Seenayya et Subba Raju, 1972, Tax. Biol. Blue-green Algae (Madras) p. 55.  
Nostocales, Nostocaceae, Anabaenoideae  
**T** = *Anabaena raciborskii* Wołoszyńska, 1913, Bull. Int. Acad. Sci. Cracov., mat.-nat., ser. B, 1912: 684 = *Cylindrospermopsis raciborskii* (Wołoszyńska) Seenaya et Subba Raju, 1972, l.c.: 55.
- **CYLINDROSPERMUM** Kützing ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 7: 249.  
Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Anabaena stagnalis* Kützing, 1843: 210] = *Cylindrospermum stagnale* [Kützing] ex Bornet et Flahault, 1886, l.c.: 250 (Geitler 1942); *Cylindrospermum majus* [Kützing 1843] ex Bornet et Flahault, 1886, l.c.: 252 (Drouet 1978).
- DALMATELLA Ercegović, 1929, Acta Bot. Inst. Bot. Univ. Zagreb. 4: 39.  
Chroococcales, Hyellaceae, Solentioideae  
**T** = *Dalmetella buaensis* Ercegović, 1929, l.c.: 39.
- **DERMOCARPELLA** Lemmermann, 1907, Bot. Jahrb. Syst. 38: 349.  
Chroococcales, Dermocarpellaceae  
**T** = *Chamaesiphon hemisphaericus* Lemmermann, 1900: 353 = *Dermocarpella hemisphaerica* (Lemmermann) Lemmermann, 1907, l.c.: 349.
- DESMOSIPHON Borzì, 1907, Atti Congr. Nat. Ital. Milano 1906: 372.  
Stigonematales, Capsosiraceae  
**T** = *Desmosiphon maculans* Borzì, 1907, l.c.: 372.
- DICHOTHRIX Zanardini ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot. ser. 7, 3: 373.  
Nostocales, Rivulariaceae  
**T** = *Dichothrix penicillata* Zanardini [1858] ex Bornet et Flahault, 1886, l.c.: 373.
- DOLIOATELLA Geitler, 1933, Arch. Hydrobiol., Suppl. 12: 630.  
Stigonematales, Fischerellaceae  
**T** = *Doliocatella formosa* Geitler, 1933, l.c.: 630.
- DZENSIA Voronichin, 1929, Izv. Glavn. Bot. Sada SSSR 28: 158.  
Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Dzensia salina* Voronichin, 1929, l.c.: 155.
- ENTOPHYSALIS Kützing, 1843, Phycol. Gen., p. 177.  
Chroococcales, Entophysalidaceae, Entophysalidoideae  
**T** = *Entophysalis granulosa* Kützing, 1843, l.c.: 177.
- EPIGLOEOSPHAERA Komárková-Legnerová, 1991, Algolog. Stud. 62: 10-11.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Aphanothece glebulenta* Zalessky, 1926 = *Epigloeosphaera glebulenta* (Zalessky) Komárková-Legnerová, 1991, l.c.: 11.
- EPILOTHIA Ercegović, 1932, Rad Jugoslav. Akad. Znan. 244: 141.  
Chroococcales, Hydrococcaceae  
**T** = *Epilithia adriatica* Ercegović, 1932, l.c.: 141.

- ERCEGOVICIA De Toni, 1936, Noter Nomencl. Algol. 8: 3.  
 Chroococcales, Hyellaceae, Podocapsoideae  
**T** = *Brachynema litorale* Ercegović, 1931: 35 = *Ercegovicia litoralis* (Ercegović) De Toni, 1936, l.c.: 3.
- EUCAPSIS Clements et Shantz, 1909, Minn. Bot. Stud. 4: 134.  
 Chroococcales, Microcystaceae  
**T** = *Eucapsis alpina* Clements et Shantz, 1909, l.c.: 134.
- FISCHERELLA (Bornet et Flahault) Gomont, 1895, J. Bot. 9: 52.  
 Stigonematales, Fischerellaceae  
**T** = *Fischerella thermalis* Schwabe ex Gomont, 1895, l.c.: 52.
- FISCHERELLOPSIS Fritsch, 1932, J. Bot. 70: 129.  
 Stigonematales, Fischerellaceae  
**T** = *Fischerellopsis harrisii* Fritsch, 1932, l.c.: 129.
- FORTIEA De Toni, 1936, Noter Nomencl. Algol. 8: 3.  
 Nostocales, Microchaetaceae, Microchaetoideae  
**T** = *Leptobasis caucasica* Elenkin, 1945, Izv. Imp. Bot. Sada Petra Velik. 15(1): 5 = *Fortiea caucasica* (Elenkin) De Toni, 1936, l.c.: 3.
- GARDNERULA De Toni, 1936, Noter. Nomencl. Algol. 8: 5.  
 Nostocales, Rivulariaceae  
**T** = [*Microcoleus corymbosus* Harvey, 1858, pre-starting-point] = *Polythrix corymbosa* Grunow ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 3: 380 = *Gardnerula corymbosa* [Harvey] De Toni, 1936, l.c.: 5.
- GEITLERIA Friedmann, 1955, Bot. Notiser 108: 444.  
 Stigonematales, Loriellaceae  
**T** = *Geitleria calcarea* Friedmann, 1955, l.c.: 444-445.
- GEITLERIBACTRON Komárek, 1975, Plant Syst. Evol. 123: 276.  
 Chroococcales, Chamaesiphinaceae  
**T** = *Geitleribactron periphyticum* Komárek, 1975, l.c.: 278.
- GEITLERINEMA (Anagnostidis et Komárek) Anagnostidis, 1989, Plant. Syst. Evol. 164: 33 - 46.  
 Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = *Oscillatoria splendida* Greville ex Gomont, 1892 = *Geitlerinema splendidum* (Greville ex Gomont) Anagnostidis, 1989, l.c.: 43.
- x GLAUCOSPIRA Lagerheim, 1892, Ber. Deutsch. Bot. Ges. 10(1): 365.  
 Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = *Glaucospira agilissima* Lagerheim, 1892, l.c.: 365.
- GLOEOBACTER Rippka, Waterbury et Cohen-Bazire, 1974, Arch. Microbiol. 100: 435.  
 Chroococcales, Gloeobacteraceae  
**T** = *Gloeobacter violaceus* Rippka, Waterbury et Cohen-Bazire, 1974, l.c.: 435.

- GLOEOCAPSA Kützing, 1843, nom. cons. Phycol. Gen. p. 173.  
Chroococcales, Microcystaceae  
T = [*Palmella sanguinea* Agardh, 1824: 15] = *Gloeocapsa sanguinea* [Agardh] Kützing, 1843, l.c.: 175 (Geitler 1942); *Gloeocapsa atrata* Kützing, 1843, l.c.: 174 (Drouet in Doty 1950).
  
- GLOEOCAPSOPSIS Geitler, 1925, Beih. Bot. Centralbl. 2, 41: 229 (sine diagn.) ex Komárek, 1993, Bull. Natn. Sci. Mus., Tokyo, ser. B, 19(1): 23-24.  
Chroococcales, Chroococcaceae  
T = *Protococcus crepidinum* Thuret, 1854: 388 = *Gloeocapsopsis crepidinum* (Thuret) Geitler ex Komárek, 1993, l.c.: 24.
  
- GLOEOTHECE Nägeli, 1849, Neue Denkschr. Allg. Schweiz. Ges. Gesamten Naturwiss. 10(7): 57.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Gloeothece linearis* Nägeli, 1849, l.c.: 58.
  
- GLOEOTRICHIA J. Agardh ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 4: 365.  
Nostocales, Rivulariaceae  
T = [*Rivularia pisum* J. Agardh, 1824, Syst. Alg., p. 25] = *Gloeotrichia pisum* Thuret ex Bornet et Flahault, 1886, l.c.: 366.
  
- GOMONTIELLA Teodoresco, 1901, Verh. Zool.-Bot. Ges. Wien 51: 757.  
Oscillatoriales, Gomontiellaceae, Gomontielloideae  
T = *Gomontiella subtubulosa* Teodoresco, 1901, l.c.: 760.
  
- GOMPHOSPHAERIA Kützing, 1836, Algarum Aquae Dulcis German. 16: 151.  
Chroococcales, Merismooediaceae, Gomphosphaerioideae  
T = *Gomphosphaeria aponina* Kützing, 1836, l.c.: 151.
  
- HALOMICRONEMA Abed, Garcia-Pichel et Hernández-Mariné, 2002, Arch. Microbiology 177: 368.  
Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
T = *Halomicronema excentricum* Abed, Garcia-Pichel et Hernández-Mariné, 2002, l.c.: 368.
  
- HALOSPIRULINA Nübel, Garcia-Pichel et Muyzer, 2000, Int. J. Syst. Evol. Microbiology 50: 1275.  
Oscillatoriales, Pseudanabaenaceae, Spirulinoideae  
T = *Halospirulina tapeticola* Nübel, Garcia-Pichel et Muyzer, 2000, l.c.: 1275.
  
- HANDELIELLA Skuja in Handel-Mazzetti, 1937, Symb. Sinicae 1: 30.  
Stigonematales, Borzinemataceae  
T = *Handeliella stockmayeri* Skuja, 1937, l.c.: 30.
  
- HAPALOSIPHON Nägeli ex Bornet et Flahault, 1887, Ann. Sci. Nat. Bot., ser. 7, 5: 54.  
Stigonematales, Mastigocladaceae, Mastigocladoideae  
T = [*Hapalosiphon pumilus* Kirchner ex Bornet et Flahault, 1887, l.c.: 61] = *Hapalosiphon fontinalis* [Agardh] Bornet, 1889, Bull. Soc. Bot. France 36: 156.

- HASSALLIA Berkeley ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 5: 115.  
 Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = [*Scytonema byssoideum* Agardh, 1812, Disp. Alg. Suec., p. 39] = *Hassallia byssoidea*  
 Hassall ex Bornet et Flahault, 1886, l.c.: 116.
- HERPYZONEMA Weber van Bosse, 1913, Siboga Exped., p. 36.  
 Stigonematales, Mastigocladaceae, Brachytrichioideae  
**T** = *Herpyzonema intermedium* Weber van Bosse, 1913, l.c.: 36.
- x HETEROCYANOCOCCUS Kufferath, 1929, Ann. Cryptog. Exot. 2: 51.  
 Stigonematales, Chlorogloeopsaceae  
**T** = *Heterocyanococcus haumanii* Kufferath, 1929, l.c.: 51.
- HETEROLEIBLEINIA (Geitler) L. Hoffmann, 1985, Cryptog. Algol. 6, 2: 76.  
 Oscillatoriales, Pseudanabaenaceae, Heteroleibleinioideae  
**T** = [*Hygrocrocis rigidula* Kützing, 1843: 152] = *Lyngbya rigidula* Kützing ex Hansgirg,  
 1892: 84 = *Heteroleibleinia rigidula* (Kützing ex Hansgirg) L. Hoffmann, 1985, l.c.: 76.
- HOMOEOPYCHE Skuja, 1944, Acta Horti Bot. Univ. Riga 14: 53-54.  
 Stigonematales, Stigonemataceae  
**T** = *Homoeopyche repens* Skuja, 1944, l.c.: 54.
- HOMOEOTHRIX (Thuret ex Bornet et Flahault) Kirchner 1900, nom. cons., In: Engler et Prantl,  
 Nat. Pflanzenfam. I(1a): 87.  
 Oscillatoriales, Ammatoideaceae  
**T** = [*Lyngbya juliana* Meneghini ex Gomont, 1892: 154] = *Homoeothrix juliana* (Bornet et  
 Flahault) Kirchner, 1900, l.c.: 87.
- HORMATHONEMA Ercegović, 1930, nom. cons., Arch. Protistenk. 71: 371.  
 Chroococcales, Hydrococcaceae  
**T** = *Hormathonema violaceo-nigrum* Ercegović, 1930, l.c.: 372.
- HORMOSCILLA Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 425.  
 Oscillatoriales, Gomontiellaceae, Hormoscilloideae  
**T** = *Borzia xishaensis* Hua, 1981, Ocean. Limnol. Sinica 12(3): 265 = *Hormoscilla xishaensis*  
 (Hua) Anagnostidis et Komárek, 1988, l.c.: 425.
- HORMOTHAMNIUM Grunow ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 7: 259.  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = *Hormothamnium enteromorphoides* Grunow ex Bornet et Flahault, 1886, l.c.: 260.
- HORMOTHECE Jao, 1944, Sinensia 15: 77.  
 Chroococcales, Synechococcaceae, Aphanothechoideae  
**T** = *Hormothece rupestris* Jao, 1944, l.c.: 77.
- HYDROCOCCUS Kützing, 1833, nom. cons., Linnaea 8: 380.  
 Chroococcales, Hydrococcaceae  
**T** = *Hydrococcus rivularis* Kützing, 1833, l.c.: 380.

- HYDROCOLEUM Kützing ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 15: 332.  
 Oscillatoriales, Phormidiaceae, Microcoleoideae  
**T** = [*Vaginaria saxicola* Kützing, 1836: 132, pre-starting-point syn.] = *Hydrocoleum homoeotrichum* Kützing ex Gomont, 1892, l.c.: 344.
- x HYDROCORYNE H. S. Schwabe ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 5: 128.  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = *Hydrocoryne spongiosa* H.S.Schwabe ex Bornet et Flahault, 1886, l.c.: 128.
- HYELLA Bornet et Flahault, 1888, J. Bot. 2: 163.  
 Chroococcales, Hyellaceae, Hyelloideae  
**T** = *Hyella caespitosa* Bornet et Flahault, 1888, l.c.: 163.
- HYPHOMORPHA Borzì, 1916, N. Giorn. Bot. Ital., ser. 2, 23: 582. Stigonematales,  
 Capsosiraceae  
**T** = *Hyphomorpha antillarum* Borzì, 1916, l.c.: 582.
- ISACTIS Thuret [Ann. Sci. Nat. Bot., ser. 6, 1: 376, 1875] ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 4: 341.  
 Nostocales, Rivulariaceae  
**T** = [*Rivularia plana* Harvey in Hooker, 1833, Brit. Fl. 2: 394] = *Isactis plana* Thuret ex Bornet et Flahault, 1886, l.c.: 344.
- ISOCYSTIS Borzì ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 7: 261.  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = *Isocystis messanensis* Borzì ex Bornet et Flahault, 1888, l.c.: 262.
- IYENGARIELLA Desikachary, 1953, Phytomorph. 3(3): 252.  
 Stigonematales, Mastigocladaceae, Brachytrichioideae  
**T** = *Iyengariella tirupatiensis* Desikachary, 1953, l.c.: 252.
- JAAGINEMA Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 395.  
 Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = [*Oscillatoria* („*Oscillaria*“) *subtilissima* Kützing, 1847: 27] = *Oscillatoria subtilissima* Kützing ex De Toni, 1907, Syll. Alg. 5: 171 = *Jaaginema subtilissimum* (Kützing ex De Toni) Anagnostidis et Komárek, 1988, l.c.: 396.
- JOHANNESBAPTISTIA De Toni, 1934, Noter. Nomencl. Algol. 1: 6.  
 Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Hormospora pellucida* Dickie, 1874 = *Johannesbaptistia pellucida* (Dickie) Taylor et Drouet in Drouet, 1938, Bull. Torrey Bot. Club 65: 285 (Geitler 1942); *Cyanothrix primaria* Gardner, 1927 = *Johannesbaptistia primaria* (Gardner) De Toni, 1934, l.c.: 6 (Drouet & Daily 1956).
- o KATAGNYMENE Lemmermann, 1899, Abh. Naturwiss. Ver. Bremen 16: 354.  
 Oscillatoriales, Gomontiellaceae, Hormosilloideae  
**T** = *Katagnymene pelagica* Lemmermann, 1899, l.c.: 354.

- KOMVOPHORON Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 372.  
Oscillatoriales, Borziaceae  
**T** = *Pseudanabaena schmidlei* Jaag, 1938: 117 = *Komvophoron schmidlei* (Jaag) Anagnostidis et Komárek, 1988, l.c.: 372.
- KYRTUTHRIX Ercegović 1929, Arch. Protistenk. 66: 170.  
Nostocales, Scytonemataceae  
**T** = *Kyrtuthrix dalmatica* Ercegović, 1929, l.c.: 170.
- LEIBLEINIA (Gomont) L. Hoffmann, 1985, Cryptog. Algol. 6, 2: 77.  
Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = *Lyngbya baculum* Gomont, 1892: 123 = *Leibleinia baculum* (Gomont) L. Hoffmann, 1985, l.c.: 77.
- LEMMERMANNIELLA Geitler, 1942, In: Engler et Prantl, Nat. Pflanzenfam., ed. 2, 1b:62.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Coelosphaerium pallidum* Lemmermann, 1898: 154 = *Lemmermanniella pallida* (Lemmermann) Geitler, 1942, l.c.: 62.
- LEPTOLYNGBYA Anagnostidis et Komárek, 1988, nom. cons., Algolog. Stud. 50-53: 390.  
Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = *Plectonema boryanum* Gomont, 1899: 36 = *Leptolyngbya boryana* (Gomont) Anagnostidis et Komárek, 1988, l.c.: 391.
- LEPTOPOGON Borzì, 1906, Nuova Notarisia 18: 38.  
Stigonematales, Fischerellaceae  
**T** = *Leptopogon intricatus* (A. Braun) Borzì, 1906, l.c.: 38.
- LETESTUINEMA Frémy, 1930, Arch. Bot. 3: 390.  
Stigonematales, Capsosiraceae  
**T** = *Letestuinema gabonense* Frémy, 1930, l.c.: 393.
- LIMNOTHRIX Meffert, 1987, Algolog. Studies 50-53: 269-270.  
Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = *Oscillatoria redekei* Van Goor, 1918, Recl. Trav. Bot. Neerl. 15: 258 = *Limnothrix redekei* (Van Goor) Meffert, 1987, l.c.: 274.
- LITHOCAPSA Ercegović, 1925, Acta Bot. Inst. Bot. Zagreb. 1: 82.  
Chroococcales, Entophysalidaceae, Entophysalidoideae  
**T** = *Lithocapsa fasciculata* Ercegović, 1925, l.c.: 82.
- LITHOCOCCUS Ercegović, 1925, Acta Bot. Inst. Bot. Zagreb. 1: 83.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Lithococcus ramosus* Ercegović, 1925, l.c.: 83.
- x LITHOMYXA Howe, 1932, U. S. Geol. Surv. Prof. Paper 170: 63.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Lithomyxa calcigena* Howe, 1932, l.c.: 63.
- LOEFGRENIA Gomont, 1896, Bot. Notiser 1897: 90.  
Stigonematales, Loriellaceae  
**T** = *Loefgrenia anomala* Gomont, 1896, l.c.: 90.

- LORIELLA Borzì, 1892, Nuova Notarisia 1892: 44.  
 Stigonematales, Loriellaceae  
**T** = *Loriella osteophila* Borzì, 1892, l.c.: 44.
- LYNGBYA C. Agardh ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 16: 118.  
 Oscillatoriales, Phormidiaceae, Microcoleoideae  
**T** = *Lyngbya confervoides* Agardh [1824] ex Gomont, 1892, l.c.: 136 (Geitler 1942);  
 [*Conferva majuscula* Dillwyn, 1809: 40 = *Lyngbya majuscula* (Dillwyn) Harvey, 1833:  
 370] = *Lyngbya majuscula* (Dillwyn) Harvey ex Gomont, 1892, l.c.: 131 (Drouet  
 1968).
- LYNGBYOPSIS Gardner, 1927, Mem. New York Bot. Gard. 7: 54.  
 Oscillatoriales, Phormidiaceae, Microcoleoideae  
**T** = *Lyngbyopsis willei* Gardner, 1927, l.c.: 55.
- MANTELLUM Dangeard, 1945, Le Botaniste 30: 129.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Mantellum adherens* Dangeard, 1945, l.c.: 129.
- MASTIGOCLADOPSIS Iyengar et Desikachary, 1946, Proc. Ind. Acad. Sci. 24B: 158.  
 Stigonematales, Nostochopsaceae  
**T** = *Mastigocladopsis jogensis* Iyengar et Desikachary, 1946, l.c.: 158.
- MASTIGOCLADUS Cohn ex Kirchner, 1898, In: Engler et Prantl, Nat. Pflanzenfam. 1(la):  
 81.  
 Stigonematales, Mastigocladaceae, Mastigocladoideae  
**T** = *Oscillatoria laminosa* Agardh ex Gomont, 1892 = *Mastigocladus laminosus* Cohn ex  
 Kirchner, 1898, l.c.: 81.
- MASTIGOCOLEOPSIS Geitler, 1925, Beih. Bot. Centralbl. 41(2): 258.  
 Stigonematales, Loriellaceae  
**T** = *Mastigocoleus obtusus* N. Carter, 1922, J. Linn. Soc. 46: 54 = *Mastigocoleopsis obtusa* (N.  
 Carter) Geitler, 1925, l.c.: 258.
- MASTIGOCOLEUS Lagerheim ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 5: 54.  
 Stigonematales, Nostochopsaceae  
**T** = *Mastigocoleus testarum* Lagerheim ex Bornet et Flahault, 1886, l.c.: 54.
- MATTEIA Borzì, 1907, Nuova Notarisia 18: 38.  
 Stigonematales, Loriellaceae  
**T** = *Matteia conchicola* Borzì, 1907, l.c.: 38.
- MERISMOPEDIA Meyen, 1839, nom. cons., N. Syst. Pflanzen-Physiol. 3: 440.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Merismopedia punctata* Meyen, 1839, l.c.: 440.
- MICROCHAETE Thuret ex Bornet et Flahault, 1886, nom. cons., Ann. Sci. Nat. Bot., ser. 7,  
 5: 83.  
 Nostocales, Microchaetaceae, Microchaetoideae  
**T** = *Microchaete grisea* Thuret ex Bornet et Flahault, 1886, l.c.: 85.

- MICROCOLEUS Desmazières ex Gomont, 1892, nom. cons. propos., Ann. Sci. Nat. Bot., ser. 7, 15: 350.  
Oscillatoriales, Phormidiaceae, Microcoleoideae  
T = [*Microcoleus terrestris* Desmazières, 1823: 7]; [*Oscillatoria vaginata* Vaucher, 1803, fig. 13] = *Microcoleus vaginatus* (Vaucher) Gomont, 1892, sine typo (Geitler 1932); *Microcoleus chthonoplastes* Zanardini, 1840, ex Gomont 1892, l.c.: 353.
  
- MICROCROCIS Richter, 1892, In: Hauck et Richter, Phyk. Univers., Fasc. 11: 548.  
Chroococcales, Merismopediaceae, Merismopedioideae  
T = *Microcrocis dietelii* Richter, 1892, l.c.: 548.
  
- MICROCYSTIS Kützing ex Lemmermann, 1907, nom. cons., Kryptogamenfl. Mark Brandenburg 3: 45.  
Chroococcaceae, Microcystaceae  
T = *Micraloa aeruginosa* Kützing, 1833: 371, sine typo; *Microcystis aeruginosa* Kützing [1846, Tab. Phycol. 1: 6-7] ex Lemmermann, 1907, l.c.: 44-45.
  
- MYXOBAKTRON Schmidle, 1904, Hedwigia 43: 415.  
Chroococcales, Synechococcaceae, Synechococcoideae  
T = *Myxobactron usterianum* Schmidle, 1904, l.c.: 415.
  
- MYXOHYELLA Geitler, 1925, Beih. Bot. Centralbl. 41(2): 246.  
Chroococcales, Hydrococcaceae  
T = *Hyella socialis* Setchell et Gardner, 1918 = *Myxohyella socialis* (Setchell et Gardner) Geitler, 1925, l.c.: 246.
  
- MYXOSARCINA Printz, 1921, Kong. Norske Vidensk. Selsk. Skr. 1920(1): 35.  
Chroococcales, Xenococcaceae  
T = *Myxosarcina concinna* Printz, 1921, l.c.: 35.
  
- NEMATOPLACA Geitler, 1933, Arch. Hydrobiol., Suppl. 12: 628.  
Stigonematales, Capsosiraceae  
T = *Nematoplaca incrustans* Geitler, 1933, l.c.: 628.
  
- NEPHROCOCCLUS Li, 1984, Acta Phytotax. Sin. 22: 191.  
Chroococcales, Chroococcaceae  
T = *Nephrococcus confertus* Li, 1984, l.c.: 191.
  
- NODULARIA Mertens ex Bornet et Flahault, 1886, nom. cons., Ann. Sci. Nat. Bot., ser. 7, 7: 243.  
Nostocales, Nostocaceae, Nostocoideae  
T = *Nodularia spumigena* Mertens ex Bornet et Flahault, 1886, l.c.: 245.
  
- NOSTOC Vaucher ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 7: 181.  
Nostocales, Nostocaceae, Nostocoideae  
T = [*Tremella nostoc* Linné, 1753, Sp. Pl., 1<sup>st</sup> ed., 2: 1157, pre-starting-point syn.] = *Nostoc commune* Vaucher [1803, Hist. Conf. d'Eau Douce, p. 223] ex Bornet et Flahault, 1886, l.c.: 203.
  
- NOSTOCHOPSIS Wood ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 5: 80.  
Stigonematales, Nostochopsaceae  
T = *Nostochopsis lobata* Wood ex Bornet et Flahault, 1886, l.c.: 80.

- ONKONEMA Geitler, 1933, Arch. Hydrobiol., Suppl. 12(4): 627.  
 Chroococcales, Hydrococcaceae  
**T** = *Onkonema compactum* Geitler, 1933, l.c.: 627.
- OSCILLATORIA Vaucher ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 16: 198.  
 Oscillatoriales, Oscillatoriaceae, Oscillatorioideae  
**T** = *Oscillatoria princeps* Vaucher ex Gomont, 1892, l.c.: 206.
  - x PALIKIELLA Claus, 1962, Hydrobiologia 19(2): 201.  
 Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Palikiella hungarica* Claus, 1962, l.c.: 202-203.
- PANNUS Hickel, 1991, Algolog. Stud. 64: 100.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Pannus spumosus* Hickel, 1991, l.c.: 101.
- x PARACAPSA Naumann, 1924, Ark. Bot. 18: 6.  
 Chroococcales, Entophysalidaceae, Entophysalidoideae  
**T** = *Paracapsa siderophila* Naumann, 1924, l.c.: 6.
- PARENCHYMORPHA Tseng et Hua, 1984, Sci. Sin., ser. B. 27(8): 813.  
 Stigonematales, Mastigocladaceae, Brachytrichioideae  
**T** = *Parenchymorpha xishanica* Tseng et Hua, 1984, l.c.: 813.
- PARTHASARATHIELLA Subba Raju, 1962, Trans. Amer. Microscop. Soc. 81: 93.  
 Stigonematales, Fischerellaceae  
**T** = *Parthasarathiella prolifica* Subba Raju, 1962, l.c.: 90-93.
- x PASCHERINEMA De Toni, 1936, Noter. Nomencl. Algol. 8: 5.  
 Chroococcales, Hyellaceae, Pascherinematoideae  
**T** = *Endonema moniliforme* Pascher, 1928: 346 = *Pascherinema moniliforme* (Pascher) De Toni, 1936, l.c.: 8.
- PETALONEMA Berkeley ex Kirchner, 1898, Flora 72: 321.  
 Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = [*Oscillatoria alata* Carmichael in Greville, 1826, Scott. Crypt. Fl. 4: 222 = *Petalonema alatum* Berkeley, 1832: 321 = *Scytonema alatum* Borzì, 1879, N. Giorn. Bot. Ital. 11(4): 373; pre-starting-point syn.] = *Petalonema alatum* Berkeley ex Kirchner, 1898, l.c.: 321.
- PHORMIDIUM Kützing ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 16: 156.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Phormidium lucidum* Kützing [1843] ex Gomont, 1892, l.c.: 179 (Geitler 1942);  
 [*Phormidium inundatum* Kützing, 1843, pre-starting-point] = *Phormidium inundatum* Kützing [1843] ex Gomont, 1892, l.c.: 172 (Drouet 1968).
  - x PILGERIA Schmidle, 1901, Hedwigia 40: 53.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Pilgeria brasiliensis* Schmidle, 1901, l.c.: 54.

PLACOMA Schousboe ex Bornet et Thuret, 1876, Notes Algol. 1: 4.

Chroococcales, Hydrococcaceae

**T** = *Placoma vesiculosa* Schousboe ex Bornet et Thuret, 1876, l.c.: 2.

PLANKTOCYANOCAPSA Hindák, 2002, Biologia (Bratislava) 57/4: 418.

Chroococcales, Synechococcaceae, Aphanothecoideae

**T** = *Planktocyanoapsa stagnalis* Hindák, 2002, l.c.: 418.

PLANKTOLYNGBYA Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 394.

Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae

**T** = *Lyngbya limnetica* Lemmermann, 1898: 154 = „*Planktolyngbya subtilis* (W. West) Anagnostidis et Komárek“, 1988, l.c.: 394, sine typo = *Planktolyngbya limnetica* (Lemmermann) Komárková-Legnerová et Cronberg, 1992, Algolog. Stud. 67: 23-24.

- PLANKTOTHRIX Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 414.

Oscillatoriales, Phormidiaceae, Phormidioideae

**T** = *Oscillatoria agardhii* Gomont, 1892: 205 = *Planktothrix agardhii* (Gomont) Anagnostidis et Komárek, 1988, l.c.: 416.

- PLANKTOTHTRICOIDES Suda et M.M. Watanabe in Suda et al., 2002, Int. J. Syst. Evol. Microbiol. 52: 1593.

Oscillatoriales, Phormidiaceae, Phormidioideae

**T** = *Oscillatoria raciborskii* Wołoszyńska, 1912: 686 = *Planktothricoides raciborskii* (Wołoszyńska) Suda et M.M. Watanabe in Suda et al., 2002, l.c.: 1593-1594.

- PLECTONEMA Thuret ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 16: 96.

Oscillatoriales, Oscillatoriaceae, Plectonematoideae

**T** = *Plectonema tomasinianum* Gomont [1890] ex Gomont, 1892, l.c.: 99 (Geitler 1942); [*Conferva mirabilis* Dillwyn, 1808, pl. 96, pre-starting-point] = *Plectonema mirabile* Thuret ex Gomont, 1892, l.c.: 99 (Drouet 1968).

- PLEUROCAPSA Thuret in Hauck, 1885, In: Rabenhorst's Kryptogamenfl., Deutschl., ed. 2, 2: 515.

Chroococcales, Hyellaceae, Hyelloideae

**T** = *Pleurocapsa fuliginosa* Hauck, 1885, l.c.: 515.

PODOCAPSA Ercegović, 1931, Acta Bot. Inst. Bot. Univ. Zagreb. 6: 33.

Chroococcales, Hyellaceae, Podocapsoideae

**T** = *Podocapsa pedicellatum* Ercegović, 1931, l.c.: 33.

POLYCHLAMYDUM West et West, 1897, J. Bot. 35: 271.

Oscillatoriales, Oscillatoriaceae, Oscillatorioideae

**T** = *Polychlamydatum insigne* West et West, 1897, l.c.: 271.

PORPHYROSIPHON Kützing ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 15: 331.

Oscillatoriales, Phormidiaceae, Phormidioideae

**T** = [*Scytonema notarisii* Meneghini in Kützing, 1849: 307 = *Porphyrosiphon notarisii* (Meneghini) Kützing, 1850: 7 pre-starting-point] = *Porphyrosiphon notarisii* [Meneghini] Kützing ex Gomont, 1892, l.c.: 331.

- x PROTERENDOTHRIX West et West, 1897, J. Bot. 35: 299.  
Oscillatoriales, Borziaceae  
T = *Proterendothrix scolecoidea* West et West, 1897, l.c.: 299.
- o PSEUDANABAENA Lauterborn, 1916, Verh. Naturhist.-Med. Vereins Heidelberg, ser. 2, 13: 437.  
Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
T = *Pseudanabaena catenata* Lauterborn, 1916, l.c.: 437.
- PSEUDOCAPSA Ercegović, 1925, Acta Bot. Inst. Univ. Zagreb. 1: 95.  
Chroococcales, Chroococcaceae  
T = *Pseudocapsa dubia* Ercegović, 1925, l.c.: 95.
- PSEUDOCONBYRSA Geitler, 1925, Beih. Bot. Centralbl. 41 (2): 237.  
Chroococcales, Synechococcaceae, Synechococcoideae  
T = *Oncobyrsa lacustris* Kirchner in Schröter et Kirchner, 1896: 102 = *Pseudoncobyrsa lacustris* (Kirchner) Geitler, 1925, l.c.: 273.
- o PSEUDOPHORMIDIUM (Forti) Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 409.  
Oscillatoriales, Phormidiaceae, Phormidioideae  
T = [*Plectonema phormidioides* Hansgirg, 1887: 121, pre-starting-point] = *Plectonema phormidioides* Hansgirg ex Gomont, 1892: 103 = *Pseudophormidium phormidioides* (Hansgirg ex Gomont) Anagnostidis et Komárek, 1988, l.c.: 410.
- PSEUDOSCYTONEMA Elenkin, 1949, Monogr. Algarum Cyanophyc., Pars Spec. 2: 1805.  
Oscillatoriales, Ammatoideaceae  
T = *Plectonema malayense* Biswas, 1929: 411 = *Pseudoscytonema malayense* (Biswas) Elenkin, 1949, l.c.: 1805.
- PULVINULARIA Borzì, 1916, Nuovo Giorn. Bot. Ital., ser. 2, 23: 574.  
Stigonematales, Stigonemataceae  
T = *Pulvinularia suecica* Borzì, 1916, l.c.: 574.
- RADAISIA Sauvageau, 1895, J. Bot. 9: 374.  
Chroococcales, Hyellaceae, Hyelloideae  
T = *Radaisia gomontiana* Sauvageau, 1895, l.c.: 374.
- RADIOCYSTIS Skuja, 1948, Symb. Bot. Uppsala 9(3): 43.  
Chroococcales, Synechococcaceae, Aphanothecoideae  
T = *Radiocystis geminata* Skuja, 1948, l.c.: 43.
- RAPHIDIOPSIS Fritsch et Rich, 1929, Trans. Roy. Soc. South Africa 18: 91.  
Nostocales, Nostocaceae, Anabaenoideae  
T = *Raphidiopsis curvata* Fritsch et Rich, 1929, l.c.: 91.
- RHABDODERMA Schmidle et Lauterborn, 1900, Ber. Deutsch. Bot. Ges. 18: 148.  
Chroococcales, Synechococcaceae, Synechococcoideae  
T = *Rhabdoderma lineare* Schmidle et Lauterborn, 1900, l.c.: 148.

- RHABDOGLOEA Schröder, 1917, Ber. Deutsch. Bot. Ges. 35: 549.  
Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Rhabdogloea ellipsoidea* Schröder, 1917, l.c.: 549.
- RHODOSTICHUS Geitler et Pascher, 1931, Arch. Protistenk. 73: 305.  
Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Rhodostichus expansus* Geitler et Pascher, 1931, l.c.: 305.
- RICHELIA J. Schmidt in Ostenfeld et J. Schmidt, 1902, Vidensk. Meddel. Dansk Naturhist. Foren. Kjöbenhavn, 1901: 146.  
Nostocales, Nostocaceae, Anabaenoideae  
**T** = *Richelia intracellularis* J. Schmidt, 1902, l.c.: 146.
- RIVULARIA [Roth] Agardh [Syst. Alg., 1824, p. 19] ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 4: 345.  
Nostocales, Rivulariaceae  
**T** = *Rivularia dura* Roth [1802, N. Beitr. Bot., p. 273] ex Bornet et Flahault, 1886, l.c.: 347.
- ROMERIA Koczwara in Geitler, 1932, In: Rabenhorst's Kryptogamenfl. Deutschl., ed. 2, 14: 915.  
Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = *Raciborskia elegans* Wołoszyńska in Koczwara, 1928: 107 = *Romeria elegans* (Wołoszyńska) Koczwara in Geitler, 1932, l.c.: 916.
- SACCONEMA Borzì [1882, N. Giorn. Bot. Ital. 14(4): 298] ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 3: 381.  
Nostocales, Rivulariaceae  
**T** = *Sacconema rupestre* Borzì ex Bornet et Flahault, 1886, l.c.: 381.
- SCHIZOTHRIX Kützing ex Gomont, 1892, Ann. Sci. Nat. Bot., ser. 7, 15: 192.  
Oscillatoriales, Schizotrichaceae  
**T** = *Schizothrix fuscescens* Kützing [1843] ex Gomont, 1892, l.c.: 324.
- SCHMIDLEINEMA De Toni, 1936, Noter. Nomencl. Alg. 8: 5.  
Stigonematales, Borzinemataceae  
**T** = *Stigonema indica* Schmidle, 1900 = *Camptylonema indicum* Schmidle, 1900 = *Schmidleinema indicum* (Schmidle) De Toni, 1936, l.c.: 5.
- SCYTONEMA Agardh [1812, Disp. Alg. Suec. p. 38] ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 5: 85.  
Nostocales, Scytonemataceae  
**T** = *Scytonema hofmannii* Agardh ex Bornet et Flahault, 1886, l.c.: 97 (Geitler 1942; [*Conferva myochrous* Dillwyn, 1802, Brit. Conf., pl. 19] = *Scytonema myochrous* Agardh [1812, Disp. Alg. Suec., p. 38] ex Bornet et Flahault, 1886, l.c.: 104 (Drouet 1973).
- SCYTONEMATOPSIS Kiseleva, 1930, Žurn. Russk. Bot. Obšč. 15: 169.  
Nostocales, Scytonemataceae  
**T** = *Scytonematopsis woronichinii* Kiseleva, 1930, l.c.: 169.
- SEGUENZAEA Borzì, 1907, Atti Congr. Nat. Ital. Milano 1906: 372.  
Stigonematales, Borzinemataceae  
**T** = *Seguenzaea sicula* Borzì, 1907, l.c.: 372.

- x SINAIELLA Gruia, 1965, *Revista Biol.* 5: 167.  
 Oscillatoriales, Borziaceae  
**T** = *Sinaiella terricola* Gruia, 1965, l.c.: 167.
- SIPHONONEMA Geitler, 1925, *Arch. Protistenk.* 51: 332, 339.  
 Chroococcales, Entophysalidaceae, Siphononematoideae  
**T** = *Pleurocapsa polonica* Raciborski, 1910: 11 = *Siphononema polonicum* (Raciborski) Geitler, 1925, 332, 341.
- SIPHONOSPHAERA Hindák, 1988, *Algolog. Stud.* 49: 416-417.  
 Chroococcales, Merismopediaceae, Gomphosphaerioideae  
**T** = *Siphonosphaera pannonica* Hindák, 1988, l.c.: 417.
- SIROCOLEUM Kützing ex Gomont, 1892, *Ann. Sci. Nat. Bot.*, ser. 7, 15: 347.  
 Oscillatoriales, Phormidiaceae, Microcoleoideae  
**T** = *Sirocoleum guianense* Kützing [1849] ex Gomont, 1892, l.c.: 348.
- SNOWELLA Elenkin, 1938, *Monogr. Algarum Cyanophyc., Pars Spec.*, 1: 278.  
 Chroococcales, Merismopediaceae, Gomphosphaerioideae  
**T** = *Coelosphaerium roseum* Snow, 1903: 387 = *Snowella rosea* (Snow) Elenkin, 1938, l.c.: 278.
- SOKOLOVIA Elenkin, 1926, *Bot. Mater. Inst. Sporov. Rast. Glavn. Bot. Sada RSFSR* 4: 89.  
 Oscillatoriales, Pseudanabaenaceae, Heteroleibleinioideae  
**T** = *Sokolovia neumaniae* Elenkin, 1926, l.c.: 89.
- SOLENTIA Ercegović, 1927, *Acta Bot. Inst. Bot. Univ. Zagreb.* 2: 79.  
 Chroococcales, Hyellaceae, Solentioideae  
**T** = *Solentia stratosa* Ercegović, 1927, l.c.: 78.
- SPELAEOPOGON Borzì, 1907, *Nuova Notarisia* 18: 38.  
 Stigonematales, Borzinemataceae  
**T** = *Spelaeopogon sommieri* Borzì, 1907, l.c.: 38.
- SPHAEROCAVUM Azevedo et Sant'Anna, 2003, *Algolog. Stud. (Cyanobact. Res. 4)* 109: 81.  
 Chroococcales, Micrococcaceae  
**T** = *Sphaerocavum brasiliense* Azevedo et Sant'Anna, 2003, l.c.: 81.
- SPIRIRESTIS Flechtner et Johansen in Flechtner et al., 2002, *Nova Hedwigia* 74(1-2): 6.  
 Nostococcales, Scytonemataceae  
**T** = *Spirirestis rafaensis* Flechtner et Johansen, 2002, l.c.: 7.
  - SPIRULINA Turpin ex Gomont, 1892, *Ann. Sci. Nat. Bot.*, ser. 7, 16: 249.  
 Oscillatoriales, Pseudanabaenaceae, Pseudanabaenoideae  
**T** = *Spirulina maior* Kützing [1843] ex Gomont, 1892, l.c.: 251 (Geitler 1942); [*Spirulina oscillarioides* Turpin, 1827: 309, pre-starting-point] = *Spirulina oscillarioides* Turpin ex Gomont, 1892, l.c.: 255 (Drouet 1988).

- STANIERIA Komárek et Anagnostidis, 1986, *Algolog. Stud.* 38-39: 208.  
Chroococcales, Dermocarpellaceae  
**T** = *Chroococciopsis cyanosphaera* Komárek et Hindák, 1975 = *Stanieria cyanosphaera* (Komárek et Hindák) Komárek et Anagnostidis, 1986, l.c.: 208.
  
- STARRIA Lang, 1977, *J. Phycol.* 13: 289.  
Oscillatoriales, Gomontiellaceae, Gomontielloideae  
**T** = *Starria zimbabweensis* Lang, 1977, l.c.: 289-291.
  
- STAUROMATONEMA Frémy, 1930, *Arch. Bot.* 3: 385.  
Stigonematales, Capsosiraceae  
**T** = *Stauromatonema viride* Frémy, 1930, l.c.: 390.
  
- STICHOSIPHON Geitler, 1932, *Rabenhorst's Kryptogamenfl. Deutschl.*, ed. 2, 14: 411.  
Chroococcales, Chamaesiphonaceae  
**T** = *Stichosiphon regularis* Geitler, 1932, l.c.: 412.
  
- STIGONEMA Agardh ex Bornet et Flahault, 1886, *Ann. Sci. Nat. Bot.*, ser. 7, 5: 62.  
Stigonematales, Stigonemataceae  
**T** = *Stigonema mammosum* Agardh ex Bornet et Flahault, 1886, l.c.: 62.
  
- SYMPHYONEMA Jao, 1944, *Sinensia* 15: 81.  
Stigonematales, Mastigocladaceae, Brachytrichioideae  
**T** = *Symphyonema sinense* Jao, 1944, l.c.: 81.
  
- SYMPHYONEMOPSIS Tiwari et Mitra, 1969, *Phykos* 7: 193.  
Stigonematales, Mastigocladaceae, Brachytrichioideae  
**T** = *Symphyonemopsis katniensis* Tiwari et Mitra, 1969, l.c.: 193.
  
- SYMPLOCA Kützing ex Gomont, 1892, *Ann. Sci. Nat. Bot.*, ser. 7, 16: 104.  
Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Symploca muralis* Kützing ex Gomont, 1892, l.c.: 112.
  
- SYMPLOCASTRUM (Gomont) Kirchner, 1900, In: Engler et Prantl, *Nat. Pflanzenfam.* 1(1a): 69.  
Oscillatoriales, Phormidiaceae, Microcoleoideae  
**T** = [*Oscillatoria friesii* Agardh, 1817: 107] = *Schizothrix friesii* Gomont ex Gomont 1892: 316 = *Symplocastrum friesii* [Agardh] Forti, 1907, *Syll. Myxoph.*, p. 347.
  
- SYNECHOCOCCUS Nägeli, 1849, *Neue Denkschr. Allg. Schweiz. Ges. Gesamten Naturwiss.* 10(7): 56.  
Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Protococcus elongatus* Nägeli in Kützing, 1849: 197 = *Synechococcus elongatus* (Nägeli) Nägeli, 1849, l.c.: 56.
  
- SYNECHOCYSTIS Sauvageau, 1892, *Bull. Soc. Bot. Fr.* 39: 115.  
Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Synechocystis aquatilis* Sauvageau, 1892, l.c.: 116.
  
- TAPINOTHRIX Sauvageau, 1893, *Bull. Soc. Bot. Fr.* 39(1892): 123.  
Oscillatoriales, Pseudanabaenaceae, Heteroleibleinioideae  
**T** = *Tapinothrix bornetii* Sauvageau, 1893, l.c.: 123.

- THALPOPHILA Borzì, 1907, Atti Congr. Nat. Ital. 1906: 373.  
Stigonematales, Mastigocladaceae, Mastigocladoideae  
**T** = *Thalpopphila cossyrensis* Borzì, 1907, l.c.: 373.
- x THIOCHAETE Welsh, 1961, Nova Hedwigia 3: 39.  
Nostocales, Nostocaceae, Anabaenoideae  
**T** = *Thiochaete chatteri* Welsh, 1961, l.c.: 40.
- TOLYPOTHRIX Kützing [1843] ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7, 5: 118.  
Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = *Tolypothrix distorta* Kützing [1843, Phyc. Gener., p. 228] ex Bornet et Flahault, 1886, l.c.: 119 (Geitler 1942); *Tolypothrix muscicola* Kützing [1843, l.c., p. 227] ex Bornet et Flahault, 1886, l.c.: 121 (Drouet 1973).
- TRICHODESMIUM Ehrenberg ex Gomont, 1892, nom. cons., Ann. Sci. Nat. Bot., ser. 7, 16: 193.  
Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Trichodesmium erythraeum* Ehrenberg [1830] ex Gomont, 1892, l.c.: 196.
  - TRICHORMUS (Ralfs ex Bornet et Flahault) Komárek et Anagnostidis, 1989, Algolog. Stud. 56: 303.  
Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Sphaerozyga variabilis* Kützing, 1849, Sp. Alg., p. 291] = *Anabaena variabilis* Kützing ex Bornet et Flahault, 1888, Ann. Sci. Nat. Bot., ser. 7, 7: 226 = *Trichormus variabilis* (Kützing ex Bornet et Flahault) Komárek et Anagnostidis, 1989, l.c.: 304.
- TRYPONEMA Ercegović, 1929, Arch. Protistenk. 66: 168.  
Chroococcales, Hydrococcaceae  
**T** = *Tryponema endolithicum* Ercegović, 1929, l.c.: 168.
- TUBIELLA Hollerbach, 1935, Acta Inst. Bot. Acad. Sci. SSSR, ser. 2, 2: 34.  
Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Tubiella elenkinii* Hollerbach, 1935, l.c.: 34.
- TYCHONEMA Anagnostidis et Komárek, 1988, Algolog. Stud. 50-53: 410.  
Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Oscillatoria bornetii* var. *tenuis* Skuja, 1930: 18 = *Tychonema tenue* (Skuja) Anagnostidis et Komárek, 1988, l.c.: 413.
  - UMEZAKIA M. Watanabe, 1987, Bull. Nat. Sci. Mus. , ser. B, 13(3): 81.  
Stigonematales, Mastigocladaceae, Mastigocladoideae  
**T** = *Umezakia natans* M. Watanabe, 1987, l.c.: 81-82.
- VOUKIELLA Ercegović, 1925, Acta Bot. Inst. Bot. Univ. Zagreb. 1: 92.  
Stigonematales, Mastigocladaceae, Mastigocladoideae  
**T** = *Voukiella rupestris* Ercegović, 1925, l.c.: 93.
- WESTIELLA Borzì, 1907, Atti Congr. Nat. Ital. 1906: 373.  
Stigonematales, Mastigocladaceae, Mastigocladoideae  
**T** = *Westiella intricata* Borzì, 1907, l.c.: 373.

WESTIELLOPSIS Janet, 1941, Ann. Bot. London, ser. 2, 5: 170.

Stigonematales, Fischerellaceae

**T** = *Westiellopsis prolifica* Janet, 1941, l.c.: 170.

WOLLEA Bornet et Flahault, 1888, Ann. Sci. Nat. Bot., ser. 7, 7: 223.

Nostocales, Nostocaceae, Anabaenoideae

**T** = [*Sphaerozyga saccata* Wolle, 1880, pre-starting-point] = *Wollea saccata* (Wolle) Bornet et Flahault, 1888, l.c.: 223.

WOLSKYELLA Claus, 1963, Nova Hedwigia 6: 32.

Chroococcales, Synechococcaceae, Synechococcoideae

**T** = *Wolskyella filamentosa* Claus, 1963, l.c.: 29-30.

- WORONICHINIA Elenkin, 1933, Trudy Bot. Inst. Akad. Nauk SSSR, ser. 2, Sporov. Rast. 1: 28.

Chroococcales, Merismopediaceae, Gomphosphaerioideae

**T** = *Coelosphaerium naegelianum* Unger, 1854: 195 = *Woronichinia naegeliana* (Unger) Elenkin, 1933, l.c.: 28.

- XENOCOCCUS Thuret in Bornet et Thuret, 1880, Notes Algol. 2: 74.

Chroococcales, Xenococcaceae

**T** = *Xenococcus schousboei* Thuret, 1875, l.c.: 75.

XENOTHOLOS Gold-Morgan, Montejano et Komárek, 1994, Arch. Protistenk. 144: 391.

Chroococcales, Xenococcaceae

**T** = *Xenotholos huastecanus* Gold-Morgan, Montejano et Komárek, 1994, l.c.: 399.

YONEDAELLA Umezaki, 1962, Taxon 11(6): 204.

Oscillatoriales, Borziaceae

**T** = *Isocystis lithophila* Ercegović, 1932: 160 = *Yonedaella lithophila* (Ercegović) Umezaki, 1962, l.c.: 204.

## Appendix 2.

### Approved List of Conserved Specific Epithets

[Not yet prepared, the proposal must be discussed!]

The names of important cyanobacterial species, used in different concepts in the past, should be used in a unified (original) sense; they are included in this list. The names are listed alphabetically.

[The following characters will be added:

name

citation

taxonomic position

type strain

reference strain

ecology

distribution

typical figures

synonymous names (different concepts, later misinterpretations, „sensu“)]

The following names are proposed. Please, add further proposals.

*Anabaena crassa* (transfer in another genus is expected)

*Anabaena flos-aquae* (transfer in another genus is expected)

*Anabaena oscillarioides*

*Aphanizomenon flos-aquae*

*Arthrospira maxima*

*Chlorogloea microcystoides*

*Chroococcus minutus*

*Chroococcus turgidus*

*Cyanobium oceanicum*

*Cyanobium waterburyi*

*Microcystis aeruginosa*

*Nostoc commune*

*Phormidium autumnale*

*Phormidium retzii*

*Pseudanabaena mucicola*

*Synechococcus bigranulatus*

*Synechococcus elongatus*

*Synechococcus lividus*

*Synechococcus nidulans*

*Synechocystis aquatilis*

*Trichodesmium erythraeum*

### Appendix 3.

#### List of Synonyms and Important Rejected Generic Names

Explanations:

**T** = type species

#### Part I.: Generic synonyms.

ACTINOCEPHALUS Kützing, 1843, Phyc. gen., p. 190; (pre-starting-point syn.).

Oscillatoriales, Phormidiaceae, Microcoleoideae

**T** = *Actinocephalus partitus* Kützing, 1843, l.c.: 190.

= ? HYDROCOLEUM Kützing ex Gomont, 1892.

AGMENELLUM Brébisson, 1839, Mem. Soc. Acad. Sci., Arts, Bell.-Lett. Falaise, 1839: 2.

Chroococcales, Merismopediaceae, Merismopedioideae

**T** = *Trochiscia quadruplicata* Meneghini, 1837: 334 = *Agmenelum quadruplicatum* (Meneghini) Brébisson, 1839, l.c.: 2.

= MERISMOPEDIA Meyen, 1839, nom. cons.

AINACTIS Kützing, 1843, Phycol. gener., p. 237; (pre-starting-point syn.).

Nostocales, Rivulariaceae

**T** = *Ainactis alpina* Kützing, 1843, l.c.: 237.

= RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886.

AMALIA De-Toni, 1934, Noter . nom. alg. 1: 5.

Oscillatoriales, Pseudanabaenaceae

**T** = *Arthrospira leopoliensis* Raciborski, 1910, Phyc. Polon. 1: 9 = *Amalia leopoliensis* De-Toni, 1934, l.c.: 5.

= ROMERIA Koczwara in Geitler, 1932.

AMORPHONOSTOC Elenkin, 1931, Priroda 20(10): 969-970; (probably special subgenus or genus).

Nostocales, Nostocaceae, Nostocoideae

**T** = *Polycoccus paludosum* [Kützing, 1850, Tab. Phycol. 2(1): 67] = *Amorphonostoc paludosum* Elenkin, 1938, Monogr. Alg. Cyanoph., Pars Spec. 1: 562.

= NOSTOC Vaucher ex Bornet et Flahault, 1886.

AMPHITHRIX Kützing ex Bornet et Flahault, 1886, Ann. Sci. Nat. Bot. 7,3: 343.

Oscillatoriales, Homoeotrichaceae, Homoeotrichoideae

**T** = [*Amphithrix amoena* Kützing, 1843, Phyc. Gener., p. 220] = *Phormidium ambiguum* sec. Gomont, 1892, Ann. Sci. Nat. Bot., Ser. 7, 16: 178; *Amphithrix janthina* Bornet et Flahault, 1886, l.c.: 344 (= starting point).

= HOMOEOTHRIX (Thuret ex Bornet et Flahault) Kirchner, 1898, nom. cons.; (pro parte trichali).

ANABAENELLA Welsh, 1964, Nova Hedwigia 7: 20.

Oscillatoriales, Pseudanabaenaceae

**T** = *Anabaenella ulula* Welsh, 1964, l.c.: 20.

= PSEUDANABAENA Lauterborn, 1915 (subg. ILYONEMA).

ANABAENOTHRIX Randhawa, 1936, Proc. Ind. Acad. Sci. 3B(5): 407.

Nostocales, Nostocaceae, Nostocoideae

**T** = *Anabaenothrix epiphytica* Randhawa et Ghose in Randhawa, 1936, l.c.: 408.

= HORMOTHAMNIUM Grunow ex Bornet et Flahault, 1886.

ANABAINA Bory de Saint Vincent, 1822, Dict. Class. Hist. Nat. 1: 308.

Nostocales, Nostocaceae, Anabaenoideae

**T** = *Anabaina pseudo-oscillatoria* Bory, 1822, l.c.: 308.

= pre-starting-point orthogr. var. of ANABAENA Bory ex Bornet et Flahault, 1886.

ANACYSTIS Meneghini, 1837, Consp. Algol. Eujan., p. 324.

Chroococcales

**T** = *Anacystis marginata* Meneghini, 1837, l.c.: 324.

= encyst. Euglenophyceae (type material); sensu auct. post.:

APHANOTHECE Nägeli, 1849 nom. cons., CHROOCOCCIDIOPSIS Geitler, 1933,

NEPHROCOCCUS Li, 1984, or SYNECHOCOCCUS Nägeli, 1849; sensu Kützing, 1849 =

MICROCYSTIS Kützing ex Lemmermann, 1907.

APLOCOCCUS Roze, 1896, J. Bot. 10: 319-323.

Chroococcales, Merismopediaceae, Merismopedioideae

**T** = *Aplococcus natans* Roze, 1896, l.c.: 321.

= APHANOCAPSA Nägeli, 1849 (?).

ARTHROSIPHON Kützing, 1845, Phyc. germ., p. 117; (pre-starting-point syn.).

Nostocales, Microchaetaceae

**T** = [*Oscillatoria alata* Carmichael in Greville, 1826, Scott. Crypt. Fl. 4: 222 =

*Arthrosiphon grevillei* Kützing, 1845, Phyc. Germ., p. 177 = *Arthrosiphon alatus*

Rabenhorst, 1865, Fl. Eur. Alg. 2: 265].

= PETALONEMA Berkeley ex Correns, 1889.

ARTHRONEMA Hassall, 1845, Brit. Freshw. Alg., p. 238; (pre-starting-point syn.).

Nostocales, Microchaetaceae

**T** = [*Scytonema cirrhosum* Carmichael in Harvey in Hooker, 1833, Brit. Fl. 2: 366 =

*Arthronema cirrhosum* Hassall, 1845, Hist. Brit. Freshw. Alg. 1: 238] ex Forti, 1907, Syll.

Myxoph., p. 558-559.

= ? COLEODESMIUM Borzì, 1879, nom. cons. propos.

ARTHROTILUM Rabenhorst, 1865, Fl. Eur. Alg. 2, p. 230.

Oscillatoriales, Homoeotrichaceae, Homoeotrichoideae

**T** = [*Amphithrix papillosa* Rabenhorst, 1863, Krypt.-Fl. Sachs. 1: 105 = *Arthrotilum*

*papillosum* Rabenhorst, 1865, Fl. Eur. Alg. 2: 230] ex Forti, 1907, Syll. Myxoph., p. 602.

= ? HOMOEOTHRIX (Thuret ex Bornet et Flahault) Kirchner, 1898, nom. cons.

- ARTUROA Gonzalez-Guerrero, 1951, Anal. Jard. Bot. Madrid 10: 210.  
 Oscillatoriales, Phormidiaceae  
**T** = *Arturoa anae* Gonzalez-Guerrero, 1951, l.c.: 210.  
 = ? MICROCOLEUS Desmazieres ex Gomont, 1892 (without sheaths).
- ASKENASYA Möbius, 1887, Ber. Dtsch. Bot. Ges. 5: 56.  
 Chroococcales, Hydrococcaceae  
**T** = *Askenasya polymorpha* Möbius, 1887, l.c.: 57.  
 = HYDROCOCCUS Kützing, 1833, nom. cons.
- BACILLOSIPHON Copeland, 1936, Ann. N.Y. Acad. Sci. 36: 66.  
 Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Bacillosiphon induratus* Copeland, 1936, l.c.: 67.  
 = BACULARIA Borzì, 1905.
- BECKIA Elenkin, 1938, Monogr. Alg. Cyanoph. URSS, pars. spec. 1: 71.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Holopedium bellum* Beck-Managetta, 1929, Arch. Protistenk. 66: 10 = *Beckia bella*  
 Elenkin, 1938, l.c.: 71.  
 = subg. of MICROCROCIS P. Richter, 1892.
- BELMONTIA Archibald, 1967, Nova Hedwigia 12(3-4): 532; later homonym to BELMONTIA E.  
 H. F. Meyer, 1838 (Phaner.).  
 Nostocales, Nostocaceae  
**T** = *Belmontia capensis* Archibald, 1967, l.c.: 532.  
 = ? ANABAENA Bory ex Bornet et Flahault, 1886.
- BELONIA Carmichael in Harvey in Hooker, 1833, Brit. Fl. 2: 379; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = *Belonia torulosa* Carmichael, 1833, l.c.: 379.  
 = ANABAENA Bory ex Bornet et Flahault, 1886.
- BICHATIA Turpin, 1828, Mem. Mus. Hist. Nat. Paris 16: 162.  
 Chroococcales, Microcystaceae  
**T** = *Bichatia vesiculosa* Turpin, 1828, l.c.: 163.  
 = GLOEOCAPSA Kützing, 1843, nom. cons.
- BRACHYNEMA Ercegović, 1931, Acta Bot. Inst. Bot. Univ. Zagreb 6: 36.  
 Chroococcales, Hydrococcaceae, Podocapsoidae  
**T** = *Brachynema litorale* Ercegović, 1931, l.c.: 35.  
 = ERCEGOVICIA De-Toni, 1936 (later homonym) = PODOCAPSA Ercegović, 1931.
- BRACHYTHRIX A. Braun in Rabenhorst, 1865, Fl. Eur. Alg. 2: 118.  
 Chroococcales, Chamaesiphonaceae  
**T** = *chamaesiphon cofervicola* A. Braun in Rabenhorst, 1865, l.c.: 148.  
 = CHAMAESIPHON A. Braun, 1865.
- CAGNIARDIA Trevisan, 1848, Sagg. Monogr. Alg. Coccot., p. 47.  
 Chroococcales, Microcystaceae  
**T** = [*Palmella cyanea* Kützing, 1843: 172 = *Cagniardia cyanea* Trevisan, 1848, l.c.: 47].  
 = ? MICROCYSTIS Kützing ex Lemmermann, 1907, nom. cons.

- CAMPTYLONEMA Schmidle, 1900, Hedwigia 39: 181; (later homonym).  
 Stigonematales, Borzinemataceae  
 T = *Camptylonema indicum* Schmidle, 1900, l.c.: 181.  
 = SCHMIDLEINEMA De-Toni, 1936.
- CAMPYLOTROPIUM Hortobágyi et Hilliard, 1965, Acta bot. hung. 11: 141.  
 Oscillatoriales, Pseudanabaenaceae  
 T = *Campylotropium alascense* Hortobágyi et Hilliard, 1965, l.c.: 140.  
 = ROMERIA Koczwara in Geitler, 1932 (incl.).
- CATELLA Ålvik, 1934, Bergens Mus. Arbok 1934 (Naturw. Rekke 6): 37.  
 Chroococcales, Synechococcaceae, Synechococcoideae  
 T = *Catella rubra* Ålvik, 1934, l.c.: 38.  
 = RHABDODERMA Schmidle et Lauterborn, 1900 (incl.).
- CHAMAENEMA Kützing, 1833, Linnaea 8: 364; (pre-starting-point syn.).  
 Oscillatoriales, Pseudanabaenaceae  
 T = *Chamaenema carneum* Kützing, 1833, l.c.: 364.  
 = LEPTOLYNGBYA Anagnostidis et Komárek, 1988.
- CHAMAESIPHONOPSIS Fritsch, 1929, New Phytol. 28: 193.  
 Chroococcales, Chamaesiphonaceae  
 T = *Xenococcus britannicus* Fritsch, 1927: 467 = *Chamaesiphonopsis regularis* Fritsch, 1929, l.c.: 173 (incorrect change of specific epitheton).  
 = CHAMAESIPHON A. Braun, 1865 (incl.).
- CHALARCTIS Kützing, 1843, Phycol. gener., p. 236; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
 T = *Chalarctis villosa* Kützing, 1843, l.c.: 237.  
 = GLOEOTRICHIA J. Agardh ex Bornet et Flahault, 1886.
- CHROOBACTER Pringsheim, 1953, Arch. Microbiol. 19: 361.  
 Chroococcales, Synechococcaceae, Synechococcoideae  
 T = *Chroobacter vantieghemii* Pringsheim, 1953, l.c.: 361.  
 = SYNECHOCOCCUS Nägeli, 1849 (incl.); or CYANOBIUM Rippka et Cohen-Bazire, 1983 (incl.).
- CIRROSIPHON Duvigneaud et Symoens, 1949, Lejeunia 13: 86; (possibly a special genus of Phormidiaceae).  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
 T = *Cirrosiphon geniculatus* Duvigneaud et Symoens, 1949, l.c.: 86.  
 = PHORMIDIUM Kützing ex Gomont, 1892.
- CLATHROCYSTIS Henfrey, 1856, Trans. Microsc. Soc. London 2, 4: 53.  
 Chroococcales, Microcystaceae, Microcystoideae  
 T = *Micraloa aeruginosa* Kützing, 1833: 371 = *Clathrocystis aeruginosa* Henfrey, 1956, l.c.: 53.  
 = MICROCYSTIS Kützing ex Lemmermann, 1907, nom. cons.

- COCCOCHLORIS Sprengel, 1807, Fl. Halens. Mantissa 1: 14; sec. Sprengel, 1827, in Linn. Syst. Vegetab., ed. 16, 4(1): 314.  
 Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Coccochloris stagnina* Sprengel, 1807, l.c.: 14.  
 = APHANOTHECE Nägeli, 1849, nom. cons.
- COELOCYSTIS Nägeli in Kützing, 1849, Spec. Alg., p. 209.  
 Chroococcales, Merismopediaceae, Gomphosphaerioideae  
**T** = *Coelocystis kuetzingianum* Nägeli in Kützing, 1849, l.c.: 209.  
 = COELOSPHAERIUM Nägeli, 1849.
- COLEODESMIUM Borzì, 1879, N. Giorn. Bot. Ital. 11: 348.  
 Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = [*Thorea wrangelii* Agardh, 1812, Disp. Alg. Suec., p. 40 = *Coleodesmium wrangelii* Borzì, 1879, l.c.: 356.  
 = COLEODESMIUM Borzì ex Geitler, 1942; (validis. of pre-starting-point name).
- COLEONEMA Schousboe ex Bornet et Thuret, 1880, Not. alg. 2: 73-75.  
 Chroococcales, Xenococcaceae  
**T** = *Coleonema arenifera* Schousboe pro syn. in Bornet & Thuret, 1880, l.c.: 74.  
 = XENOCOCCUS Thuret, 1875.
- COLEOSPERMUM Kirchner in Cohn, 1878, Krypt.-fl. Schlesiens 2: 239.  
 Nostocales, Microchaetaceae, Microchaetoideae  
**T** = *Coleospermum goeppertianum* Kirchner, 1878, l.c.: 239.  
 = MICROCHAETE Thuret ex Bornet et Flahault, 1886, nom. cons.
- CORYNEPHORA Kützing, 1843, Phyc. Gener., p. 177; pro syn.  
 Chroococcales, Entophysalidaceae  
**T** = *Corynephora granulosa* Kützing, 1843, l.c.: 177.  
 = ENTOPHYSALIS Kützing, 1843, l.c.: 177.
- CROATELLA Ercegović, 1925, Acta Bot. Inst. R. Univ. Zagreb 1: 92.  
 Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = *Croatella lithophila* Ercegović, 1925, l.c.: 91.  
 = PETALONEMA Berkeley ex Correns, 1889 (incl.).
- CYANARCUS Pascher, 1914, Ber. Deutsch. Bot. Ges. 32: 351.  
 Oscillatoriales, Gomontiellaceae, Gomontelloideae  
**T** = *Cyanarcus hamiformis* Pascher, 1914, l.c.: 351.  
 = GOMONTIELLA Teodoresco, 1901 (incl.).
- CYANODERMA Hansgirg, 1890, Phys. algol. Mitt. Sitzungsb. Kgl. Böhm. Acad. 1890(2): 91.  
 Chroococcales, Hydrococcaceae, Hydrococcoideae  
**T** = *Pleurocapsa bradypodis* Hansgirg, 1890, l.c.: 92.  
 = PLEUROCAPSA Thuret ex Hauck, 1885.
- CYANOGLASTRUM Schiller, 1956, Ergebn. Dtsch. Limnol. Venezuela-Exp. 1952, p. 204.  
 Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Cyanogastrum variabile* Schiller, 1956, l.c.: 204.  
 = ? APHANOTHECE Nägeli, 1849, (incl.), nom. cons.; (probably special subgenus).

- CYANOHYDNUM Copeland, 1936, Ann. N. Y. Acad. Sci. 36: 199.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Cyanohydnium ciliatum* Copeland, 1936, l.c.: 199.  
 = SYMPLOCA Kützing ex Gomont, 1892 (incl.).
- CYANOSPIRA Florenzano et al., 1985, Arch. Microbiol. 140: 305; (invalid; nomen nudum).  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = *Cyanospira rippkae* Florenzano et al., 1985, l.c.: 305.  
 = ANABAENOPSIS (Wołoszyńska) Miller, 1923.
- CYANOTHRIX Schmidle, 1897, All. bot. Ztschr. 3(3): 37.  
 Cyanopyceae, Stigonematales, Mastigocladaceae  
**T** = *Cyanothrix vaginata* Schmidle, 1897, l.c.: 37.  
 = HAPALOSIPHON Nägeli in Kützing et Flahault, 1886.
- CYANOTHRIX Gardner, 1927, Mem. N. Y. Bot. Garden 7: 30; (later homonym).  
 Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Cyanothrix pimaria* Gardner, 1927, l.c.: 30.  
 = JOHANNESBAPTISTIA De-Toni, 1934.
- CYSTOCOLEUS Thuret, 1875, Ann. Sci. Nat.-Bot. 6, 1: 376; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Symphosiphon minor* Hilse, 1865, Jahresb. Schles. Ges. Vaterl. Cultur 1864: 94 = *Cystocoleus minor* Thuret, 1875, l.c.: 381].  
 = HYDROCORYNE S. H. Schwabe ex Bornet et Flahault, 1886.
- DASYACTIS Kützing, 1843, Phycol. gener., p. 239; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** = [*Dasyactis salina* Kützing, 1843, l.c.: 239].  
 = RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886.
- DASYGLOEA Thwaites ex Gomont, 1892, Ann. Sci. Nat.-Bot. 7, 15: 346.  
 Oscillatoriales, Phormidiaceae, Microcoleoideae  
**T** = [*Dasygloea amorpha* Thwaites, 1848] ex Gomont, 1892, l.c.: 347.  
 = SIROCOLEUM Kützing ex Gomont, 1892 (incl.).
- DESMARESTELLA Bory, 1824, Dict. class. Hist. Nat. 5: 438; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** = [*Desmarestella confervicola* Bory, 1824, l.c.: 438; sec. Gaillon, 1833, Mém. Soc. Emulat. Abbeville 1833: 476].  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886.
- DESMONEMA Berkeley et Thwaites ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot. 7, 5: 126; (later homonym).  
 Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = [*Microcoleus dillwynii* Harvey, 1841, Man. Brit. Alg., p. 169 = *Desmonema dillwynii* Berkeley et Thwaites, 1849, Suppl. Engl. Bot., pl. 2958] ex Bornet et Flahault, 1886, l.c.: 127.  
 = COLEODESMIUM Borzì ex Geitler, 1942.

- DICTYOTHRIX Kützing (1843) ex Forti, 1907, Syll. Myxoph., p. 308.  
 Oscillatoriales, Schizotrichaceae  
**T** = [*Dictyothrix lateritia* Kützing, 1843, Phyc. Gener., p. 202] ex Forti, 1907, l.c.: 308.  
 = SCHIZOTHRIX Kützing ex Gomont, 1892.
- DILLWYNELLA Bory, 1824, Dict. Class. Hist. Nat. 5: 507.  
 Nostocales, Scytonemataceae  
**T** = [*Conferva mirabilis* Dillwyn, 1808, Brit. Conf., pl. 96 = *Dilwynella serpentina* Bory, 1824, l.c.: 507] = *Dilwynella mirabilis* Kuntze, 1891, Rev. Gen. Pl. 2: 892.  
 = SCYTONEMA Agardh ex Bornet et Flahault, 1886.
- DIPLOCOLON Nägeli ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot. 7, 5: 129.  
 Nostocales, Scytonemataceae  
**T** = [*Diplocolon heppii* Nägeli in Itziksohn, 1855, Verh. Leop.-Carol. Acad. Naturf. 18: 160] ex Bornet et Flahault, 1886, l.c.: 129.  
 = SCYTONEMA Agardh ex Bornet et Flahault, 1886 (incl.).
- DIPLOCYSTIS Trevisan, 1848, Sagg. Monogr. Alg. Coccot., p. 40.  
 Chroococcales, Microcystaceae  
**T** = *Micraloa aeruginosa* Kützing, 1833: 371 = *Diplocystis aeruginosa* Trevisan, 1848, l.c.: 40.  
 = MICROCYSTIS Kützing ex Lemmermann, 1907, nom. cons.
- DIPLONEMA Borzì, 1917, N. Giorn. Bot. Ital. 24: 103; (later homonym).  
 Stigonematales, Borzinemataceae  
**T** = *Diplonema rupicola* Borzì, 1917, l.c.: 103.  
 = BORZINEMA De-Toni, 1936.
- DIPLOTRICHIA J. Agardh, 1842, Alg. mar. medit. adriat., p. 10; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** = [*Diplotrichia polyotis* J. Agardh, 1842, l.c.: 10].  
 = RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886.
- DOLICHOSPERMUM Thwaites in Ralfs, 1843, Ann. Nat. Hist. 11: 161.  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Sphaerozyga ralfsii* Thwaites in Harvey, 1849, Man. Brit. Mar. Alg., p. 233 = *Dolichospermum thwaitesii* Ralfs, 1850, Ann. Mag. Nat. Hist., Ser. 2, 5: 337] ex Bornet et Flahault 1886, Ann. Sci. Nat.-Bot. 7,5: 234 = *Anabaena oscillarioides* Bory ex Bornet et Flahault 1886, l.c.: 233.  
 = ANABAENA Bory ex Bornet et Flahault, 1886.
- DOLICHOSPERMUM [Harvey, 1849, Man. Brit. Mar. Alg., p. 233; sec. Ralfs, 1850, Ann. Mag. Nat. Hist., Ser. 11, p. 325] ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot. 7,5: 228, sub sectio.  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Dolichospermum thompsonii* Ralfs, 1850, l.c.: 336] = *Anabaena circinalis* Rabenhorst ex Bornet et Flahault, 1886, l.c.: 230-231.  
 = ANABAENA Bory ex Bornet et Flahault, 1886; (subgenus?).
- DRILOSIPHON Kützing, 1843, Phycol. gener., p. 214; (pre-starting-point syn.).  
 Nostocales, Scytonemataceae  
**T** = *Drilosiphon muscicola* Kützing, 1843, l.c.: 214.  
 = SCYTONEMA C.A. Agardh et Bornet et Flahault, 1886.

- ECHEVERRIOPSIS Kufferath, 1929, Ann. crypt. exot. 2: 49.  
 Nostocales, Nostocaceae, Nostocoideae  
 T = Hormogonia of an undefined *Nostoc*-species.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886.
- ELEUTHERONEMA Weber van Bosse in Borzi, 1914, N. Giorn. Bot. Ital. 21: 354; (nomen nudum).  
 Stigonematales, Mastigocladaceae  
 T = ? *Herpyzonema intermedium* Weber van Bosse, 1913, Siboga Exped. 1913: 36.  
 = HERPYZONEMA Weber van Bosse, 1913.
- ENDONEMA Pascher, 1929, Jahrb. Wiss. Bot. 70: 347; (later homonym).  
 Chroococcales, Hydrococcaceae, Pascherinematoideae  
 T = *Endonema moniliforme* Pascher, 1929, l.c.: 346.  
 = PASCHERINEMA De-Toni, 1936.
- ENDOSPORA Gardner, 1927, Mem. N. Y. Bot. Garden 7: 27.  
 Chroococcales  
 T = *Endospora rubra* Gardner, 1927, l.c.: 28.  
 = CYANOSARCINA Kováčik, 1988 and MYXOSARCINA Printz, 1921.
- FISCHERA S. H. Schwabe, 1837, Linnaea: 124; (pre-starting-point syn.).  
 Stigonematales, Fischerellaceae  
 T = *Fischera thermalis* S. H. Schwabe, 1837, l.c.: 124.  
 = FISCHERELLA (Bornet et Flahault) Gomont, 1895.
- FREMYELLA De-Toni, 1936, Noter. Nom. Alg. 8: 3.  
 Nostocales, Microchaetaceae, Microchaetoideae  
 T = *Microchaete grisea* Thuret ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot., 7,5: 83 =  
*Fremyella grisea* De-Toni, 1936, l.c.: 4.  
 = MICROCHAETE Thuret ex Bornet et Flahault, 1886, nom. cons.
- GAILLARDOTELLA Mougeot, 1898, Stirpes Vogesorhen. 8, nr. 796; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
 T = [*Tremella natans* Hedwig, 1798, Theoria Gener. Fructiv. Pl. Crypt. Linn., Retr. Aucta, p. 218 = *Gaillardotella natans* Bory in Mougeot et Nestler, 1823, Crypt. Vogesorhen.8: 796].  
 = GLOEOTRICHIA J. Agardh ex Bornet et Flahault, 1886.
- GEITLERIELLA De-Toni, 1930, Noter. Nomencl. Algol. 8: 5.  
 Chroococcales, Hyellaceae, Hyelloideae  
 T = *Radaisia subimmersa* Setchell et Gardner, 1918: 446 = *Geitleriella subimmersa* De-Toni, 1930, l.c.: 5.  
 = CYANODERMA Weber van Bosse 1887 (incl.).
- GEOCYCLUS Kützing, 1843., Phycol. Gener., p. 235; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
 T = *Geocyclus oscillarinus* Kützing, 1843, l.c.: 235.  
 = RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886.

- GLAUCOTHRIX Kirchner in Cohn, 1878, Kryptogamenfl. Schlesiens 2: 229; (pre-starting-point syn.).  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Glaucothrix putealis* Kirchner, 1878, l.c.: 229.  
 = ? PSEUDOPHORMIDIUM (Forti) Anagnostidis et Komárek, 1988; (after Drouet, 1968: bacteria).
- GLOEOCHLAMYS Schmidle in Simmer, 1899, Allg. Bot. Ztschr. 12: 192.  
 Nostocales, Scytonemataceae  
**T** = *Gloeochlamys simmerii* Schmidle in Simmer, 1899, l.c.: 192.  
 = SCYTONEMA C. A. Agardh ex Bornet et Flahault, 1886.
- GODLEWSKIA Janczewski, 1883, Ann. Sci. Nat., VI. Bot. 16: 227 (? valid genus).  
 Chroococcales, Chamaesiphonaceae  
**T** = *Godlewskia aggregata* Janczewski, 1883, l.c.: 229.  
 = CHAMAESIPHON A. Braun, 1865 (incl., subgenus).
- GONIDIUM Ehrenberg ex Meneghini, 1840, Linnaea 14: 213.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Gonium glaucum* Ehrenberg, 1838, Infusionsth., p. 58 (Drouet & Daily, 1956); *Trochiscia prasiola* Meneghini, 1837, Consp. Algol. Eujan., p. 334 = *Gonidium prasiola* Meneghini, 1840, l.c.: 214.  
 = MERISMOPEDIA Meyen, 1839.
- HALIARACHNE Lemmermann, 1899, Abh. Naturw. Ver. Bremen 16: 353.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Haliarachne lenticularis* Lemmermann, 1899, l.c.: 354  
 = TRICHODESMIUM Ehrenberg ex Gomont, 1892, nom. cons. (incl.).
- HELIOTRICHUM Wille ex Schütt, 1893, Pflanzenleben Hochsee, p. 39.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Heliostrichum radians* Wille ex Schütt, 1893, l.c.: 40.  
 = TRICHODESMIUM Ehrenberg ex Gomont, 1892, nom. cons.
- HETERACTIS Kützing, 1843, Phycol. gener., p. 239; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** = *Heteractis mesenterica* Kützing, 1843, l.c.: 236.  
 = RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886.
- HETEROHORMOGONIUM Copeland, 1936, Ann. N. Y. Acad. Sci. 36: 64.  
 Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Heterohormogonium schizodichotomum* Copeland, 1936, l.c.: 65.  
 = JOHANNESBAPTISTIA De-Toni, 1934.
- HILSEA Kirchner, 1878, Kryptogamenfl. Schlesiens 2: 239; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Symphyosiphon minor* Hilse, 1865, Jahresb. Schles. Ges. Vaterl. Cultur, 1864: 94 = *Hilsea tenuissima* Kirchner, 1878, l.c.: 239].  
 = HYDROCORYNE S. H. Schwabe ex Bornet et Flahault, 1886.

- HOLOPEDIUM (Lagerheim) Lagerheim, 1893, Nuova Notarisia 4: 209.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Merismopoedia geminata* Lagerheim, 1883: 43 = *Holopedium geminatum* Lagerheim, 1893, l.c.: 209.  
 = MICROCROCIS P. Richter, 1892.
- HORMACTIS Thuret, 1875, Ann. Sci. Nat.-Bot. 6, 1: 376; (pre-starting-point syn.).  
 Stigonematales, Mastigocladaceae  
**T** = *Hormactis balani* Thuret, 1875, l.c.: 382.  
 = BRACHYTRICHIA Zanardini ex Bornet et Flahault, 1886.
- HORMATHONEMA Ercegović, 1929, Arch. Protistenk. 66: 165.  
 Chroococcales, Hyellaceae, Solentioideae  
**T** = *Hormathonema paulocellulare* Ercegović, 1929, l.c.: 165.  
 = SOLENTIA Ercegović, 1927.
- HORMOSIPHON Kützing, 1843, Phycol. gener., p. 209; (pre-starting-point syn. ).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Hormosiphon furfuraceus* Kützing, 1843, l.c.: 209 = *Nostoc furfuraceum* Kützing, 1843, l.c.: 209, pro syn.].  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886
- HYDROEPICOCCUM De-Notaris, 1869, Erb. Crittog. Ital., ser. 2, 4: 178.  
 Chroococcales, Merismopediaceae, Gomphosphaerioideae,  
**T** = *Hydroepicoccum genuense* De-Notaris, 1869, l.c.: 178.  
 = COELOSPHAERIUM Nägeli 1849.
- HYELLOCOCCUS Schmidle, 1906, Allg. Bot. Ztschr. 11: 64.  
 Chroococcales, Chamaesiphonaceae  
**T** = *Hyelococcus niger* Schmidle, 1906, l.c.: 64.  
 = CHAMAESIPHON A. Braun, 1864.
- HYPHEOTHRIX Kützing, 1843, Phycol. gener., p. 229; (pre-starting-point syn.).  
 Oscillatoriales, Schizotrichaceae  
**T** = [*Sclerothrix callitrichae* Kützing, 1833, Alg. Aq. Dulc. Dec. 2: 17 = *Hypheothrix callitrichae* Kützing, 1843, l.c.: 229.  
 = SCHIZOTHRIX Kützing ex Gomont, 1892, p. p.
- HYPHEOTHRIX (Gomont ex Gomont) Kirchner, 1898. In Engler & Prantl, Nat. Pflanzenfam. 1(1a): 67.  
 Oscillatoriales, Schizotrichaceae  
**T** = not designatus  
 = SCHIZOTHRIX Kützing ex Gomont, 1892 (subgenus), or PHORMIDIUM Kützing ex Gomont, 1892.
- INACTIS Kützing, 1843, Phycol. gener., p. 202; (pre-starting-point syn.).  
 Oscillatoriales, Schizotrichaceae  
**T** = [*Inactis tornata* Kützing, 1843, l.c.: 202].  
 = SCHIZOTHRIX Kützing ex Gomont, 1892 (subgenus).

- INACTIS (Gomont) Kirchner, 1898, Engler & Prantel, Nat. Pflanzenfam. 1, 1a: 68.  
 Oscillatoriales, Schizotrichaceae  
**T** = *Inactis vaginata* (Gomont) Forti in De-Toni, 1907, Syll. Alg., 5: 354.  
 = SCHIZOTHRIX Kützing ex Gomont, 1892?
- INACTIS Thuret, 1875, Ann. Sci. Nat.-Bot. 6, 1: 375; (pre-starting-point syn.).  
 Oscillatoriales, Schizotrichaceae  
**T** =  
 = SCHIZOTHRIX Kützing ex Gomont, 1892?
- INOCONIA Libert, 1827, Ann. Soc. Linn. Paris 5: 402; (pre-starting-point syn.).  
 Nostocales, Scytonemataceae  
**T** = [*Inoconia michelii* Libert, 1827, l.c.: 403].  
 = SCYTONEMA C. A. Agardh ex Bornet et Flahault, 1886.
- INOMERIA Kützing, 1845, Phycol. german., p. 191; (pre-starting-point syn.).  
 Oscillatoriales, Schizotrichaceae  
**T** = [*Inomeria roemeriana* Kützing, 1845, l.c.: 191].  
 = SCHIZOTHRIX Kützing ex Gomont, 1892, p. p.
- KUETZINGINA Kuntze, 1898, Rev. Gener. Pl. 3(3): 411.  
 Oscillatoriales, Homoeotriehaceae, Homoeotrichoideae  
**T** = [*Amphithrix amoena* Kützing, 1843, Phyc. Gener., p. 220] = *Kuetzingina amoena* Kuntze, 1898, l.c.: 411.  
 = AMPHITHRIX Bornet et Flahault, 1886 = HOMOEOTHRIX (Thuret ex Bornet et Flahault) Kirchner, 1898, nom. cons.
- KYANOSTICHUS Romanov, 1966, Two New Algae from a California Oxid. Pond, p. 1.  
 Oscillatoriales, Schizotrichaceae  
**T** = *Kyanostichus dexter* Romanov, 1966, l.c.: 1.  
 = SCHIZOTHRIX Kützing, 1892.
- LAUTERBORNIA Pringsheim, 1968, Arch. Microbiol. 63: 1-6.  
 Chroococcales, Synechococcaceae, Synechococcoideae  
**T** = *Lauterbornia nidulans* Pringsheim, 1968, l.c.: 1-6.  
 = SYNECHOCOCCUS Nägeli, 1849 (incl.).
- LEIBLEINIA Endlicher, 1836, Gen. plant., p. 5; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** = [*Conferva mucor* Roth, 1797, Catal. Bot. 1: 191 = *Leibleinia confervicola* Endlicher, 1843, Mant. Bot. Altera Sist. Gen. Pl., Suppl. 3: 21].  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886.
- LEIBLEINIA Meneghini, 1838, Cenni Algh., p. 31; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** =  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886.
- LEIBLEINIA Kützing, 1843, Phycol. gener., p. 221; (pre-starting-point syn.).  
 Oscillatoriales, Pseudanabaenaceae  
**T** =  
 = LEIBLEINIA (Gomont) L. Hoffmann, 1895.

- LEMMERMANNIA Elenkin, 1933, Acta Inst. Bot. Acad. Sci. USSR, 2, 1: 26; (later homonym).  
 Chroococcales, Synechococcaceae, Aphanothecoideae  
**T** = *Coelosphaerium pallidum* Lemmermann, 1898: 154 = *Lemmermannia palida* Elenkin, 1933, l.c.: 25.  
 = LEMMERMANNIELLA Geitler, 1942.
- LEPTOBASIS Elenkin, 1915, Bull. Jard. Imp. Pierre le Grande 15: 21; (later homonym).  
 Nostocales, Microchaetaceae, Microchaetoideae  
**T** = *Leptobasis caucasica* Elenkin, 1915, l.c.: 6-22.  
 = FORTIEA De-Toni, 1936.
- LEPTOCHAETE Borzì, 1882, ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot. 7, 3: 341.  
 Oscillatoriales, Homoeotrichaceae, Homoeotrichoideae  
**T** = [*Leptochaete crustacea* Borzì, 1882, N. Giorn. Bot. Ital. 14(4): 298] ex Bornet et Flahault, 1886, l.c.: 341.  
 = HOMOEOTHRIX (Thuret ex Bornet et Flahault) Kirchner, 1898, nom. cons.; (pro parte trichali).
- LIMNANTHE [Kützing, 1843] ex Forti, 1907, Syll. Myxoph., p. 468.  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Byssus flos-aquae* Linnaeus, 1753, Sp. Pl., p. 1168 = *Limnanthe linnaei* Kützing, 1843, Linnaea 17: 86] ex Forti, 1907, l.c.: 469.  
 = APHANIZOMENON Morren ex Bornet et Flahault, 1886
- LIMNOCHLIDE [Kützing, 1843] ex Hansgirg, 1892, Prodr. Algenfl. Böhm. 2: 73.  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Byssus flos-aquae* Linnaeus, 1753, Sp. Pl., p. 1168 = *Limnochlide flos-aquae* Kützing, 1843, Phycol. gener., p. 203] ex Hansgirg, 1892, l.c.: 73.  
 = APHANIZOMENON Morren ex Bornet et Flahault, 1886.
- LINCKIA Wiggers, 1780, Prim. Fl. Holsat. 94; (pre-starting-point syn., mixed with Xanthophyceae ?).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = not designatus  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886
- LINCKIA [Micheli ex Adanson, 1763, Fam. Pfl. 2: 13, pro syn.] Roth, 1802, Neue Beitr. Bot. 1: 297; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Tremella nostoc* Linnaeus, 1753, Sp. Pl., ed.1, 2: 1157 = *Linckia nostoc* Roth, 1802, l.c.: 304].  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886.
- LINCKIELLA Gaillon, 1833, Tab. Synopt. Meth. Gen. Némazoaires, p. 29; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** =  
 = GLOEOTRICHIA J. Agardh ex Bornet et Flahault, 1886, or RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886.

- LINKIA [Micheli] ex Adanson, 1763, Fam. Pfl. 2: 13, pro syn.; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Tremella nostoc* Linnaeus, 1753, Sp. Pl., ed.1, 2: 1157 = *Linkia terrestris* Micheli ex Adanson, 1763, l.c.: 13] = *Nostoc comune* Vaucher ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot., 7,5: 203.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886.
- LITHONEMA Ercegović, 1929, Ann. Protist. 2: 136; (later homonym).  
 Stigonematales, Mastigocladaceae  
**T** = *Lithonema adriaticum* Ercegović, 1929, l.c.: 138.  
 = ADRIANEMA De-Toni, 1936.
- LOPHOPODIUM Kützing, 1849, Tab. phycol. 1: 45; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** =  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886.
- LPP-group A sensu Rippka et al., 1979, J. Gener. Microbiol. 111: 29-34.  
 Oscillatoriales, Oscillatoriaceae, Oscillatorioidae  
**T** = strain PCC 7419, Rippka et al., 1979, l.c.: 34.  
 = LYNGBYA C. Agardh ex Gomont, 1892.
- LPP-group B sensu Rippka et al., 1979, J. Gener. Microbiol. 111: 29-34.  
 Oscillatoriales, Pseudanabaenaceae  
**T** = not determined (? strain PCC 6306, Rippka et al., 1979, l.c.: 33).  
 = LEPTOLYNGBYA Anagnostidis et Komárek, 1988.
- LUNOEVIA Sukačev, 1908, J. Bot. Soc. Imp. Nat. St.-Petersb. 3: 124.  
 Stigonematales, Mastigocladaceae  
**T** = *Lunoevia sphaerica* Sukačev, 1908, l.c.: 124-136.  
 = HAPALOSIPHON Nägeli in Kützing ex Bornet et Flahault, 1886.
- MASTICHONEMA Kützing, 1843, Phycol. gener., p. 232; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** =  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886.
- MASTIGONEMA S. H. Schwabe, 1837, Linnaea 11: 112; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** = [*Oscillatoria subulata* Corda in de-Carro, 1835, Alman. Carlsbad 5: 183 = *Mastigonema thermale* S.H. Schwabe, 1837, l.c.: 112].  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886
- MAZAEA Bornet et Grunow, 1881, Bull. Soc. Bot. Fr. 33: 287; (pre-starting-point syn.).  
 Stigonematales, Nostochopsaceae  
**T** = [*Mazaea rivularioides* Bornet et Grunow, 1881, l.c.: 287].  
 = NOSTOCHOPSIS Wood ex Bornet et Flahault, 1886.

- MERISMOPOEDIA Kützing, 1843, Phyc. Gener., p. 163.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Merismopoedia punctata* Meyen, 1839: 440 = *Merismopoedia punctata* Meyen in Kützing, 1843, l.c.: 163.  
 = MERISMOPEdia Meyen 1839, nom. cons.
- MONOCAPSA Itzigsohn in Rabenhorst, 1853, Alg. Sachsen. 27/28: 263.  
 Chroococcales, Microcystaceae  
**T** = *Monocapsa stegophila* Itzigsohn in Rabenhorst, 1853, l.c.: 263.  
 = GLOEOCAPSA Kützing, 1843, nom. cons.
- MONORMIA Berkeley, 1832, Glean. Brit. Alg., p. 46; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Monormia intricata* Berkeley, 1832, l.c.: 46].  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886.
- MYRIONEMA J. Agardh, 1842, Alg. Mar. Medit. Adriat., p. 32.  
 Chroococcales, Entophysalidaceae  
**T** = *Myrionema crustaceum* J. Agardh, 1842, l.c.: 32.  
 = ENTOPHYSALIS Kützing, 1843.
- MYXODERMA Hansgirg, 1890, Phys. Algol. Mitt. Sitzungsab. Kgl. Böhm. Acad. 1890: 91.  
 Chroococcales, Hydrococcaceae, Hydrococcoideae  
**T** = *Cyanoderma rivulare* Hansgirg, 1888, Notarisia 4: 658 = *Myxoderma rivulare* Hansgirg, 1890, l.c.: 91.  
 = PLEUROCAPSA Thuret ex Hauck, 1885.
- MYXODERMA Schmidle, 1901, Engl. Bot. Jahrb. Syst. 30: 246.  
 Stigonematales, Nostochopsaceae  
**T** = *Myxoderma goetsei* Schmidle, 1901, l.c.: 246.  
 = NOSTOCHOPSIS Wood ex Bornet et Flahault, 1886.
- NEMATONOSTOC [Nylander, 1873] ex Elenkin, 1934, Priroda 20(10): 969-970.  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Nematonostoc rhizomorphoides* Nylander, 1873, Bull. Soc. Bot. Fr. 20: 263]; [*Nostoc flagelliforme* Berkeley et Curtis in Berkeley, 1857, Introd. Crypt. Bot., p. 142] = *Nematonostoc flagelliforme* Elenkin, 1931, Priroda 1931 (10): 982.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886 (incl.).
- NEMATORADAISSIA Geitler, 1925, Beih. Bot. Centralbl. 41(2): 242.  
 Chroococcales, Hyellaceae, Hyelloideae  
**T** = *Radaisia laminariae* Setchell et Gardner, 1918: 444 = *Nematoradaisia laminariae* Geitler, 1925, l.c.: 242.  
 = CYANODERMA Weber van Bosse, 1887 (incl.).
- NEOADELIA Bompard, 1867, Hedwigia 9: 1; (pre-starting-point syn.).  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = [*Neoadelia fimbriata* Bompard, 1867, l.c.: 1].  
 = SYMPLOCA Kützing ex Gomont, 1892.

- NOSTOC Geoffrey ex Linné, 1753, Sp. Plant., ed. 1,2: 1157; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Tremella nostoc* Linneaus, 1753, l.c.: 1157] = *Nostoc comune* Vaucher ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot., 7,5: 203.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886
- NOSTOCELLA Gaillon, 1833, Ap. Hist. Nat., p. 28.  
 Chroococcales, Entophysalidaceae  
**T** = *Nostocella lemaniae* (Agardh) Gaillon, 1833, l.c.: 28.  
 = ENTOPHYSALIS Kützing, 1843, nom. cons. prop.
- NOSTOCUS Rafinesque ex Geitler pro synonym., 1942, Nat. Pflanzenf. 2. Aufl. 1b:188; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Tremella nostoc* Linneaus, 1753, l.c.: 1157] = *Nostoc comune* Vaucher ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot., 7,5: 203.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886
- NOSTOCHIUM Link in Nees, 1820, Hor. Phys. Berol., p. 6; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Tremella nostoc* Linneaus, 1753, l.c.: 1157] = *Nostoc comune* Vaucher ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot., 7,5: 203.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886.
- ONCOBYRSA Agardh, 1827, Flora 10(2): 629.  
 Chroococcales, Hydrococcaceae  
**T** = *Oncobyrsa fluviatilis* Agardh, 1827, l.c.: 629.  
 = ? PLACOMA Schousboe ex Bornet et Thuret, 1876; (after Drouet & Daily, 1956: Fungi with spores).
- ONCOBYRSA Meneghini, 1843, Atti R. Accad. Sci. Torino, ser. 2, 5: 95.  
 Chroococcales, Hydrococcaceae, Hydrococcoideae  
**T** = *Oncobyrsa brebissonii* Meneghini, 1843, l.c.: 96.  
 = HYDROCOCCUS Kützing, 1833, nom. cons.
- OSCILLATORIA sect. AEQUALES Gomont, 1892, Ann. Sci. Nat. VII, Bot. 16: 202.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = [*Oscillatoria (Oscillaria) irrigua* Kützing, 1843, Phyc. Gener., p. 189] ex Gomont, 1892, l.c. : 218.  
 = PHORMIDIUM Kützing ex Gomont, 1892.
- OSCILLATORIA sect. PROLIFICA Gomont, 1892, Ann. Sci. Nat. VII, Bot. 16: 199.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = [*Lyngbya prolifica* Greville, 1828, Scott. Crypt. Fl. 6: 303] = *Oscillatoria prolifica* Gomont, 1892, l.c.: 205 = *Planktothrix prolifica* (Gomont) Anagnostidis et Komárek, 1988.  
 = PLANKTOTHRIX Anagnostidis et Komárek, 1988.
- OSCILLATORIELLA Gaillon, 1833, Aperçu Hist. Nat., p. 28; (pre-starting-point syn.)  
 Oscillatoriales, Oscillatoriaceae, Oscillatorioideae  
**T** = [? *Oscillatoria princeps* Vaucher, 1803, Hist. Conf. Eau Douce, p. 190].  
 = OSCILLATORIA Vaucher ex Gomont, 1892.

- PELAGOTHRIX J. Schmidt, 1902, Vidensk. Medd. Nat. Foren. Kjobenhavn, 1901: 144.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
 T = *Pelagothrix clevei* J. Schmidt, 1902, l.c.: 144.  
 = TRICHODESMIUM Ehrenberg ex Gomont, 1892, nom. cons.
- PHAEODERMATIUM Hansgirg, 1889, Notarisia 4: 658.  
 Chroococcales, Entophysalidaceae,  
 T = *Phaeodermatium rivulare* Hansgirg, 1889, l.c.: 658.  
 = ENTOPHYSALIS Kützing, 1843.
- PHYSACTIS Kützing, 1843, Phycol. gener. p. 235.; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
 T = [*Physactis lobata* Kützing, 1843, l.c.: 236].  
 = RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886, p. p.
- PLANOSPHERULA Borzì, 1905, Nuova Notarisia, ser. 16: 20.  
 Chroococcales, Merismopediaceae, Gomphosphaerioideae  
 T = *Planosphaerula natans* Borzì, 1905, l.c.: 20.  
 = COELOSPHAERIUM Nägeli, 1849.
- PLAXONEMA Tangl, 1884, Denkschr. K. Akad. Wiss. Wien, mat.-nat., 48: 1; (pre-starting-point syn.).  
 Oscillatoriales, Oscillatoriaceae  
 T = [*Plaxonema oscillans* Tangl, 1884, l.c.: 1].  
 = OSCILLATORIA Vaucher ex Gomont, 1892, or LYNGBYA C. Agardh ex Gomont, 1892.
- POLYCOCCUS Kützing, 1841, Naturk. Verh. Holl. Maatsch. Wetensch. Haarlem 2(1): 67; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
 T = [*Polycoccus punctiformis* Kützing, 1841, l.c.: 67] = *Nostoc punctiforme* Hariot, 1891, J. Bot. 5: 31.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886?
- POLYCYSTIS (Kützing) Kützing, 1849, Spec. Alg., p. 210.  
 Chroococcales, Microcystaceae  
 T = *Micraloa aeruginosa* Kützing, 1833: 371 = *Polycystis aeruginosa* Kützing, 1849, l.c.: 210.  
 = MICROCYSTIS Kützing ex Lemmermann, 1907, nom. cons.
- POLYTHRIX [Zanardini, 1872] ex Bornet et Flahault, 1886, Ann. Sci. Nat.-Bot. 7,3: 380; (later homonym).  
 Nostocales, Rivulariaceae  
 T = [*Polythrix spongiosa* Zanardini, 1872, Phyc. Indic. Pugill., p. 32] = *Polythrix corimbosa* Grunow ex Bornet et Flahault, 1886, l.c.: 380.  
 = GARDNERULA De-Toni, 1936.
- POTARCUS [Rafinesque, 1819] ex Kuntze (sub. "Portacus"), 1891, Rev. Gener., Pl. 2: 911; (in Kuntze, not sensu Rafinesque).  
 Nostocales, Rivulariaceae  
 T = [*Potarcus bicolor* Rafinesque, 1819, J. Phys. 89: 107] ex Kuntze, 1891, l.c.: 911.  
 = GLOEOTRICHIA J. Agardh ex Bornet et Flahault, 1886.

- PSEUDOHOLOPEDIA (Ryppowa) Elenkin, 1938, Monogr. Alg. Cyanoph. URSS 1: 539.  
 Chroococcales, Merismopediaceae, Merismopedioideae  
**T** = *Merismopedia gigas* Ryppowa, 1925: 462 = *Pseudoholopedia convoluta* (Brébisson) Elenkin, 1938, l.c.: 86, pro typo (non sensu Elenkin).  
 = MICROCROCIS P. Richter, 1892 (incl.).
- PSEUDONOSTOC Elenkin, 1949, Monogr. Alg. Cyanoph. URSS, pars spec. 2: 1225.  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = *Pseudonostoc richteri* Elenkin, 1949, l.c.: 1226.  
 = ISOCYSTIS Borzì ex Bornet et Flahault, 1888 (incl.).
- PSEUDOSPELAEOPOGON Elenkin, 1949, Monogr. Alg. Cyanoph. URSS, pars spec. 2: 1839.  
 Stigonematales, Borzinemataceae  
**T** = *Spelaeopogon lucifugus* Borzì, 1917, N. Giorn. Bot. Ital., n. ser. 24: 107 = *Pseudospelaeogon lucifugus* Elenkin, 1949, l.c.: 1840.  
 = SPELAEOPOGON Borzì, 1905 (incl.).
- RACIBORSKIA Koczwara, 1929, Kosmos 53: 108; (later homonym).  
 Oscillatoriales, Pseudanabaenaceae  
**T** = *Arthrospira leopoliensis* Raciborski, 1910, Phyc. Polon. 1: 9 = *Raciborskia leopoliensis* Koczwara, 1929, l.c.: 107.  
 = ROMERIA Koczwara in Geitler, 1932.
- RADAISIELLA Geitler, 1925, Beih. Bot. Centralbl. 2, 41: 242.  
 Chroococcaceae, Hydrococcaceae, Hydrococcoideae  
**T** = *Radaisia subimmersa* Setchell et Gardner, 1918: 446 = *Radaisiella subimmersa* Geitler, 1925, l.c.: 242.  
 = CYANODERMA Weber van Bosse 1887 (incl.).
- RHODOCOCCUS Hansgirg in Wittrock et Nordstedt, 1884, Alg. Exsicc. 14: 697.  
 Chroococcales, Chroococcaceae  
**T** = *Rhodococcus caldarium* Hansgirg, 1884, l.c.c: 697.  
 = CHROOCOCCUS Nägeli, 1849 (?).
- RIVULARIOPSIS (Kirchner sub sectio) Voronichin, 1923, Bot. Mat. Inst. Spor. Rast. Gl. Bot. Sada Petrohrad 1(8): 115.  
 Nostocales, Rivulariaceae  
**T** = *Calothrix vemberensis* Hieronymus et Schmidle in Kirchner, 1900, Nat. Pfl.-f. 1(1A): 87 = *Rivulariopsis floccosa* Voronichin, 1923, l.c.: 115.  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886 (subgenus?).
- SCHIZODICTYON Kützing, 1943, Phycol. Gener., p. 230; (pre-starting-point syn.).  
 Oscillatoriales, Schizotrichaceae  
**T** = *Schizodictyon purpurascens* Kützing, 1843, l.c.: 230.  
 = SCHIZOTHRIX Kützing ex Gomont, 1892.
- SCHIZOSIPHON Kützing, 1843, Phycol. Gener., p. 233; (pre-starting-point syn.).  
 Nostocales, Rivulariaceae  
**T** = [*Scytonema salinum* Kützing, 1836, Alg. Aq. Dulc. Germ. Dec. 14: 136 = *Schizosiphon salinus* Kützing, 1843, l.c.: 233].  
 = CALOTHRIX Agardh ex Bornet et Flahault, 1886

- SCLEROTHRIX** Kützing, 1833, Alg. Aq. Dulc., Dec. 2, 17; (pre-starting-point syn.).  
 Nostocales, Microchaetaceae, Tolypotrichoideae  
**T** = *Sclerothrix callitrichae* Kützing, 1833, l.c.: 17.  
 = **TOLYPOTHRIX** Kützing ex Bornet et Flahault, 1886.
- SCOPULONEMA** Ercegović, 1930, Arch. Protistenk. 71: 365.  
 Chroococcales, Hydrococcaceae, Hydrococcoideae  
**T** = *Scopulonema hansgirgianum* Ercegović, 1930, l.c.: 365.  
 = **PLEUROCAPSA** Thuret et Hauck, 1885.
- SCYTHYMENIA** Agardh, 1824, Syst. Algarum.  
 Stigonematales, Stigonemataceae  
**T** =  
 = **STIGONEMA** Agardh ex Bornet et Flahault, 1886.
- SETCHELLIELLA** De-Toni, 1936, Noter. Nom. Alg. 8: 6.  
 Nostocales, Scytonemataceae  
**T** = *Scytonema fuliginosum* Tilden, 1909, Amer. Alg. 7(1): 629 = *Setcheliella fuliginosa*  
 (Tilden) De-Toni, 1936, l.c.: 6.  
 = **SCYTONEMATOPSIS** E. Kiseleva, 1930.
- SIPHODERMA** Kützing, 1843, Phyc. Gener.: 220; (pre-starting-point syn.).  
 Oscillatoriales, Oscillatoriaceae, Oscillatorioideae  
**T** = *Siphoderma lyngbyaceum* Kützing, 1843, l.c.: 220.  
 = **LYNGBYA** C. Agardh ex Gomont, 1892.
- SIROSIPHON** Kützing, 1843, Phycol. gener., p. 219; (pre-starting-point syn.).  
 Stigonematales, Stigonemataceae  
**T** =  
 = **STIGONEMA** Agardh ex Bornet et Flahault, 1886
- SKUJAELLA** De-Toni, 1938, Diagn. Alg. Nov. 1, 4: 397.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = [*Trichodesmium erythraeum* Ehrenberg, 1830, Ann. Phys. Chem. 18(4): 506] ex Gomont,  
 1892, Ann. Sci. Nat. VII., Bot. 16: 196 = *Skujaella erythraea* De-Toni, 1938, l.c. 5: 477.  
 = **TRICHODESMIUM** Ehrenberg ex Gomont, 1892, nom. cons.
- SOMMIERELLA** Borzì, 1917, N. Giorn. Bot. Ital. 24: 79.  
 Stigonematales, Fischerellaceae  
**T** = *Sommierella cossyrensis* Borzì, l.c.: 79.  
 = **FISCHERELLA** (Bornet et Flahault) Gomont, 1895 (incl.).
- SOROSPORA** Hassall, 1845, Hist. Brit. Freshw. Algae 1: 309.  
 Chroococcales, Microcystaceae  
**T** = [*Ulva montana* Lightfoot, 1777: 973 = *Sorospora montana* Hassell, 1845, l.c.: 309].  
 = **GLOEOCAPSA** Kützing, 1843, nom. cons.
- SPERMOSIRA** Kützing, 1843, Phycol. Gener., p. 213; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Spermosira litorea* Kützing, 1843, l.c.: 213] = *Nodularia litorea* [Thuret, 1875, Ann. Sci.  
 Nat. Bot., ser. 7,1: 378] ex Bornet et Flahault, 1888, Ann. Sci. Nat. Bot., ser. 7,7: 246.  
 = **NODULARIA** Mertens ex Bornet et Flahault, 1886.

SPHAENOSIPHON Reinsch, 1874, Contr. Alg. Fungol., p. 15.

Chroococcales, Dermocarpellaceae

**T** = *Sphaenosiphon cuspidatus* Reinsch, 1874, l.c.: 15.

= CYANOCYSTIS Borzì, 1882 (?).

SPHAERASTRUM Kützing in Meneghini, 1837, Consp. Algol. Eugan., p. 337.

Chroococcales, Merismopediaceae, Gomphosphaerioideae

**T** = *Sphaerastrum cuneatum* Kützing in Meneghini, 1837, l.c.: 337

= GOMPHOSPHERIA Kützing, 1836.

SPHAERODICTYON Geitler, 1925, Beih. Bot. Centralbl. 2, 41: 231.

Chroococcales, Synechococcaceae, Aphanothecoideae

**T** = *Polycystis (Clathrocystis) reticulata* Lemmermann, 1898: 153 = *Sphaerodistyon reticulatum* (Lemmermann) Geitler, 1925, l.c.: 231.

= CYANODICTYON Pascher, 1914.

SPHAEROGONIUM Rostafinski, 1883. Rozpr. Akad. Umiej. Krak. 10: 280.

Chroococcales, Chamaesiphonaceae

**T** = *Chamaesiphon incrustans* Grunow in Rabenhorst, 1865: 149 = *Sphaerogonium incrustans* Rostafinski, 1883, l.c.: 282.

= CHAMAESIPHON A. Braun, 1865.

SPHAERONEMA Umezaki, 1961, Mem. Coll. Agric. Kyoto Univ., 83:31; (later homonym).

Oscillatoriales, Phormidiaceae, Phormidioideae

**T** = *Isocystis lithophila* Ercegović, 1932, Rad. Jugosl. Akad. 244 (Razr. mat.-prir. 75): 160 = *Sphaeronema lithophilum* Umezaki, 1961, l.c.: 31.

= YONEDAELLA Umezaki, 1962.

SPHAERONOSTOC Elenkin, 1931, Priroda 20(10): 970.

Nostocales, Nostocaceae, Nostocoideae

**T** = [*Ulva pruniformis* Linnaeus, 1753, Sp. Pl., ed. 1,2: 1164] = *Sphaeronostoc pruniforme* Elenkin, 1931, Priroda 20(10): 971.

= NOSTOC Vaucher ex Bornet et Flahault, 1886 (incl.).

SPHAEROZYGA C. A. Agardh, 1827, Flora 10, 2: 634; (pre-starting-point syn.).

Nostocales, Nostocaceae, Anabaenoideae

**T** = [*Sphaerozyga jacobii* C.A.Agardh, 1827, l.c.: 634].

= ANABAENA Bory de Saint-Vincent et Flahault, 1886.

SPHINCTOSIPHON G.S.West, 1907, Linn. Soc. J.-Bot. 38: 145.

Chroococcales, Microcystaceae

**T** =

= MICROCYSTIS Kützing ex Lemmermann, 1907, nom. cons.;(syn. after orig. fig.).

SPIRILLOPSIS Naumann, 1921, K. Sv. Vet.-Acad. Handl. 62(4): 18.

Chroococcales, Synechococcaceae, Synechococcoideae

**T** = *Spirillopsis irregularis* Naumann, 1921, l.c.: 18.

= RHABDODERMA Schmidle et Lauterborn, 1900 (incl.).

- SPIRILLUM Hassall, 1845, Hist. Brit. Freshw. Alg., p. 279; ( pre-starting-point syn.).  
 Oscillatoriales, Pseudanabaenaceae  
 T = *Spirillum jenneri* Hassall, 1845, l.c.: 277.  
 = ARTHROSPIRA Stizenberger ex Gomont, 1892.
- SPIROCOLEUS Möbius, 1889, Hedwigia 28: 312; ( pre-starting-point syn.).  
 Oscillatoriales, Pseudanabaenaceae  
 T = *Spirocoleus lagerheimii* Möbius, 1889, l.c.: 312.  
 = LYNGBYA C. Agardh ex Gomont, 1892, or LEPTOLYNGBYA Anagnostidis et Komárek 1988.
- SPIROCOLEUS Möbius ex Crow, 1927, Trans. Amer. Microsc. Soc. 46(2): 147.  
 Oscillatoriales, Oscillatoriaceae, Oscillatorioideae  
 T =  
 = LYNGBYA C. Agardh ex Gomont, 1892; (sensu Crow, non sensu Möbius).
- SPIRULINOPSIS Bharadwaya, 1963, Proc. Ind. Acad. Sci. 57B (4): 248.  
 Oscillatoriales, Pseudanabaenaceae  
 T = *Spirulinopsis conica* Bharadwaya, 1963, l.c.: 248.  
 = ? SPIRULINA Turpin ex Gomont, 1892.
- STILOCAPSA Ley, 1947, Bot. Bull. Acad. Sinica 1: 77.  
 Chroococcales, Merismopediaceae, Gomphosphaerioideae  
 T = *Stilocapsa sinica* Ley, 1947, l.c.: 77.  
 =? CYANOSTYLON Geitler, 1928.
- STRATONOSTOC Elenkin, 1931, Priroda 20(10): 970.  
 Nostocales, Nostocaceae, Nostocoideae  
 T = [*Tremella nostoc* Linnaeus, 1753, Sp. Pl., ed. 1,2: 1157] = *Nostoc commune* Vaucher ex  
 Bornet et Flahault, 1886, Ann. Sci. Nat. Bot., ser. 7: 203.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886 (incl.).
- SYMPHYOSIPHON Kützing, 1843, Phycol. Gener., p. 218; (pre-starting-point syn.).  
 Nostocales, Scytonemataceae  
 T = *Symphyosiphon dentatus* Kützing, 1843, l.c.: 218.  
 = SCYTONEMA Agardh ex Bornet et Flahault, 1886, p.p.
- SYMPHYOTHRIX Kützing, 1843, Phycol. Gener., p. 200; (pre-starting-point syn.).  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
 T = [*Symphyothrix fuscescens* Kützing, 1843, l.c.: 200] ex Forti, 1907, Syll. Myxoph., p. 307.  
 = SYMPLOCA Kützing ex Gomont, 1892.
- THACKERELLA Bharadwaya, 1963, Proc. Ind. Acad. Sci. 57, b4: 254.  
 Stigonematales, Stigonemataceae  
 T =  
 = HOMOEOPYCHE Skuja, 1944.
- THAUMALEOCYSTIS Trevisan, 1848, Sagg. Monogr. Alghe Coccot., p. 79.  
 Chroococcales, Microcystaceae  
 T = *Coccochloris deusta* Meneghini, 1841: 173 = *Thaumaleocystis deusta* Trevisan, 1848, l.c.:  
 79.  
 = GLOEOCAPSA Kützing, 1843, nom. cons.

- THERMOSYNECHOCOCCUS Katoh, Itoh, Shen et Ikeuchi, 2001, *Plant Cell Physiol.* 42(6): 599; (invalid; nomen nudum).  
 Chroococcales, Synechocystaceae  
**T** = *Thermosynechococcus elongatus* Katoh et al., 2001, l.c.: 599-606.  
 = SYNECHOCOCCUS Nägeli, 1849.
- TILDENIA Kosinskaja, 1926, *Not. Syst. Inst. Crypt. Horti Bot. Pr. USSR* 4: 85; (later homonym).  
 Nostocales, Scytonemataceae  
**T** = *Scytonema fuliginosum* Tilden, 1909, *Amer. Alg.* 7(1): 629 = *Tildenia fuliginosa* Kosinskaja, 1926, l.c.: 77.  
 = SCYTONEMATOPSIS E. Kiseleva, 1930.
- TRICHOPHORA Bonnemaïson, 1822, *J. Phys.* 94: 186; (pre-starting-point syn.).  
 Oscillatoriales, Oscillatoriaceae, Oscillatorioideae  
**T** =  
 = OSCILLATORIA Vaucher ex Gomont, 1892.
- TRICHOPHORUS [Palisat ex Desvaux, 1809, *J. Bot.* 2: 309] ex Forti, 1907, *Syll. Myxoph.*, p. 147; (pre-starting-point syn.)  
 Oscillatoriales, Oscillatoriaceae, Oscillatorioideae  
**T** = [*Trichoforus lanatus* Desvaux, 1809, l.c.: 309] = ? *Tolypothrix lanata* [Agardh ex Kützing, 1849, *Sp. Alg.*, p. 314] ex Bornet et Flahault, 1887, *Ann. Sci. Nat. Bot.*, ser. 7, 5: 119 (sensu Desvaux); [? *Oscillatoria princeps* Vaucher, 1803, *Hist. Conf. Eau Douce*, p. 190] (sensu Forti, 1907).  
 = OSCILLATORIA Vaucher ex Gomont, 1892
- TRICHORMUS Allmann, 1843, *Ann. Mag. Nat. Hist.* 11: 163; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Anabaenoideae  
**T** = [*Trichormus incurvus* Allman, 1843, l.c.: 163].  
 = ANABAENA Bory ex Bornet et Flahault, 1886
- UNDINA Fries, 1825, *Syst. orb. veg. I, Pl. homon.*, p. 348; (pre-starting-point syn.).  
 Nostocales, Nostocaceae, Nostocoideae  
**T** = [*Ulva pruniformis* Linnaeus, 1753, *Sp. Pl.*, ed. 1,2: 1164 = *Undina pruniformis* Fries, 1825, *Syst. Orb. Veget.* 1: 348] = *Nostoc pruniforme* Agardh ex Bornet et Flahault, 1888, *Ann. Sci. Nat. Bot.*, ser. 7, 7: 215.  
 = NOSTOC Vaucher ex Bornet et Flahault, 1886.
- VAGINARIA Gray, 1821, *Nat. Arr. Brit. Pl.* 1: 280; (pre-starting-point syn.).  
 Oscillatoriales, Phormidiaceae, Microcoleoideae  
**T** = *Oscillatoria vaginata* Vaucher  
 = MICROCOLEUS Desmazieres ex Gomont, 1892
- VANHOEFFENIA Wille, 1928, *Dtsch. Südpolar-Exped. 1901-03*, 8: 422.  
 Chroococcales, Entophysalidaceae  
**T** = *Vanhoeffenia antarctica* Wille, 1928, l.c.: 423.  
 = CHLOROGLOEA Wille, 1923 (?).
- XANTHOTRICHUM Wille in Schütt, 1893, *Pflanzenleben Hochsee*, p. 39.  
 Oscillatoriales, Phormidiaceae, Phormidioideae  
**T** = *Xanthotrichum contortum* Wille in Schütt, 1893, l.c.: 39.  
 = TRICHODESMIUM Ehrenberg ex Gomont, 1892, nom. cons.

ZONOTRICHIA J. Agardh, 1842, Alg. Mar. Medit. Adriat., p. 9; (pre-starting-point syn.).  
Nostocales, Rivulariaceae  
T = [*Zonotrichia hemispherica* J. Agardh, 1842, l.c.: 9].  
= RIVULARIA [Roth] Agardh ex Bornet et Flahault, 1886.

Part II.: **Rejected names** (excluded from the cyanobacterial system).

ACHROONEMA Skuja, 1948. Symb. bot. upsala. 9(3): 30.  
= Bacteria (Thiobacteriae).

ACTINOCEPHALUM Saito, 1905. Bot. Mag. Tokyo 19: 36.  
= Fungi.

AGONIUM Ørsted, 1844. De region. mar., p. 44.  
= Fungi (?).

ALLOGONIUM Kützing, 1843. Phycol. gener., p. 245.  
= red alga (Bangiaceae); *Asterocytis ornata* (Agardh) Hamel (Drouet & Daily 1956).

ANHALTIA S. H. Schwabe, 1834. Linnaea 9: 127.  
= Bacteria (?).

ASPALATIA Ercegović, 1927. Acta Bot. Inst. Bot. Univ. Zagreb. 2: 82.  
= germlings of BANGIA (Bangiaceae); (FREMY 1934, GEITLER 1942).

ASTEROCYTIS Gobi, 1879. Arb. St. Petersb. Ges. Naturf. 10: 83.  
= red alga (Bengiaceae); *Asterocytis ornata* (Agardh) Hamel (Drouet & Daily 1956).

ASTEROTHRIX Kützing, 1843. Phycol. gener., p. 200.  
= Fungi (?).

ATRACTELLA Printz, 1921. Kgl. Norske Vidensk. Selsk. Skr. 1920, 1: 93.  
= ? (Oscillatoriales), unclear description.

ATRACITIELLA Saccardo, 1886. Syll. Fung. 4: 578.  
= Fungi.

BEGGIATOIA Trevisan, 1845. Nomencl. Alg. 58.  
= Bacteria (nom. cons, among bacteria, against Trevisan, 1842)

BOANEMA Ercegović, 1927. Acta Bot. Inst. Bot. Univ. Zagreb. 2: 84.  
= developmental stage of NEMALION (Rhodophyceae); (Geitler 1942, Drouet & Daily 1956).

BRACHTIA Trevisan, 1848. Algae Cocc., p. 57.  
= green alga (Chlorophyceae).

BROMICOLLA Eichwald, 1843. Forh. Skand. Naturf. Mote 3: 615.  
= green alga (Chlorophyceae).

- BYSSUS [Michaeli] Linné, 1753. Spec. Plant., p. 1168.  
= mixture of algae, incl. APHANIZOMENON (pre-starting-point).
- CALIALOA Trevisan, 1848. Alghe Cocc., 41.  
= unidentifiable.
- CALLONEMA Reinsch, 1874-1875. Contr. Algol. Fungol., p. 40.  
= Rhodophyceae (?); (Drouet & Daily 1956).
- CAMPTOTHRIX West et West, 1897. J. Bot. 35: 269.  
= unidentifiable, probably initial stages of another cyanophyte-species.
- CHAETOCOCCUS Kützing, 1849. Tab. Phycol. 1: 51.  
= unidentifiable, probably green alga; (Drouet & Daily 1956).
- CHALARODORA Pascher, 1929. Jahrb. Wiss. Bot. 71: 460.  
= genus of Glaucophyceae.
- CHAMAESIPHONOSIRA Geitler, 1975. Arch. Microbiol. 103: 234-236.  
= Bacteria.
- CHAOS Bory, 1823. Dict. Class. d'Hist. Nat. 3: 13,15.  
= mixture of green algae.
- CHLOROBIIUM Nadson, 1906. Bull. Jard. Bot. St. Petersburg 6: 190.  
= Bacteria.
- CHROODACTYLON Hansgirg, 1855. Ber. Dtsch. Bot. Ges. 3: 14.  
= red alga (Rhodophyceae).
- CHROOSTIPES Pascher, 1914. Ber. Dtsch. Bot. Ges. 32: 351.  
= probably bacteria.
- CHROOTHECE Hansgirg, 1884. Österr. bot. Ztschr. 34: 352.  
= red alga (Rhodophyceae).
- "CHRYSOSTIGMA Kirchner, 1843"  
= pre-starting-point name, probably used for *Scytenema cincinatum*.
- CHTHONOBLASTUS Kützing, 1843. Phyc. Gener., p. 196.  
= pre-starting-point name, used for different genera, mainly from Oscillatoriales (unclear type;  
*C. atropurpurens* Kütz.).
- CLADISCOTHALLUS Renault, 1896. Etud. Cites Min. France, 553.  
= fossil alga (Cyanophyte ?).
- CLATHROCHLORIS Geitler, 1925. Pascher's Süßwasserfl. 12: 457.  
= Bacteria.
- CLONOTHRIX Roze, 1896. J. Bot. 10: 325.

= Bacteria.

CLOSTERIOCOCCUS Schmidle, 1906. Allgen. bot. Ztschr. 1905: 64.  
= green algae; (Drouet & Daily 1956).

COLLEINIA Walcott, 1914. Smiths. Misc. Coll. 64 (2): 110.  
= fossil species of Cyanophytes.

CONIDIOTHRIX Benecke et Petersen, 1921. Dansk Bot. Arkiv. 4(1): 8.  
= Bacteria.

CONSTANTINEA Postels et Ruprecht, 1840. III. Alg., p. 17.  
= red alga ( Rhodophyceae).

CYANIDIUM Geitler, 1935. Arch. Hydrobiol., Suppl. 12: 624.  
= red alga (Rhodophyceae).

CYANOCHAETE Gobi, 1916. Bot. Jap. 30:6.  
= GLOEOCHAETE Lagerh. , 1883; ( Glaucophyceae) , nomen altern.

CYANOCLOSTER Kufferath, 1929. Ann. Crypt. Exot. 2: 49.  
= probably MONORAPHIDIUM ( Chlorellales, Chlorophyceae); type- species: *C. muscicolus* from Costa Rica.

CYANOCOCCUS Hansgirg, 1905. Beih. Bot. Centralbl. 18, 2: 521.  
= ? (possibly Glaucophyceae).

CYANOCYTA Hall et Claus, 1963. J. Cell. Biol. 19: 558.  
= Glaucophyceae.

CYANOPHORA Koršikov, 1924. Russ. Arch. protistol. 3: 57, 71.  
= Glaucophyceae.

CYANOPTYCHE Pascher, 1929. Jahrb. wiss. Bot. 71: 459.  
= Glaucophyceae.

CYANOTHECA Pascher, 1914. Ber. Dtsch. Bot. Ges. 32: 351.  
= Bacteria (Caulobacteriae); (Claus 1961).

CYCLOSPERMA Bonnemaïson, 1822. J. Phys. 44: 179.  
= pre-starting-point syn. to LYNGBYA G. Agardh ex Gomont, 1892 (?)

DACTYLOCOCCOPSIS Hansgirg, 1888. Notarisia 3: 590.  
= green algae from the genera MONORAPHIDIUM and ANKISTRODESMUS (Chlorellales, Chlorophyceae), type-species: *D. rupestris* from Czech Republic (Drouet & Daily 1956); sensu auct. post. = RHABDOGLOEA Schröder, 1917, or MYXOBACTRON Schmidle, 1904.

DACTYLOGLOEA Borzì (1887) ex Borzì, 1914. N. Giorn. Bot. Ital., N. S. 21(4): 348, 358.  
= 1887 — nomen nudum, 1914 — unidentifiable (Oscillatoriales ?).

DERMOCARPA Crouan et Crouan, 1858. Ann. Sci. Nat. Bot., ser. 4, 9: 70.

= nomen ambiguum (type = mixture of different species from different genera); (Komárek et Anagnostidis 1986).

DERMOGLOEA Zanardini, 1872. Atti R. Istr. Veneto Sci. Lett. Arti, ser. 4, 1: 1885.  
= undefinable.

DESMANTHOS Skuja, 1956. Nova Acta Reg. Soc. Sci. Upsal., ser. 4, 16(3): 83.  
= Bacteria; later homonym to DESMANTHUS Willdenow 1806 nom. cons.; =  
SKUJAEPHYCONEMA Burkart, 1959.

DETONIELLA Trevisan in De Toni et Trevisan, 1889. Syll. Schizomyc., p. 929.  
= Bacteria.

DIDYMOHELIX Griffith, 1853. Ann. Mag. Nat. Hist., ser. 2, 12: 439.  
= Bacteria.

ELISA Gray, 1821. New Arr. Brit. Pl. 1: 282.  
= mixture of filamentous Cyanophytes and Algae.

EMBRYOSPHAERA Trevisan, 1848. Alg. coccot., p. 36.  
= green alga (Chlorophyceae).

ENTOTHRIX Kützing, 1843. Phycol. gener., p. 224.  
= unidentifiable; ex Forti 1907 = probably MICROCOLEUS.

ERNSTIELLA Chodat, 1911. Bull. Soc. Bot. Geneve 2, ser. 3: 125.  
= mixture of Cyanophyte species (from the genera SIPHONONEMA, CHAMAESIPHON,  
HETEROLEIBLEINIA, etc.).

ERYTHROCONIS Ørsted, 1842. Naturhist. Tidsskr. 3: 555.  
= unidentifiable.

EUACTIS Kützing, 1843. Phycol. gener., p. 240.  
= pre-starting-point name, unclear taxonomic position; probably RIVULARIA.

EXOCOCCUS Nägeli, 1847. Neue Denkschr. Allg. Schweiz. Ges. Gesamten Naturwiss. 9(2):  
170.  
= unidentifiable genus and species from Cyanophyceae (? Hydrococcaceae).

FILARSZKIA Forti in De Toni, 1907. Syll. Alg. 5: 258.  
= hormocysts of Scytonema (?).

FRIDAEA Wille, 1909. In: Engler & Prantl, Nat. Pflanzenfam., Nachtr. 1(2): 77, 79.  
= later homonym (orth. var.) to FRIEDAEA Schmidle, 1905; (Chlorophyceae).

GERVASIA Borzì ex Forti in De-Toni, 1907. Syll. alg. 5: 704.  
= nomen nudum.

GIRARDIA Gray, 1821. New Arr. Brit. Pl., 1: 287.  
= unidentifiable.

GLAUCOCYSTIS Itzigsohn in Rabenhorst, 1854. Alg. Eur. Exsicc., n. 1935.

= Glaucophyceae.

GLAUCOCYSTOPSIS Bourrelly, 1960. C. R. Hebd. Seances Acad. Sci. 251: 416.  
= Glaucophyceae.

GLAUCOSPHAERA Koršikov, 1930. Arch. Protistenk. 70: 222.  
= Glaucophyceae.

GLIOTHRIX Zopf, 1882. Morph. Spaltpfl., p. 51.  
= mixture of different Cyanophytes.

GLOEOCHAETE Lagerheim, 1883. Ofvers. Kgl. Vetensk .- Ak. Forhandl. 1883, 2 - 39.  
= Glaucophyceae.

GLOEOCAPSOMORPHA Zalesskij, 1918. Ezeg. Russk. Paleontol. Obšč. 1: 34.  
= fossil cyanophyte genus.

GLOIONEMA Agardh, 1817. Syn. Alg. Scand., p. 120.  
= pre-starting-point syn. of MICROCOLEUS (?).

GONIOTRICHUM Kützing, 1843. Linnaea 17: 89.  
= red alga (Bangiaceae, Rhodophyceae).

GUYOTIA Schmidle, 1905. Allg. Bot. Ztschr. 11: 64.  
= unclear described, unidentifiable genus (PLACOMA ?).

HAPALOPSIS Kufferath, 1942. Bull. Soc. Roy. Bot. Belg. 74: 96.  
= stage of STIGONEMA (?).

"HAPLONEMA Borzì, 1914".  
= probably invalidly published, taxonomically unclear.

HASSALLIA Trevisan, 1848. Alghe cocc., p. 67.  
= later (and pre-starting-point) homonym to HASSALLIA Berkeley, 1845 (= HASSALLIA Berkeley ex Bornet et Flahault, 1886).

HAVRELLA Breton et Saulot, 1986. Cryptogamie-Algologie 7,4: 286-287.  
= Bacteria.

HETEROCHROA Areschoug, 1866. Alg. Scand. Exs., ser. 2, 6: 289.  
= later homonym to HETEROCHROA Bunge in Ledebour, 1830; pre-starting-point syn., probably to SCHIZOTHRIX Kützing ex Gomont, 1892 (?).

HOMALOCOCCUS Kützing, 1863. Osterpr. Realschule Nordhausen, p. 6.  
= unidentifiable.

HORMOBOLUS Borzì, 1914. Boll. Stud. Inform. Reale Giard. Colon. 1: 93.  
= probably SCYTONEMA Agardh ex Bornet et Flahault, 1886 (?).

HUMIDA Gray, 1821. New Arr. Brit. Pl. 1: 281.  
= unidentifiable, mixture of filamentous Cyanophytes.

HYGROCROCIS C. A. Agardh, 1824. Syst. Alg. 23: 45.

= Bacteria.

IALOMITZIA Gruia, 1969. Rev. Algol., ser. 2, 7: 292.

= unclearly described, not revised (probably Fungi imperf.; comp. BOURRELLY 1970).

JUGUSPIRA Crow, 1927. Trans. Amer. Micr. Soc. 46: 147.

= unclearly described, confused morphology.

KIRCHNERIELLOPSIS Kufferath in Conrad et Kufferath, 1954. Mem. Inst. Roy. Sci. Nat. Belg. 127: 271.

= probably coccal green alga without pyrenoid (? syn. with RAPHIDOCCELIS).

KNEUCKERIA Schmidle, 1905. Allg. Bot. Ztschr. 1905: 64.

= red alga (Bangiaceae, Rhodophyceae).

KRKIA Pevalek, 1929. Acta Bot. Inst. Bot. Univ. Zagreb 6: 16.

= unclearly described, probably syn. with CYANOCYSTIS (?).

KYANOSTICHUS Romanov, 1964. Two new algae from a Calif. Oxid. Pond, p. 1.

= indeterminable cyanophyte species (?).

KYBOTION Pascher, 1940. Arch. Protistenk. 93: 348.

= Chrysophyceae.

"LAGERHEIMIELLA Borzì, 1914".

= non "LAGERHEIMIELLA Boedijn, 1940"; probably invalidly published, unclear.

LAMPROPEDIA Schroeter, 1886. In Cohn, Kryptogamenfl. Schlesiens, 1: 151.

= Bacteria; later homonym is LAMPROPEDIA Pringsheim, 1966.

LEPTONEMA Rabenhorst, 1857. Algen Sachsens, p. 653.

= Bacteria.

LEPTOTHRIX Kützing, 1843. Phycol. gener., p. 198.

= Bacteria.

LEPTOTRICHIA Trevisan, 1879. Rendic. R. Istit. Lombardo Sci. Lett., ser. 2, 12: 138.

= Bacteria.

LEUCONEMA Kaas, 1983.

= Bacteria.

LEUCONOSTOC Van Tieghem, 1878. Ann. Sci. Nat. Bot. 7(6): 198.

= Bacteria.

LEUCOTHRIX Orsted, 1844. De region mar., p. 44.

= Bacteria.

LIMNACTIS Kützing, 1843. Phycol. gener., p. 237.

= mixture of GLOEOTRICHIA and RIVULARIA, pre-starting-point genus.

"LITHONEMA Hassall, 1845".

= pre-starting-point name, unclear; not LITHONEMA Ercegović, 1929.

LOPHOPODIUM Kützing, 1849. Tab. Phycol. 1: 45.

= unclear filamentous, heteropolar genus of Cyanophytes.

LOTEN Adanson, 1763. Fam. plant. 2: 3.

= mixture of filamentous Cyanophytes.

LYNGBYA Gaillon, 1828. Meth. Class. Thalassioph., p. 46.

= Phaeophyceae (*Pylaiella* sp.).

MARSSONIELLA Lemmermann, 1900. Ber. Dtsch. Bot. Ges. 18: 275.

= spores of GURLEYA (Microsporidia); (Komárek & Vávra, 1968).

"MASTICHOTHRIX Kützing, 1843".

= pre-starting-point name, unclear content.

"MASTIGOTHRIX Reinsch., 1867".

= pre-starting-point name, unclear; not MASTIGOTHRIX Poche, 1913.

MERISMOARCUS Hindák, 1988. Biologia, Bratislava, 43: 749.

= probably Bacteria.

MERIZOMYRIA Pollini, 1817. Biblioth. Ital. 7: 420.

= unclear, probably a mixture of filamentous Cyanophytes; STIGONEMA (?).

MICRALOA Biasoletto, 1832. Alg. microsc., p. 44-47.

= unclear, according to Drouet & Daily, 1956 = fytoflagellates; type species: *M. protogenita*.

"MICRASCIDIUM Borzì, 1914".

= unclear, probably never validly published.

MICROCYSTIS Kützing, 1833. Linnaea 8: 372.

= green algae (Chlorophyceae).

MICRODISCUS Steinecke, 1915. Schr. phys.-okon. Ges. Königsberg 56: 25.

= unclear, epiphytic on CLOSTERIUM; type species = *M. parasiticus* (unclear reproduction, not revised).

MICROHALOA Kützing, 1843. Phycol. gener., p. 169.

= mixture of coccal Cyanophytes and green algae.

MONTANOA Guerrero, 1947. Anal. Jard. Bot. Madrid 7: 267.

= unclear description, possibly CALOTHRIX (?).

NELLIECARTERIA De-Toni, 1936. Nomencl. Algol. 8: 5.

= Fungi.

NEMACOLA Massalongo, 1955. Flora 38: 36.

= unclear, probably a pre-starting-point syn. to MICROCOLEUS (?).

- NEMATOCOCCUS Kützing, 1833. *Linnaea* 8: 381.  
= Fungi.
- NEOADELIA Bompard, 1867. *Hedwigia* 6: 129.  
= unclear, probably pre-starting-point syn. to SYMPLOCA Kützing ex Gomont, 1892.
- OLIGOCLONIUM Brooker-Klugh, 1921. *Contr. Canad. Biol.* 1918/20: 181.  
= degenerated Oscillatoriaceae trichomes.
- ONCOBYRSA Agardh, 1827. *Flora* 10(2): 629.  
= Fungi; (Drouet & Daily 1956).
- "OSCILLARIA" sensu auct.  
= pre-starting-point orth. var. of OSCILLATORIA Vaucher ex Gomont, 1892.
- PALMOGLOEA Kützing, 1843. *Phycol. gener.*, p. 176.  
= mixture of green algae with (?) APHANOCAPSA.
- PARAPLECTONEMA Frémy, 1939. *Arch. Bot.* 3: 178.  
= Bacteria.
- PAULINELLA Lauterborn, 1895. *Ztschr. Wiss. Zool.*, p. 59.  
= syncyanotic genus of Testacea with cyanelles.
- PEDIOCHLORIS Geitler, 1925. In: Pascher's *Süßwasserfl.* 12: 457.  
= Bacteria.
- PEGOMALION Brügger, 1863. *Jahresb. Naturf. Ges. Granbündens, N.F.* 8: 251.  
= type is *Chthonoblastus plantae* Brügg. = possibly *Schizothrix*.
- PELODICTYON Lauterborn, 1913. *Allg. Bot. Ztschr.* 19: 98.  
= Bacteria.
- PELONEMA Lauterborn, 1916. *Verh. Naturh. Med. Ver. Heidelberg* 13: 408.  
= Bacteria.
- PELOPLOCA, Lauterborn, 1913. *Allg. Bot. Ztschr.* 19: 99.  
= Bacteria.
- PHRAGMONEMA Zopf, 1882. *Morph. Spaltpfl.*, p. 49.  
= red alga (Rhodophyceae).
- PHYTOCONIS Bory de Saint Vincent, 1797. *Mem. Conferva & Byssus*, p. 52.  
= unidentifiable.
- PLEOCOCCUS Kützing, 1843. *Linnaea* 17: 84.  
= syn. of "BOTRYDINA Brebisson" (= consortium of COCCOMYXA with protonemes).
- PLEUROCOCCUS Meneghini, 1837. *Consp. Algol. Euan.*, 337.  
= nomen ambiguum, type = probably green alga (Chlorophyceae).
- PLUTO Copeland, 1936. *Ann. N. Y. Acad. Sci.* 36: 72.

= CYANIDIUM (Rhodophyceae).

POLYCOCCUS Kützing, 1843. *Linnaea* 17: 84.  
= probably developmental stage of *Nostoc punctiforme*.

PONTOTHRIX Nadson et Krasilnikov, 1932. *Dokl. Akad. Nauk SSSR* 1932 A: 246, 247.  
= Bacteria.

PORPHYRIDIDIUM Nägeli, 1849. *Gatt. einzell. Algen*, p. 71.  
= red alga (Bangiaceae, Rhodophyceae).

PORTACUS Rafinesque, 1819. *J. Phys.* 89: 107.  
= unidentifiable genus, probably from Nostocales.

PSEUDOSPIRULINA Pankow et Jahnke, 1964. *Osterr. Bot. Ztschr.* 111(4): 335.  
= stalks of *Vorticella*.

RHIZONEMA Thwaites in Smith et Sowerby, 1849. *Suppl. Engl. Bot.* 4: 2954.  
= ? SCYTONEMA mixed with fungal hyphae.

ROSARIA N. Carter, 1922. *J. Linn. Soc.* 16: 54  
= NELLIECARTERIA (Fungi).

SARCINASTRUM Lagerheim, 1900.  
= Bacteria.

SCHMIDLEA Lauterborn, 1913. *Allg. Bot. Ztschr.* 19: 98.  
= Bacteria.

SCYTHYMENIA Agardh, 1824. *Syst. Alg.*, p. 20(xx).  
= pre-starting-point syn. of STIGONEMA Agardh ex Bornet et Flahault, 1886 (?).

SKUJAEPHYCONEMA Burkhart, 1959. *Darwiniana* 11: 765.  
= Bacteria.

SKUJAPELTA Hall et Claus, 1967. *J. Phycol.* 3: 50.  
= Glaucophyceae.

SOROSPORA Hassall, 1845. *Brit. Freshw. Algae* 1: 309.  
= probably mixture of several epilithic Cyanophyte species.

"SPHAENOCYSTIS Reinsch"  
= erroneous citation, correctly see under "SPHAENOSIPHON Reinsch".

SPHAEROTHROMBIUM Kützing, 1833. *Linnaea* 8: 370.  
= pro syn., unclear (? MICROCYSTIS Kützing ex Lemmermann, 1907).

"SPIRULINA" Bory, 1824. *Encycl. Meth.* 2: 690.  
= Protozoa?; pollen grains? (Drouet 1968).

STAUROCLADIA Gonzalez-Guerrero, 1966. *A. Inst. Bot. Cavanilles* 2: 135.

= indeterminable Cyanophytes (?).

SYMPHYOSIPHON Kützing, 1843. Phycol. gener., p. 218.  
= mixture of filamentous Cyanophytes.

TETRAPEDIA Reinsch, 1867. Algenfl. Franken, p. 37.  
= green algae from different genera; (Geitler 1942, Claus 1963), type species = *T. gothica* = *Crucigenia tetrapedia* (Chlorophyceae).

TETRARCUS Skuja, 1934. Acta Horti Bot. Univ. Latv. 7: 46.  
= probably Rhodobacteria.

THAMNIASTRUM Reinsch, 1888. Notarisia 3(11): 513.  
= free stalk-system of Gomposphaeriaceae (probably of SNOWELLA).

THIONEMA Kolkwitz, 1938. Ber. Dtsch. Bot. Ges. 56: 15.  
= Bacteria.

THIOPLOCA Lauterborn, 1907. Ber. Dtsch. Bot. Ges. 25: 242.  
= Bacteria.

THIOSIPHON Klas, 1936. Akad. Wiss. Wien Sitzungsab. mat.-nat. Kl., Abt. 145: 213.  
= Bacteria.

THIOSPIRILLOPSIS Uphof, 1927. Arch. Hydrobiol. 18: 83.  
= Bacteria.

THIOTHRIX Vinogradskij, 1888. Beitr. Morphol. Physiol. Bacter., p. 29.  
= Bacteria.

TRICHOCYSTIS Kützing, 1846. Tab. phycol. 1: 20.  
= ? zoochlorellas.

TRICHOSPIRA McNeill, 1948. Castanea 13: 44.  
= unclear genus from Oscillatoriales; later homonym to TRICHOSPIRA Humboldt, Bonpland et Kunth, 1818.

UROCOCCUS (Hassall) Hassall ex Kützing, 1849. Spec. Alg., p. 206  
= green alga (Chlorophyceae).

VAGINARIA Bonnemaïson, 1822. J. Phys., Chem., Hist. Nat. & Arts 94: 175.  
= pre-starting-point syn., probably to MICROCOLEUS Desmazieres ex Gomont, 1892; later homonym to VAGINARIA Persoon, 1805.

VAGINARIA Gray ex Kuntze, 1898. Rev. Gen. Pl. 3(3): 435.  
= pre-starting-point syn. to MICROCOLEUS Desmazieres ex Gomont, 1892; later homonym to VAGINARIA Persoon, 1805.

ZACHARIASIA Lemmermann, 1895. Vorarb. Fl. Ploner Seengeb., p. 60.  
= unclear description, not revised (with "chlorophora stellata"), probably a red alga Bangiaceae, Rhodophyceae).

## **Appendix 4.**

List of Type and Reference Strains

[Must be prepared according to Bergey's Manual and literature.]

## Appendix 5.

### List of Collections with Type Strains

[Will be prepared after discussion. Only the main collections are preliminary included into the first proposal.]

#### **ACOI**

Full name: Coimbra Collection of Algae

Institution: University of Coimbra

Correspondent: Dr. Fátima Santos

Postal Address: Department of Botany, University of Coimbra, 3000 Coimbra, Portugal

#### **ATCC**

Full name: American Type Culture Collection

Institution:

Correspondent: Cypess, Prof., Dr. Raymond H.

Postal Address: 10801 University Boulevard, Manassas, VA, 20110-2209, USA

#### **BCCUSP**

Full name: Brazilian Cyanobacteria Collection - University of Sao Paulo

Institution: University of Sao Paulo

Correspondent: Bittencourt-Oliveira, Prof., Dr. Maria C.

Postal Address: Av. Padua Dias, 11, Piracicaba, Sao Paulo, 13418-900, Brazil

#### **CCALA**

Full name: Culture Collection of Autotrophic Organisms

Institution: Institute of Botany, Czechoslovakg Academy of Science

Correspondent: Lukavský, Dr. Jaromir

Postal Address: Dukelská 135, CZ- 379 82 Třeboň, Czech Republic

#### **CCAP**

Full name: Culture Collection of Algae and Protozoa

Institution: Centre for Ecology and Hydrology

Correspondent: Day, Dr. John G.

Postal Address: CEH Windermere, The Ferry House, Far Sawrey, Ambleside, Cumbria, LA22 OLP, U.K.

#### **CCCM**

Full name: Canadian Center for the Culture of Microorganisms

Institution: University Boulevard Vancouver

Correspondent: Dr. Donna Dinh

Postal Address: Canadian Center for the Culture of Microorganisms, Department of Botany  
6270 University Boulevard, Vancouver, B.C. Canada V6T 1Z4

#### **CSMA**

Full name: Centro di Studio dei Microorganismi Autotrofi - CNR

Institution: Istituto di Microbiologia Agraria e Tecnica Universita degli Studi - Firenze

Correspondent: Florenzano, Prof.G.

Postal Address: P.zale Cascine, 27, Firenze 50144, Italy

**NIES**

Full name: Microbial Culture Collection  
Institution: National Institute for Environmental Studies  
Correspondent: Kasai, Dr. Fumie  
Postal Address: 16-2, Onogawa, Tsukuba, Ibaraki, 305-8506, Japan

**NIVA**

Full name: Culture Collection of Algae (NIVA)  
Institution: Norwegian Institute for Water Research  
Correspondent: Skulberg, Dr. Olav M.  
Postal Address: P.O. Box 173 Kjelsas, N-0411 Oslo, Norway

**PCC**

Full name: Pasteur Culture Collection of Cyanobacteria,  
Institution: Institut Pasteur (Unité de Physiologie Microbienne)  
Correspondent: Rippka, Mrs. Rosmarie,  
Postal Address: 28, rue du Docteur Roux, Paris 75724 Cedex 15, France

**SAG**

Full name: Sammlung von Algenkulturen at Universität Göttingen  
Institution: Albrecht-v.Haller-Institut für Pflanzenwissenschaften  
Correspondent: Friedl, Prof.Thomas  
Postal Address: Untere Karspüle 2, 37073 Göttingen D-37073, Germany

**UTEX**

Full name: The Culture Collection of Algae at the University of Texas Austin  
Institution: University of Texas at Austin  
Correspondent: Brand, Dr. Jerry  
Postal Address: MCDB/1 University Station A6700, Austin, Texas, 78712-0183, U.S.A.

## **Appendix 6.**

### Abbreviations of Names of Authors

[Discussion!; not yet prepared.]

## **Appendix 7.**

Recommended Journals for Publication of New Taxa

[Discussion!; not yet prepared.]

## **Appendix 8.**

### Schemes of Latin Diagnosis

Latin diagnoses should be prepared using the book:

Stearn W.T. (1998): *Botanical Latin*. – Timber Press, Portland, Oregon, 546 pp.

[or any later edition of this book]

[Discussion, if Latin diagnoses should be obligatory!; or “scheme of diagnosis”. Will be prepared in respect to obligatory characters for description of new taxa on generic and specific levels.]