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The New Bionomenclature:
The BioCode Debate

Proceedings of a symposium held during the
Fifth International Congress on Systematic and Evolutionary Biology in
Budapest on 21 August 1996

Edited by
David L Hawksworth
Chair, International Committee on Bionomenclature

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Preface

The Draft BioCode: The prospective international rules for the scientific name of organisms was first released by the IUBS/IUMS International Committee on Bionomenclature in May 1996 for circulation and comment by biologists world-wide.

One component of the Committee’s task of broadening the debate, was a symposium on The New Bionomenclature held on 21 August 1996 during the Fifth International Congress on Systematic and Evolutionary Biology in Budapest. This symposium was sponsored by IUBS, and the contributions presented are now made available to a wider audience through this Special Issue of Biology International.

Also enclosed are statements and discussions from the symposium, together with an additional contribution by James Reveal which acts as a lead-in to the mini-symposium on Biological Nomenclature in the 21st Century held at the University of Maryland on 4 November 1996; the full proceedings of that meeting are available on www.life.umd.edu/bees/96sym.html.

As convenor of the Budapest symposium, I wish to thank Professor “Bill” Chaloner for chairing the session and reading Dr Brummitt’s paper, all contributors and participants for their frank opinions, and Ms Marilyn S. Rainbow for assistance in preparing the material for publication.

David L. Hawksworth
Chair, International Committee on Bionomenclature

International Mycological Institute
Bakeham Lane, Egham, Surrey TW20 9TY, UK

biocode@cmsa.berkeley.edu
listserv@cmsa.berkeley.edu
http://www/rom.on.ca
1. The Need for a New Bionomenclature

David L. Hawksworth
International Mycological Institute, Bakeham Lane,
Egham, Surrey TW20 9TY, UK

Abstract

Biology is increasingly being unified and is no longer conceived as split into mutually exclusive disciplines of botany, microbiology and zoology. Concepts of kingdoms are in flux, so that opinions vary as to the Codes to be used for certain groups, for example some protists and cyanobacteria. Even Fungi are now recognized as closest to Animalia. The current suite of Codes with disparate practices gives the impression of a fragmented and disorganized subject, and makes nomenclature difficult to teach in unified courses. The current Codes have common problems to address, and this provides an opportunity for consistent approaches. The IUBS General Assembly of 1994 initiated the establishment of an International Committee on Bionomenclature, with the support of IUMS, to respond to the demand of users of names for an improved and harmonized system of bionomenclature for the future. This will simplify procedures for both systematists and other users of names, be sensitive to the needs of developing countries, and facilitate common systems for the description, registration, and access to names. Further, it will enable a unified approach to be made to donor agencies for the ongoing support of the communication system of biology world-wide.

Background

The objective of this symposium is to promote debate as to the best method by which systematic biologists can address a problem that should never have existed: five systems of rules regulating the names of different categories of organisms. The circumstance we have inherited is an historical accident, the redressment of which is long overdue.

Linnaeus applied the binomial system of naming the living world he had elaborated to animals as well as plants, although the details were explained most fully in the *Philosophia botanica* of 1751 (Stearn, 1959). This held sway for the first 100 years of binomial nomenclature. Zoologists were the first to develop a separate Code in 1843, but as noted at the time the intent was not to be devious but "for the sake of rendering the question less complex, and because . . . botanical nomenclature stands in much less need of distinct enactment" (Melville, 1995). By the time botanists produced their first stand-alone system of rules at an international botanical congress in 1867 (De Candolle, 1867),
the zoological rules had previously been revised and the die was cast for increasing divergence. Interestingly, De Candolle (1867) already foresaw a time when a major revision would be needed, when "this nomenclature which we now strive to improve will then appear like an old scaffolding, laboriously patched together and surrounded and encumbered by the debris of rejected parts" (transl. Weatherby, 1949).

Microbiologists (excluding mycologists) then became frustrated because botanists could not accept, amongst other things, their need to designate living cultures as name-bearing types for bacteria. Steps towards the formation of independent rules were initiated in 1930, and a new text was agreed in 1953 (International Committee on Bacteriological Nomenclature, 1958). Virus names were at first embraced along with the bacteria, but schisms emerged even amongst virologists with the result that viruses were excluded from the Bacteriological Code approved in 1973 (Sneath, 1992). Only now is a unified approach to all kinds of virus names being adopted (Murphy et al., 1995). Those working with cultivated plants were equally discontented by the lack of appreciation for the need to allocate names to cultivated variants, their impatience leading to the adoption of a separate Code in 1952 (Stearn, 1986).

This fragmented approach to the key communication system of biology is becoming increasingly out of step with the current teaching and organization of the subject. Further, the needs of the majority of biologists are for a transparent and straightforward system which is able to accommodate advances in science, but is not repeatedly subject to changes for historic and nomenclatural vagaries or peccadillos. The issue is whether nomenclaturalists should continue to "cherish labyrinthine convolutions of thought and claim the right to burden the future with tortuous mazes" (Weresub, 1970), or whether the time is ripe to break out from an escalating spiral of complexity.

An emerging appreciation that the latter course of action merited exploration spurred the International Union of Biological Sciences (IUBS), with the support of the Systematics Association, to sponsor a symposium to review the present state and current issues of biological nomenclature during the Third International Congress of Systematic and Evolutionary Biology (ICSEB III) in 1985 (Ride & Younes, 1986). Stimulated by the resolutions and report from that occasion, the last ten years has witnessed a series of meetings and discussions, mandated by resolutions from a succession of General Assemblies of IUBS, and the development of proposals to improve harmonization between the existing Codes (Hawksworth, 1995). In 1995 IUBS and the International Union of Microbiological Societies (IUMS) agreed to form a joint inter-union International Committee on Bionomenclature to further these unifying initiatives, and a draft unified BioCode has now been released as a discussion document under its auspices (Greuter et al., 1996). The production of such a draft may be seen as either a foolhardy or a courageous first step, akin to sticking one's head over a rampart to shoot when snipers are known to be poised for action. It is anticipated that after further debate and refinement, a BioCode acceptable to biologists at large will be produced - currently, this is
Need for a New Bionomenclature

envisaged as being adopted for names of the future from a date to be agreed by the pertinent existing internationally mandated bodies.

After almost 150 years of separate Codes, the movement to progress towards a harmonized and unified new bionomenclature has arisen from several independent stimuli. I draw attention to these needs here as a backcloth to the technical issues addressed in the following contributions.

The Unification of Biology

Biology is increasingly taught as a single discipline in schools, colleges and universities, and single textbooks are becoming the rule (e.g. Raven & Johnson, 1992). This has been a consequence of the appreciation of the common basis all aspects of the subject have; this applies not only at the genetic, cellular, molecular, biochemical and physiological levels, but also in ecological and systematic theory. In synchrony, departments in educational establishments have been relabelled as Biology, Biological Sciences, or Life Sciences - and at least combined into schools with common courses where separate departmental titles have been retained. The period when only botany or zoology might be taught in a university, as occurred in pre-coeducational days, or a single degree in biology was unthinkable, are now a matter of history. For example, Royal Holloway, University of London, initially exclusively a womens' college, had only a Department of Botany from 1893 until 1956 (Bingham, 1987).

The tendency to unify aspects of biology also results in one to harmonize terms across the entire field. This is a slow process, and recently Lovelock (The Times, 3 May 1995) observed that “There are at least 30 kinds of biologist, each with a mutually incomprehensible biobabble” - the introduction of the new term “biobabble” is in itself a plea from outside the discipline to hasten the unification process for terms.

The Kingdoms of Life

The realization that Life could not be accommodated into two kingdoms only started to gain general acceptance in the late 1960s after the five-kingdom system of animals, bacteria, fungi, plants, and protists was actively promoted (Whittaker, 1969). Molecular data (e.g. Schlegel, 1994; Sogin et al., 1996) are now showing more forcefully than could have been anticipated even five years ago just how phylogenetically misleading simplistic systems might be. While hierarchies and boundaries are still under debate (e.g. Cavalier-Smith, 1993; Corliss, 1994; Margulis, 1996), it is indisputable that the traditional divisions between the Codes do not make any phylogenetic sense.

This is not simply a matter of assigning particular groups of organisms for jurisdiction under one of the existing Codes or another as opinions vary and can be vehemently argued. For example, does the recognition that blue-green algae are really bacteria mean that their nomenclature must be handled through the Bacteriological Code? And how should protoctistan genera which
include both photosynthetic and non-photosynthetic species be assigned? The nomenclatural treatment of organisms that might be referred to more than one kingdom (i.e. ambireginal organisms), depending on the opinions of different scientists, was one of the issues prompting the ICSEB III symposium in 1985. It is regrettable when differences not about generic and species concepts, but where they are placed at higher ranks, can lead to name changes (Patterson & Larsen, 1991, 1992).

In the case of the fungi, which are treated under the Botanical Code and have some special provisions made for them, these are now dispersed into three kingdoms, Chromista, Fungi (or Eumycota) and Protozoa (Barr, 1992; Hawksworth et al., 1995). Protozoa have traditionally been treated under the Zoological Code, but should the established systems for slime moulds be disrupted (cf. Weresub, 1979)? Further, molecular data suggest that the kingdom Fungi is closer to Animalia than Plantae, although the confidence in that branching point on the rRNA sequence tree is not high (Embley et al., 1994). It could therefore be argued that Fungi should start to be treated under the Zoological and not the Botanical Code as at present! A further complication in the case of yeast fungi is that zymologists frequently publish in the International Journal of Systematic Bacteriology and some yeast names have inadvertently entered updates of the Approved Lists of bacterial names (Moore & Moore, 1989).

It is impossible to forecast how the concepts of higher categories will evolve in the future, yet we can be sure that increasingly harmonized, and eventually unified, rules will obviate the need for acrimonious debates on issues which are an abstraction from phylogenetic realities.

The Needs of Users of Names

First and foremost, the users of scientific names require the maximum level of stability that is consistent with advances in knowledge of the organisms themselves. As Dwight (1909) already stated, "unpractical zoologists have long put up with a nuisance that business men would not have tolerated a moment". His views are echoed in more recent headlines such as "Stop taxonomists" (Barnett, 1989) and "Taxonomic instability continues to irritate" (Crisp & Fogg, 1988). The needs of users translate into having as pragmatic a system as possible which minimizes changes in names for other than scientific reasons. At present there is an enormous reluctance amongst fellow scientists in the same disciplines to take up name changes if the reason for them is unclear, as evidenced by examples from the BIOSIS database (Hawksworth, 1994).

The advent of computerized searching in bibliographic databases, particularly through the enormous numbers of connections becoming possible at an accelerating rate by the Internet and World Wide Web has highlighted the issue of inter-Code homonyms, which can only be contained in the future by concerted actions. The scale of this problem is not always appreciated. A study undertaken on behalf of the International Committee on Bionomenclature (ICB) revealed that of 64 419 names of "botanical" genera, 8784 were
Homonyms of zoological generic names; further, of the 8784, 3554 are of generic names in current botanical usage (P.M. Kirk, unpubl.).

Homonyms are likely to become an increasing source of confusion as the trend for cross-group approaches to site inventories and checklists accelerates, and also to ecological studies involving a wide array of organisms; the possibilities of confusion abound.

The Needs of Systematists

However, one of the main needs for a new bionomenclature is to limit the time systematists themselves spend on nomenclatural matters, taking them away from productive scientific research. The world's taxonomic workforce is declining both numerically and in years, to the extent that, as pointed out by Gaston & May (1992), captive breeding programmes would be contemplated if we were other than humans. It has been calculated that there were 7000 biosystematists world-wide publishing new taxa in 1992 (Heywood, 1995). It has also been suggested that publishing taxonomists only spend 0-20% of their professional time actually doing taxonomy (Janzen, 1993); accepting the 20% figure suggests that the actual work force could be as low as 1400 full-time equivalents.

The little research time that is available needs to be maximized. Data have been presented which suggest that for botanists an average of 20% of their time is spent on nomenclatural matters, i.e. one day in five (Hawksworth, 1992). Taken in the context of the declining workforce and the magnitude of the task before them this is matter of great concern. At the present rate of progress of species description, it will take another 575 years to name all the estimated 13.6 million species on Earth (Heywood, 1995) - assuming that taxonomists switch from plants and vertebrates to bacteria, fungi, nematodes and insects. Biosystematists can be perceived as fiddling with historical and pseudolegalistic niceties amongst the 13% of the known biota on Earth, rather than directing the available energies to tackling the undocumented 87% (Heywood, 1995).

A further difficulty for the upcoming practicising systematist is a lack of training in bibliographical, historical, and nomenclatural skills. With so much to learn with respect to the use of genetic, molecular, phylogenetic, ultrastructural, morphometric, and other techniques, the biosystematists of the 1990s are even more reluctant to become well-versed in the application of Latin and nomenclatural rules than their predecessors of the 1980s. With increased attention to productivity and excellence being demanded by those who manage science, the extent to which professional biosystematists have a choice in prioritizing their time is already on the wane.

The Needs of Less-Developed Nations

Less developed countries have a resurgence of interest in their biotas as a result of the Convention on Biological Diversity, now ratified by 152
governments. National biodiversity action plans are being developed which involve the recognition of endemic and endangered species. All this is being undertaken against a background of minimal human, library, and reference collection resources. The nomenclatural systems which emerging nations require have to be as straightforward and minimally dependent on resources as is practicable with accuracy.

A paper on *Practical Approaches for Capacity Building for Taxonomy* prepared by the Secretariat to the Convention for the second meeting of its Subsidiary Body on Scientific, Technical and Technological Advice on 2-6 September 1996 specifically identified the need to streamline the process of bionomenclature, which it considered time consuming and expensive to pursue.

In meeting the demands of less developed countries, we will simultaneously be meeting the needs of other users of names, including many younger systematists.

**The Common Problems to be Addressed**

The different Codes, especially the Botanical and Zoological, are increasingly finding that they have common problems to address: priority (and its restriction), effective and valid publication (including electronic publication), illegitimacy, typification, ambiereginal organisms, and decision-making processes (Hawksworth, 1992). These issues are starting to be addressed in the principal Codes. Significant progress was made at the International Botanical Congress in 1993 (Greuter & Nicolson, 1993), and many new ideas are currently under discussion in relation to the next edition of the Zoological Code. Rather than separate groups discussing different solutions to the same or different problems, it is clearly advantageous to pool resources and work towards the most effective solutions. The areas in which common solutions to shared problems can be sought are discussed in the following contributions.

**The Image of Biosystematics**

The image of the taxonomist is perceived so negatively in many areas of the biological sciences that I avoid the word wherever possible, and preferentially employ the broader term "biosystematist". The image is of someone divorced from issues of the real world, often working in amongst dusty collections or books. The problem is one of long-standing, and its essence is encapsulated in Haldane's (1940) remark that "species making is a nice job for biologists who . . . lack that peculiar quality which makes the good experimenter . . . some of [whom] abuse one another . . . for breaking various sacred rules . . . ; such rules are of course needed to avoid confusion, but a life spent enforcing them leads one a long way from the scientific spirit". Almost 50 years later, Hull (1988) observed that "as most people view taxonomists, they are more librarians than scientists". The images may on occasion amuse, as in Gould's (1991) *Bully for Brontosaurus*, but they can also subliminally reinforce the concept of irrelevance from one generation to the next. Old images have a
tendency to persist, as with impressions of holiday venues of the past, oblivious to changes that may have taken place; if sites are not revisited we remain ignorant of developments, whether positive or negative, unless changes are brought to our attention - for example through the media.

Some criticisms may be justifiable, and the need to put our house in order in relation to bionomenclature has been stressed elsewhere (Bisby & Hawksworth, 1991). A vigorous and determined approach to address this underlying cause of the image-problem will require a concerted approach in sympathy with the needs of its practitioners and its users.

The Funding of Bionomenclature

The real cost of bionomenclature world-wide, including the time researchers devote to the task, dedicated staff, committees, and meetings, has been estimated at not less than around US$ 22 million per year (Hawksworth, 1994). The bulk of this cost is hidden in the salaries of organizations and institutions paying individual scientists, and also their travel and communication costs. This matter will gradually come to the fore as individual duties are increasingly scrutinized (see above); it will prove more difficult to secure biosystematists to serve on labour-intensive committees, and for them to obtain funds to attend primarily nomenclatural meetings. Of more urgent concern is the support for the operational structures necessary to provide even the current system, especially in the case of zoology.

If we can present an organized front across biology, orientated towards delivering a system users require, and meeting the needs of developing countries, the prospects of gaining international donor support will be immeasurably increased. This is especially so if the concerns being voiced by the Secretariat of the Convention on Biological Diversity (see above) are addressed, and if developments can be integrated with the Clearing House Mechanism's national focal points being established under its auspices - something particularly pertinent in relation to the possible registration of newly proposed names.

Continuing the Debate

The need for change at this time is overwhelming. But we proceed too hastily at our peril. The Codes are already littered with problems arising from provisions which were first introduced with the best of intentions. It is for this reason that the debates which started back at ICSEB III in 1985 are continuing. I consider it vital that any major changes are proceeded with only after full and open debate, and a most careful consideration of all substantive concerns that may be identified. It is for this reason that the Draft BioCode has been made freely available in printed and electronic media, and that this present meeting is talking place. This is a debate which cannot be confined to international biological fora. It has to continue in specialist disciplinary scientific congresses and symposia, and in national as well as international
arenas. It also has to involve the producers and the consumers of the scientific names of organisms.

My vision is for a system of the future which will combine the maximum of scientific freedom with optimal utility and simplicity. To attain this goal may involve some near-misses, but I believe we have a target worthy of a strike, and that our approach should be one of seeking solutions and not only of identifying problems. I encourage you to approach this issue in that light.

Acknowledgements

I am indebted to Dr D.H. Nicolson for drawing to my attention the quoted sentence from De Candolle's Lois and its translation, and to Dr P.M. Kirk for access to the first results of the inter-Code homonym analysis undertaken in collaboration with BIOSIS.

References


Abstract

Biology as a science is unusual in that the objects of its study can be named according to five different Codes of nomenclature. Three of these, the International Code of Botanical Nomenclature (ICBN), the International Code of Zoological Nomenclature (ICZN), and the Bacteriological Code (BC), although sharing common principles, diverge in the terminology that they use and in important aspects of their rules. Effective biological communication requires simple, common procedures for establishing the accepted scientific names of organisms. The first priority is a common terminology. The second is the resolution of those few but significant differences in philosophy that have arisen, particularly during the 150 years of separate evolution of the ICZN and the ICBN; these include issues of status and homonymy within ranks and groupings of ranks and upon taxonomic change in generic assignment. The resolution of these by the establishment of common rules, as in the Draft BioCode, provides the only unequivocal solution for resolving practical issues, such as the nomenclature of groups subject to more than one existing Code, the so-called ambi-regnal organisms.

Introduction

Effective biological communication requires simple, common procedures for establishing the accepted scientific names of organisms. I emphasize that the procedures must be simple. This is particularly important in a time of decreasing human and financial resources available for the scientific study of organisms and their interrelationships yet no diminution of the need for systematized information about organisms.

A number of years ago a particular step in my career prompted one of the more prestigious biographical directories to invite inclusion of a résumé of my career. The questionnaire included the entry "Recreation". To emphasize a point that I had been making to a colleague, pressuring me to complete a nomenclatural paper, that I was paid to increase understanding of the diversity of living organisms and not to spend hours in libraries seeking to elucidate the intentions of long-dead authors (however fascinating that may sometimes be), I chose to enter "botanical nomenclature" under the "Recreation" heading — and there I believe it survives to this day. I tell this story because I believe that it highlights the fact that although a stable, unambiguous nomenclatural system is vital for
scientific communication, the balance of time and effort must not be allowed to
switch from the generation and synthesis of data about the kinds and diversity of
organisms to concentrating solely on determining the acceptable names — the
"recreation" must not take over from the real work.

I sometimes wonder if those who most eloquently plead for retaining the
nomenclatural status quo are not, at least in part, pleading to retain the central
importance of their "recreation" from new and simpler procedures that would
devalue existing nomenclatural erudition in favour of more constructive taxo-
nomic output.

I believe that a simple, stable system of biological nomenclature requires a two-
pronged approach: the development of lists of acceptable names ("potentially
valid" in zoological parlance and "legitimate" in bacteriological and botanical
speech) that would be needed in any likely modern taxonomic treatment, along
with a simple, integrated set of rules for the naming of all organisms in the
future, such as is envisaged in the Draft BioCode. This paper seeks to identify
the key issues that need to be addressed in preparing such a simple, integrated
code. In order to do so, I have sought to analyze the differences between
existing codes, identifying their impact and their implications for future
scientific nomenclature. To the best of my knowledge, although Jeffrey (1989)
provides an integrated summary of the provisions of the various Codes of
Nomenclature, the only previous attempts to compare the provisions of different
Codes were restricted to the botanical and zoological Codes. The first was a
symposium held by the Linnean Society of London in 1944 (Anon., 1944)
where M.L. Sprague (née Green), presenting "the case for the botanists", out-
lines clearly some of the major differences between the two Codes that then
existed, the botanical (Briquet, 1935) and the zoological (International
provided a useful summary of some of the differences between the current
zoological Code (Ride et al., 1985) and the botanical Sydney Code (Voss et al.,
1983).

The Current Situation

As Hawksworth (1995) puts it: "Biology as a science is unusual in that the ob-
jects of its study can be named according to five different Codes of nomen-
clature". The current rules governing the names of animals and plants,
respectively the International Code of Zoological Nomenclature (ICZN) (Ride
et al., 1985) and the International Code of Botanical Nomenclature (ICBN)
(Greuter et al., 1994), have origins that diverged in the mid-19th century.
Although based on essentially the same principles, notably that there should be
a unique name for each taxon and that the choice of competing names should be
determined by precedence in date of publication, the two sets of rules have
diverged in detail over their 150 or so years of separate existence. A third set of
rules, the Bacteriological Code (BC) (Lapage et al., 1992), first developed in
1953 (published in 1958), started essentially as a derivative of the ICBN and in
1973 developed a new starting-point date (1 January 1980) through the
establishment of an "Approved List of Bacterial Names" (Skerman et al., 1980,
Key Issues to be Addressed

1989). The *International Code of Nomenclature for Cultivated Plants* (ICNCP) originated in 1953 and represents a set of rules subordinate to those of the ICBN and applicable specifically to cultivated plants. The most recent (6th) edition (Trehane *et al.*, 1995) clarifies the complementary role of the ICNCP relative to the ICBN. The naming of viruses and sub-viral agents (prions etc.) will be covered by the draft *International Code of Virus Classification and Nomenclature*, being developed from the current *Rules of Virus Classification and Nomenclature* (Murphy *et al.*, 1995), by the International Committee for the Taxonomy of Viruses (ICTV) of the International Union of Microbiological Societies (IUMS).

For the general user of scientific names of organisms, there is inherent confusion in many aspects of this situation: different sets of rules have different conventions for citing names, provide for different forms for names at the same rank, and, although primarily each is based on priority of publication, they differ somewhat in how they determine the choice of correct name. This diversity of Codes can also create more serious problems as, for example, in the determination of which Code to follow for those organisms that are not clearly plants, animals or bacteria, the so-called ambireginal organisms, or those whose current genetic affinity may be well established but whose traditional treatment has been in a different group (e.g. the cyanobacteria, alias the blue-green algae). Moreover, the development of electronic information retrieval, by often using scientific names without clear taxonomic context, accentuates the problem of divergent methods of citation and makes homonymy between, for example, plants and animals a source of trouble and frequently confusion.

It should, however, be noted that the confusion arising from the existence of different Codes, is essentially confined to applications of the bacteriological, botanical and zoological Codes. As noted above, the cultivated plant Code (ICNCP) supplements the botanical Code by providing for special ranks covering "plants whose origin or selection is primarily due to the intentional actions of mankind". The different form of virus names has hitherto precluded confusion with names of non-virus organisms, but it is vital that this be maintained and strengthened.

Interestingly, there were early attempts at integrated Codes of biological nomenclature. The first, contemporaneous with the 1843 "Strickland Rules" for zoology, reflected the work of a commission of the Scienziati Italiani set up under the leadership of Principe C. Bonaparte (cf. *Atti Scienziati Italiani* 4: 229-238; 305-315, 1843; 5: 382-387; 761-825, 1844). Some 30 years later, Dall (1877) was commissioned to prepare a report on zoological nomenclature to the American Association for the Advancement of Science included under a "Discussion of the Subject of Nomenclature" 34 pages of "General Principles". These were more by way of quotations from previous works, such as de Candolle's *Lois* (Candolle, 1867), than a true integration, and, in critical areas of divergence between the Codes, the principles Dall is recommending are far from clear. Perhaps it is for this reason that his work is little more than a footnote in the history of biological nomenclature.
Divergence Between the Codes

To anyone familiar only with the botanical Code, the zoological Code does not at first make easy reading; I am certain that the same is true for someone familiar with the zoological Code on being first presented with the ICBN. The reason for this is much more fundamental than the superficialities of format, or even the general past practice of the ICZN, fortunately being discontinued, to use hypothetical rather than actual examples (so that the mythical genera A-us and B-us appeared confusingly often). It is indeed a function of the independent development of the two sets of rules since the "Strickland Rules" (Strickland et al., 1843), from which zoological nomenclature originated, and de Candolle's Lois (Candolle, 1867) from which the successive editions of the botanical Code have stemmed. Separate philosophies, manifest in different concepts and terminology, have developed from the same basic principles. This paper seeks to interpret these differences, distinguishing the superficial from the more fundamental.

By comparison with the ICZN, the Bacteriological Code is an "easy read" for anyone familiar with the ICBN, doubtless reflecting the fact that, prior to the BC's development, the botanical Code had governed the nomenclature of bacteria. Indeed the two Codes are essentially similar apart from the BC's distinctive features of Approved Lists, and the requirement, for establishment of names, of publication directly or through Validation Lists in the International Journal of Systematic Bacteriology. The other differences are the adoption of a few terms from the zoological Code (see Greuter et al., 1996, Table 1; McNeill, 1996b, Table 2), and the preservation of some elements of earlier editions of the botanical Code that have been modified in the ICBN since 1978 — i.e. the bacteriological and botanical Codes are already diverging after only 20 years of separate existence!

In the discussion that follows, emphasis will be on the differences between the ICBN and the ICZN with supplemental notes on the provisions of the Bacteriological Code where these are particularly noteworthy.

The divergence between the botanical and zoological Codes which is, as noted above, by far the greatest, can be looked on in under six different headings, as follows:

a. Terminology
b. Form of names and author citation
c. Coverage (up to family/all scientific names)
d. Particular requirements and procedures (language requirements; starting-point dates; typification procedures; tautonyms; other requirements for establishment, e.g. basionym citation)
e. Provision for over-riding or supplementing the Code (lists of protected names; registration as a criterion for establishment of names; conservation/suppression)
f. Concepts (independency; co-ordinate status; secondary homonymy; illegitimacy)
Key Issues to be Addressed

All of these have some bearing on how an accepted (correct/valid) name is determined under the respective Codes and many are, therefore, particularly critical in the dealing with ambireginal organisms, but from the perspective of the development of a BioCode, I believe that the key issues are the first and the last: (a) Terminology and (f) Concepts.

(a) Terminology

One of the mandates of the 1994 Egham meeting, arising from the XXIV IUBS General Assembly held in Amsterdam in 1991, was to consider how to harmonize the terminology of biological nomenclature (Hawksworth et al., 1994a, 1994b). The need for this is clear when one realizes that when a botanist or bacteriologist describes a name as "valid", he or she is applying it to a name that a zoologist would call "available", a term that in turn a botanist would equate with something close to the zoologist's "potentially valid". By contrast, the zoologist's "valid name" is the botanist's and bacteriologist's "correct name". Indeed, one of the first things that the participants at the Egham meetings had to do among themselves was to acquire a knowledge of the terminology of the other Codes, e.g. to allow botanists and bacteriologists to understand what we quickly came to call "zoospeak", and, conversely to ensure that "botspeak" was intelligible to zoologists. The need for a new "biospeak" was self-evident.

One of the first achievements of the International Committee on Bionomenclature was the development of recommended nomenclatural terms. These are summarized in Table 1 of the Draft BioCode (Greuter et al., 1996; see also International Committee on Bionomenclature, 1996), in Table 1 of Hawksworth (1995), in Table 2 of Hawksworth (1996), and with minor corrections in Table 2 of McNeill (1996b). The principles upon which these have been chosen were as follows. In all cases of confusion (such as the use of "valid" and "available" mentioned above), a new term was adopted, if possible one whose meaning was identical to, or was encompassed by, the everyday meaning of the word. In the more numerous cases in which there was different usage but no inherent confusion, the more generally understandable term was adopted. If no such distinction appeared to exist, a choice was made such as to maintain an approximately equal number of usages from the different Codes.

New terms have, therefore, been proposed for many of the familiar nomenclatural expressions used in Botany such as "effectively published", "validly published", "legitimate" and "correct", and some in Zoology such as "available", "valid" and "senior" and "junior". In this way, it is hoped in the future to avoid the ambiguity that results, under the current Codes, from use of the same terms in a different meaning, or of different terms for the same concept. Interestingly, the International Commission for the Nomenclature of Cultivated Plants has found it possible to adopt the new terminology in the most recent edition of the International code of nomenclature for cultivated plants (Trehane et al., 1995). I understand, moreover, that in a forthcoming Italian translation of the ICBN Tokyo Code the recommended BioCode terminology will be utilized instead of that in the original English version of the Tokyo Code. I would sincerely hope that in the production of the forthcoming fourth edition of the ICZN, the revised
bionomenclature terminology might also be used. If this is done, then there is every likelihood that this terminology could also be adopted in the edition of the ICBN that is to be expected following the XVI International Botanical Congress to be held in St. Louis in August 1999.

I believe, however, that more needs to be done in this area. A Draft Glossary of Terms used in Bionomenclature (Hawksworth et al., 1994b) was deliberately presented as an integrated list but without any value judgements on preferred terms. The tables of equivalents discussed above includes key recommended terms, but there are other terms, and, more particularly, other usages of terms, that are differentially preferred by botanical or zoological nomenclaturalists or are used in different senses by the two groups. The phrase "specific name" when used by zoologists implies the "specific epithet" of botanists, whereas a "specific name" to a botanist is a "binomen" to a zoologist. This is not solely a matter of terminology, but also a matter of nomenclatural actions being expressed in ways that reflect some of the conceptual differences between the Codes that are discussed below. The discussion by Melville (1986) of "nominal taxa" is a good example of divergent philosophy encompassing divergent terminology. Perhaps a revision of the Draft Glossary that took account of differing philosophy and that did seek to make recommendations would be a goal for which to aim.

(b) Form of names and author citations

The form of names, and the form of author citations associated with names, although prescribed to a greater or lesser extent in all the Codes, are, relatively speaking, details which should not be fundamental to any integration of biological nomenclature. Nevertheless, despite the fact that they are essentially details within the Codes, they tend to generate strongly held views and consequent controversy. They are, indeed, one of the components of biological nomenclature that most need to be explained to users (cf. McNeill & Barkworth, 1996).

(i) Terminations

The differing terminations ("suffixes" in the ICZN, which reserves "termination" to describe modification to epithets to ensure agreement in gender) for the same rank (e.g. -aceae for botanical and bacteriological families and -idae for zoological ones) can be confusing for beginning students and the situation in which the same termination is used for different ranks under the different Codes (e.g. -inae for subtribes under the ICBN and the BC, and for subfamilies under the ICZN, as well as the former's use -idae for subclasses of plants) is perhaps even more so – see discussion and proposals by Greuter in this Symposium. Fundamentally, however, they are not major obstacles to a simple, integrated BioCode.

(ii) Italicization

The question of how to distinguish scientific names from other text, e.g. by italicization, and the ranks of names to be so distinguished, is not directly
Key Issues to be Addressed

Legislated by any Code, although the ICZN (App. E.2) recommends the use of a different typeface for the scientific names of taxa of the genus and species groups and the question is discussed in the Preface (p. xii) to the ICBN, which chooses to italicize all scientific names. The practice of the different Codes thus varies and there is some suggestion that the utilization of italics for ranks above the family in zoology might lead to confusion with generic names because of the absence of the mandatory terminations for many such ranks that exist in the botanical Code (cf. Hawksworth et al., 1994a, pp. 21–22).

(iii) Orthography

Apart from evident typographic errors (Art. 32(c)), the zoological Code requires that the original spelling of a name be adopted, regardless of whether it represents an orthographic error, whereas the botanical Code permits limited correction of orthographic errors and routine correction of typographical ones. Neither Code permits resolution of the problem of divergent orthography for the same word, e.g. some common epithet such as sylvaticus / silvaticus and pennsylvanicus / pensylvanicus / pensilvanicus. This is an issue addressed constructively by Greuter in this Symposium.

(iv) Conformity to Latin grammar

All three Codes specify that scientific names are Latin, latinized, or "treated as" / "deemed to be" Latin (BC Prin. 3; ICBN Prin. V; ICZN Art. 11(b)). This would appear to be the fundamental issue with regard to proposals such as those made in preparing the fourth edition of the ICZN (not, as it turns out, sufficiently well supported to be incorporated in the new edition) of abandoning the requirement for an epithet (e.g. a "specific name" in zoospeak) to agree in gender on transference from a genus with one gender to that with another. Nomenclature is a system of appellations intended to facilitate communication amongst modern scientists. In that sense, the particular form of words can be quite arbitrary and need not conform to the grammar of any particular language. If this is done, however, then scientific names are no longer Latin nor being treated as Latin.

The question that must then be addressed is how they can be most effectively distinguished from other names. For example, in languages other than Latin in which the adjective also commonly follows the noun, how can it be established that a designation such as Castor americain, or Virio blanc, followed by a French description, is not intended as a scientific name? Indeed, if names are not Latin or treated as Latin, there is no legislative requirement at the moment for the generic name to precede the specific and so there is nothing to rule that an account of the Lochness Monster with the description "a serpent-like animal with five humps appearing on dark nights, particularly after the pubs close" is not a serious scientific description of a member of the new genus Monster. By comparison, Nessiteras rhombopteryx Scott & Rines (cf. Scott & Rines, 1975; Lawton, 1996) may indeed be a "monster hoax by Sir Peter S" but at least it is evidently intended to be a scientific name.
(v) Author citation

The one matter of form — normally a detail under the Code — that does have some conceptual implications is that of the citation of author names. The major difference between botanical and bacteriological usage on the one hand and that of zoologists on the other, is the "double citation" used in botanical and bacteriological work. That is, the name of an author transferring a species from one genus to another, or making a change of rank, e.g. from subspecies to species, is placed outside the parenthetical citation of the original author of the epithet. The reason for this difference in botanical and bacteriological practice is not a mere matter of quixotic style, but is quite fundamental. This is obvious in the case of a change of rank, because precedence (priority) under the botanical and bacteriological Codes is strictly limited by rank (see below), whereas the publication of a subspecies under the zoological Code implies the publication at one and the same time of the same epithet (name) at species rank — and vice-versa.

The same conceptual basis exists in the case of a transfer to a new genus because precedence of the combination (as opposed to the epithet) under the botanical and bacteriological Codes dates only from the time of the transfer, whereas under the zoological Code, it dates from the original publication of the epithet "species name", and takes precedence over an independent usage of the name in the genus to which transfer is being made, the so-called secondary homonym situation in zoological nomenclature (see below). For example, the full author citation with the date of transfer to *Rhododendron*, e.g. in the form *Rhododendron japonicum* (A. Gray) Suringer (1908), based on *Azalea japonica* A. Gray (1859), is essential to explain why this name has precedence, under the ICBN, over *Rhododendron japonicum* (Blume) Schneider (1909), based on *Hymenanthes japonica* Blume (1826). Under the ICZN, the priorities would be reversed, the only critical dates, and hence the only critical citation being that of the original author. [See (iii) Secondary Homonymy under (e) Concepts, below.]

The double citation in bacteriological and botanical nomenclature is thus a natural concomitant of not recognizing secondary homonymy and rejecting co-ordinate status. As the Draft BioCode also does not recognize secondary homonymy, I believe that it errs in not requiring double citation on transfer between genera, although, as it does provide for co-ordinate status, it is correct in abandoning the bacteriological and botanical tradition of double citation on changes of rank within the species, genus and family groups.

(e) Coverage

The Codes vary in terms of the ranks covered by their provisions. Essentially there are two elements involved: the ranks to which precedence applies, and the ranks which are governed only by other provisions of a particular Code. In the case of the ICZN, these are identical: the ICZN regulates only "the names of taxa in the family, genus and species groups" (Art. 1 (a)), and in all these the rule of precedence applies (Art. 23). The ICBN, while restricting precedence to the rank
of family and below (Art. 11) (but note that this includes *varietas* and *forma* not covered by the *ICZN*), seeks to govern all scientific names of organisms "traditionally treated as plants" (Pre. 7) and enumerates possible ranks from *regnum* to *subforma* (Art. 4.2). For ranks above that of family, the rules govern the form of names, permitting descriptive names, but specifying the endings for names of divisions (phyla), classes, subclasses and orders that are derived from the stem of the name of an included genus (Arts. 16-17), and that are thereby automatically typified. The *Bacteriological Code*, resembles the *ICBN* in restricting the rule of precedence, but applies this up to the rank of order (Rule 23a), and does not recognize any rank below subspecies (Rules 5c, 14a); it also specifies the form of names above the rank of order, but only to the rank of class (Rule 5b). Like the *ICZN*, the *BC* does not govern ranks such as section and series between genus and species, which are covered by the *ICBN*.

Patterson & Larsen (1992) discuss how the application of the rules of precedence and typification, particularly, though not only, through their divergence amongst *Codes*, can be destabilizing at higher taxonomic levels. Given the fluidity of classification of protists at higher taxonomic ranks, they suggest that nomenclatural "coherency", i.e. application of rules such as typification and precedence, be abandoned above the rank of family, essentially the current position of the *ICZN*. Corliss (1993), in his review of the nomenclatural problems and needs of protistology, takes the same view.

(d) Particular requirements and procedures

Under this heading, I include those differences between the *Codes* that, although of considerable significance so far as their effect on the choice of accepted name is concerned, do not have any conceptual basis, but are, as the title indicates, strictly particular requirements that have been embedded in the *Codes* in somewhat different ways.

(i) Requirement for Latin diagnoses

The most striking of these particular requirements is that in the botanical *Code* (Art. 36) specifying that, from 1 January 1935, a Latin diagnosis or description is required for establishment (valid publication) of the name of any new taxon of recent plants. (Names of new taxa of fossil plants were previously established (validated) by means of a description in any language; since 1995 this must be in either Latin or English.) By contrast, names of new taxa may be published under the zoological *Code* with a description in any language that uses "words" (Art.13 (a)(i)), although it is recommended that when the description "is not written in English, French, German, Italian or Latin, it should be accompanied by a translation into one of these languages", which might suggest a rather odd European bias, given the more widespread use of Chinese, Hindi, Spanish, Russian, Arabic, Bengali, Portuguese and Japanese than any of these languages, save English! Names of taxa of bacteria can also be described in any language, and in this case the recommendation is that if it is "published in a work written in a language unfamiliar to the majority of workers in bacteriology", which, in effect, probably means any language other than English, "it is recommended
that the author(s) include in the publication a description in a more familiar language" (BC Rec. 25a).

(ii) Starting-point dates

Differences in starting-point dates, although on the face of it an inherently self-contained matter, in that the different starting-point dates apply to different groups of organisms, can be of significance in determining the correct name of taxa that have been considered under more than one Code. 1 January 1758 is the starting-point for all names under the zoological Code (the date upon which both Linnaeus's *Systema Naturae* edition 10 and Clerck's *Aranei Svecici* are deemed to have been published, although the latter, covering the *Arachnida*, was actually published in 1757 and is given precedence over Linnaeus's publication), and 1 May 1753 for most groups under the botanical Code, but with numerous exceptions involving six different dates, ranging from 1801 for the mosses (*Sphagnaceae* excepted), through 1820 for all groups of fossil plants, to as late as 1900 for the algal family *Oedogoniaceae*. Until the Sydney Congress of 1981, the starting-point dates for names of fungi were either 1801 (*Uredinales* (smuts), *Ustilaginales* (rusts) and *Gasteromycetes*) or 1821 (all other fungi), the dates of significant publications by Persoon (*Synopsis methodica fungorum*) and Fries (*Systema mycologicum*), respectively; although the starting point is now the same as that of most other organisms covered by the botanical Code, these works are granted special status under a procedure known as sanctioning, analogous to conservation *en bloc* (see ICBN Art. 15). Apart from the specific starting dates under the ICBN of 1 January 1886 and 1892 for the homo- and hetero-cystous *Nostocaceae*, respectively, which, as *Cyanobacteria*, some might wish to treat under the Bacteriological Code, with its starting-point date of 1 January 1980 (Rule 24a), divergence in starting-point date is unlikely to be a serious problem, as it can, in practice, only effect those few names of organisms that might be treated under the botanical or zoological Codes, that were published between 1753 and 1758.

(iii) Mandatory designation of type

Whereas the ICBN has required, since 1952, specific designation of a type for establishment (valid publication) of the name of a new taxon, this, although considered good zoological practice, has not hitherto been mandatory, although the provision will be included in the forthcoming fourth edition of the ICZN. The BC also makes designation of a type mandatory for effective publication (Rule 16). As this requirement has been a feature of the BC since its inception, that *Code* has no need for specific rules governing the designation of alternatives to a holotype, as have the botanical and zoological Codes. Whereas the ICZN requires that the first choice of lectotype must be followed unless it can be shown that the designated specimen was not eligible (not being a syntype) (Art. 74(a)), the ICBN can permit supersession of such a choice if the element chosen is in conflict with the protologue (i.e. the original description and associated material).
Key Issues to be Addressed

(iv) Prohibition of tautonyms

The relatively simple prohibition of tautonyms, that is, names in which the specific epithet exactly repeats the generic name, in the botanical Code causes quite a marked difference in the treatment of names of many common species under the botanical Code, compared to what would be the case were they animals (see Table 1). This arises principally from the usage by Linnaeus, and other early taxonomists, of old, disused generic names as specific epithets. Later work has seen the establishment or re-establishment of these names for genera including the species so named, and the botanical autonym rule has required the adoption of a later epithet, often based on a different type, and in some cases representing divergent populations that might be or come to be taxonomically distinguishable, creating undesirable instability. For example, the almost cosmopolitan common reed was named Arundo phragmites by Linnaeus (1753); it is now considered to belong to the genus Phragmites Adanson (1763). Trinius (1820) was the first to rename the common reed in the genus Phragmites and he very appropriately called it P. communis Trin. However, in 1799, Cavanilles had described what he believed to be a new Southern Hemisphere species of Arundo on the basis of material collected at "Botany Bay" in Sydney, Australia, calling it A. australis Cav. Trinius later recognized that this belonged to Phragmites and the new combination P. australis (Cav.) Trin. ex Steudel was published in 1841. Some 30 years ago (cf. Greuter & Rechinger, 1967), it was concluded that the Australian species was conspecific with the common reed, and so the cosmopolitan species must now be called P. australis. Although no recent work suggests that the Australian plants do indeed represent a distinct species, native ("P. australis") and introduced ("P. communis") populations can apparently be distinguished morphologically in Australia, raising questions as to the stability of this name change.

(v) Other criteria for establishment of names

Jeffrey (1986) lists a number of other particular requirements, generally of the botanical Code, that differentially restrict the establishment of names. These include the requirement for Latin terminations for names at the rank of family and above, and the prior or co-establishment of a generic name for establishment of that of an included species.

(e) Provision for over-riding or supplementing the Code

(i) Conservation and suppression

Historically, botanical nomenclature has been much less willing to permit departures from the application of the rules than has zoological nomenclature (see McNeill & Greuter, 1986, for a discussion of historical factors in the development of mechanisms for over-riding the provisions of the International Code of Botanical Nomenclature.) Although the much wider scope for conservation and suppression (rejection) approved in Yokohama for the 1994 Tokyo Code now permits, for purposes of maintaining nomenclatural stability, conservation or suppression of any name at the species, genus or family rank, there is no parallel
Table 1. Effect of the tautonym rule in botanical nomenclature

Comparison of the accepted names of the European larch (Larix), and cassava or tapioca (Manihot) under the botanical Code with what would be the accepted names were the nomenclature of these organisms governed by the zoological Code, and a similar comparison of the name of the electric ray (Torpedo) were its nomenclature governed by the botanical Code.

<table>
<thead>
<tr>
<th>ICBN</th>
<th>ICZN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Larix decidua</strong> Miller, <em>Gard. Dict.</em> ed. 8, no. 1 (1768)</td>
<td><strong>Larix larix</strong> (Linnaeus 1753) [Karsten, 1881]</td>
</tr>
<tr>
<td><strong>Manihot esculenta</strong> Crantz, <em>Institut.</em> 1: 167 (1766)</td>
<td><strong>Manihot manihot</strong> (Linnaeus, 1753) [Cockerell, 1892]</td>
</tr>
<tr>
<td><strong>Torpedo ocellata</strong> Raf., <em>Indice ittiol.</em> Sicil. 48, 60 (1810)</td>
<td><strong>Torpedo torpedo</strong> (Linnaeus, 1758) [Fraser-Brunner, 1949]</td>
</tr>
</tbody>
</table>

in botanical nomenclature to the virtually unlimited plenary powers of the International Commission on Zoological Nomenclature. In practice, however, the botanical and zoological Codes both now provide effective mechanisms for avoiding "disadvantageous changes in nomenclature". As noted below, the need for such provisions in the Bacteriological Code is substantially less in light of the Approved Lists of bacterial names (Skerrnan, 1980, 1989) and the requirement for publication of all new names in the *International Journal of Systematic Bacteriology*. Nevertheless the Bacteriological Code provides for a Judicial Commission (General Consideration 6(4) and Rule 4), which in addition to handling proposals for conservation and suppression of names, is responsible for "interpretation of the Rules in doubtful cases" and may overturn nomenclatural actions such as neotypification (Rule 18c).
Key Issues to be Addressed

(ii) Approved lists

As noted above, the most significant feature by which the *Bacteriological Code* differs from the *ICBN* and the *ICZN* is in the establishment of an approved list of bacterial names which was adopted in 1978 with the second edition of the *Bacteriological Code* and which established 1 January 1980 as a new starting-point date for names of bacteria (Rule 24a). In consequence, many of the provisions of the *ICBN* and the *ICZN* that are particularly applicable to situations for names of the 18th, 19th and early 20th centuries are not required in the *Bacteriological Code*. As already mentioned, the establishment of well-researched and documented lists of names under the botanical and zoological Codes such as would be needed for any likely contemporary taxonomic treatment is a desideratum. As such lists of names are developed, and particularly if, as provided in the new fourth edition of the zoological *Code*, other names are thereby disestablished (made unavailable), the pre-existence of an approved *BioCode* becomes increasingly desirable.

(iii) Registration

Another distinctive feature of the *Bacteriological Code* is the requirement for establishment that names be published in the *International Journal of Systematic Bacteriology*. Similar provisions are included in the most recent edition of the *ICBN* but with implementation delayed until after the 1999 International Botanical Congress, to be held in St. Louis, Missouri, USA, and only so long as effective mechanisms for such registration are in place by that time. The International Commission for Zoological Nomenclature has concluded that any similar system for zoological names is not at this time feasible and has not included such a provision in the draft fourth edition of the *ICZN*. Provision for at least a single location for the listing of new names becomes extremely desirable for any group in which an accepted list of names exists.

(f) Concepts

(i) Independency

It is appropriate here in Budapest to pay tribute to the outstanding taxonomic and floristic work of the great Hungarian botanist Rezső Soó. In the introductory material to his 5-volume account of the flora and vegetation of Hungary (Soó, 1964-73), he has a section entitled "A Nomenklatúra Szabályai", in which he outlines the principles upon which the *International Code of Botanical Nomenclature* is based. In one form or another, such principles are common to the botanical, zoological and bacteriological *Codes*, but the first one, which in Hungarian is "A botanikai nomenklatúra független a zoológiaától, növények és állatok ugyanazt a nevet viselhetik" (Botanical nomenclature is independent of zoological nomenclature) is the major factor in these two *Codes* developing in separate ways, such that many of the concepts that are implicit in one code are not shared by the others.
Most obviously, the independence of the nomenclature determined by each of the Codes can and does lead to extensive homonymy, that is, the occurrence of names spelled in exactly the same way for organisms governed by different Codes. The one limitation on independency rests with the Bacteriological Code, which excludes independency of nomenclature between it and the names of "algae and fungi" and "protozoa" (Prin. 2). In consequence, generic names such as Micrococcus and Pirella, later homonyms of fungal generic names governed by the ICBN, have been replaced by names (Ancylobacter and Pirellula) that would not otherwise have precedence.

Table 2 provides a summary of the extent of generic homonymy as determined on the basis of the electronic databases of genera of plants, animals and bacteria. From this, it can be seen that although nearly 9 000 botanical generic names are to be found as genera in the Zoological Record database (13.6% of the total number of botanical genera), only 3 554 of these appear to be in current use in botany (only some 5%). Many well-known botanical and zoological genera are known to be homonymous with names governed by the other Code; some examples of vascular plant genera include Arenaria L. (1753) (sandwort, Caryophyllaceae) and Arenaria Brisson (1760) (turnstone, Aves: Scolopacidae), Ficus L. (1753) (fig, Moraceae) and Ficus Bolten (1798) (Mollusca), Oenanthe L. (1753) (evening primrose, Onagraceae), and Oenanthe Pallas (1771) (wheatear, Aves: Muscicapidae), Pieris D. Don (1834) (Ericaceae) and Pieris Schrank (1801) (cabbage white butterfly, Lepidoptera: Pieridae) Paul Dessart, Bruxelles (dessart@D5100.kbinrnsn.be) (pers. comm.), as part of an ongoing comparison of the botanical and zoological Codes, has accumulated a list of more than 140 homonymous pairs of generic names in current use (see archives of TAXACOM@csma.Berkeley.edu for September 1996 at http://www.keil.ukans.edu/archive/taxacom.html), but the overall extent of potential confusion in terms of the size of the genera involved and the presence or absence of homonyms at the species level remains to be examined in detail.

The only example currently known of homonymy between Codes at the species level is of the vascular plant Pieris japonica (Thunb.) G. Don (1834) (Ericaceae) and the butterfly, Pieris napi subsp. japonica Shirozu (1952) (Lepidoptera: Pieridae), which are homonymous because of the co-ordinate status provision of the ICZN, by which the publication of the epithet japonica at subspecific level implies the co-ordinate publication of Pieris japonica Shirozu. (Cf. Mary E. Petersen (mepetersen@zmuc.ku.dk) in the September 1996 archives of the TAXACOM Listserver (cf. http://www.keil.ukans.edu/archive/taxacom.html)). The issue of the overall extent of homonymy between Codes clearly needs to be an important priority for the International Committee on Bionomenclature.

(ii) Co-Ordinate Status

One of the major differences between the botanical and bacteriological Codes on the one hand, and the zoological Code on the other, is that in the former, each rank is considered distinct and, with one exception in the Bacteriological Code (see below), precedence (priority) is restricted to within ranks, whereas in
Table 2. Inter-Code Generic Homonymy

Botanical generic names

<table>
<thead>
<tr>
<th>Homonyms in</th>
<th>In current use</th>
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<tbody>
<tr>
<td>Zoological Record</td>
<td>in Zoology</td>
</tr>
<tr>
<td>Total</td>
<td>64,419</td>
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<tr>
<td>In current use</td>
<td>28,041</td>
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Bacteriological generic names

<table>
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<th>Homonyms in</th>
<th>Homonyms in</th>
<th>Homonyms in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoological Record</td>
<td>ING</td>
<td>both</td>
</tr>
<tr>
<td>Total</td>
<td>739</td>
<td>50 (6.8%)</td>
</tr>
<tr>
<td>In current use</td>
<td>701</td>
<td>48 (6.9%)</td>
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<th>Homonyms in</th>
<th>Homonyms in</th>
<th>Homonyms in</th>
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<tbody>
<tr>
<td>current use</td>
<td>Botany</td>
<td>both</td>
</tr>
<tr>
<td>in zoology</td>
<td>NCU-3 list</td>
<td>in both</td>
</tr>
<tr>
<td>Total</td>
<td>739</td>
<td>??</td>
</tr>
<tr>
<td>In current use</td>
<td>701</td>
<td>??</td>
</tr>
</tbody>
</table>

Modified from data provided by Paul Kirk, International Mycological Institute, Egham, UK.

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1 *Zoological Record* generic names database.
2 From ING (*Index Nominum Genericorum*), i.e. in the ING electronic data file.
3 Based on inclusion in *Generic Names in Current Use (NCU-3)* (1993).
4 Only names included in the "Approved List of Bacterial Names" and additions published to November 1996 in the *International Journal of Systematic Bacteriology*. (See http://www.gbf-braunschweig.de/DSMZ/bactnom/bactname.htm, but note that the generic list has 740 names, because the misspelling *Melisococcus* is included as well as the correct *Melissococcus*).
5 Based on the 38 synonyms listed in the DSMZ current list of bacterial names (to November 1996). (From bactname.exe. available from http://www.gbf-braunschweig.de/DSMZ/bactnom/bactname.htm).
the zoological *Code*, precedence runs across those ranks that are considered to be within each of three rank groups, the species group, comprising species and subspecies (and also superspecies if used), the genus group, comprising genus and subgenus, and the family group comprising superfamily, family, subfamily, tribe and subtribe. Any name published in any of these ranks is considered to have also been published with the same precedence in each of the other ranks of the particular rank group. This is termed "co-ordinate status" and Table 3 illustrates the effect that co-ordinate status has on the choice of correct name under some examples from the botanical and zoological *Codes*. Although the *Bacteriological Code* treats subspecies and species as different ranks and, like the botanical *Code*, but unlike the zoological, requires formal transfer from one to the other, it resemble the zoological *Code* in attributing equal priority at the two ranks, namely that of the earlier publication. Melville (1986) discusses the philosophical basis for the zoological rule on co-ordinate status.

(iii) *Secondary Homonymy*

Whereas the general principles of precedence based on first publication of new scientific names is common across all codes, biologists have had much more difficulty in determining precedence when a taxonomic change is made such that a taxon, most notably a species, is placed in a different genus from that in which it was originally described. There are three logical alternatives, and all have been adopted at different times. Currently the zoological *Code* adopts one of them and the botanical and bacteriological *Codes* another.

The first possibility is to regard the first binomen used in the new genus as having precedence regardless of the correct name in any other genus, including that in which the species was originally published. This was the basis of the so-called *Kew Rule*, widely used in botany in the 19th century, e.g. not only at the RBG, Kew, but by Asa Gray (Harvard) and Adolf Engler (Berlin) (cf. Stevens, 1991), and most noted as being the basis for some of the taxonomic nomenclatural judgements of accepted names in *Index kewensis* (cf. Nicolson, 1991).

The first botanical *Code*, the Vienna Rules of 1905, established the procedure that exists today in botany and bacteriology, namely that the earliest epithet is to be retained on transfer to another genus, unless by doing so a later homonym would be created because of the previous use of the same epithet with that generic name based on a different type.

The third alternative, that used in zoology, involves the concept of secondary homonymy, in that the earliest epithet is to be used regardless of whether there is already an independent pre-existing use of that epithet in the genus to which the species is being transferred. In such a case, the transfer creates a secondary homonym, whose name must therefore be changed.

Table 4 illustrates the differential effects of the three logical alternative procedures on the nomenclature of two azaleas, species of the deciduous Section *Pentanthera* of the genus *Rhododendron*. Table 5 gives further examples of the
Table 3. Effect of the Co-ordinate status rule in zoological nomenclature.

Comparison of the names that would be accepted under the botanical and zoological Codes for a series of examples from these Codes (Wahlenbergia / Campanopsis: ICBN Art. 11 Ex. 1; Magnolia: ICBN Art. 11 Ex. 2; Lycaena: ICZN Art. 57 (b) Ex. [2]).

**ICBN**

Wahlenbergia Schrad. ex Roth, Nov. Pl. Sp. 399. (1821)

Campanula sect. Campanopsis
R. Br., Prodr. 561 (1810)

Campanopsis (R. Br.) Kuntze, Rev. Gen. 378 (1891)

Magnolia grandiflora L., Syst. Nat. (1759)

Magnolia virginiana var. foetida L., Sp. Pl. 536. (1753) ('b')

Magnolia foetida (L.) Sarg., Gard. & Forest 1: 615 (1889)

**ICZN**

Campanopsis R. Br., 1810 (Prodr. 561) [as Subgenus ('section' - cf. Art. 10e) of Campanula] [as genus Kuntze, 1891]

Wahlenbergia Roth, 1821

Magnolia foetida Linnaeus 1753 [Sp. Pl. 536, as subspecies 'b' under M. virginiana - cf. Art. 45 (f)(i)] [as species, Sargent, 1889]

Magnolia grandiflora L., 1759

Agriades nevadensis (Zullich) _____


Lycaena zullichi Hemming, Entomologist 66: 277 (1933), nom. illeg.

Although Wahlenbergia is a conserved name, conservation under the ICBN is only over all homonyms, all homotypic synonyms and specifically listed heterotypic synonyms. The only heterotypic synonym against which Wahlenbergia is conserved is Cervicina; hence it is not conserved against Campanopsis, which, although untypified, is also heterotypic, as the three species included in its original publication do not include the type of Wahlenbergia (W. elongata) or that of Cervicina.

Although Lycaena argus nevadensis was actually published at varietal rank, being published before 1960, it is treated as a subspecies under the provisions of the ICZN Art. 46 (g), and hence has co-ordinate status with and precedence over Lycaena nevadensis Zullich.

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1 Although Wahlenbergia is a conserved name, conservation under the ICBN is only over all homonyms, all homotypic synonyms and specifically listed heterotypic synonyms. The only heterotypic synonym against which Wahlenbergia is conserved is Cervicina; hence it is not conserved against Campanopsis, which, although untypified, is also heterotypic, as the three species included in its original publication do not include the type of Wahlenbergia (W. elongata) or that of Cervicina.

2 Although Lycaena argus nevadensis was actually published at varietal rank, being published before 1960, it is treated as a subspecies under the provisions of the ICZN Art. 46 (g), and hence has co-ordinate status with and precedence over Lycaena nevadensis Zullich.
Table 4. Comparison of the three logical alternatives ("Kew Rule", ICBN, and ICZN) for determining precedence on transfer from one genus to another.

Comparison of what would be the accepted names of two "azalea" species, members of the deciduous Section Pentanthera of the genus Rhododendron, under the provisions of the "Kew Rule" (cf. text and Stevens 1991) the ICBN and the ICZN. Square brackets [ ] are used for basionym authorship under the "Kew Rule", because the basionym has no significance for priority.

<table>
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<tr>
<th>&quot;Kew Rule&quot;</th>
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<th>ICZN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhododendron nudiflorum [L.] Torrey (1824)</td>
<td></td>
<td>Rhododendron luteum (Linnaeus, 1753), not Sweet, 1830.</td>
</tr>
<tr>
<td>Azalea lutea L. (1753)</td>
<td>Azalea lutea L. (1753), non R. luteum Sweet (1830)</td>
<td>Azalea lutea Linnaeus, 1753</td>
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<tr>
<td>A. nudiflorum L. (1763)</td>
<td>Azalea nudiflorum L. (1763), nom. illeg. (= A. lutea L. 1753)</td>
<td>A. nudiflorum Linnaeus, 1762</td>
</tr>
<tr>
<td>A. periclymenoides Michx. (1803)</td>
<td>A. periclymenoides Michx. (1803)</td>
<td>A. periclymenoides Michaux, 1803</td>
</tr>
<tr>
<td>R. periclymenoides [Michx.] Shinners (1962)</td>
<td>R. luteum (L.) C.K. Schneider (1911), non Sweet (1830)</td>
<td></td>
</tr>
</tbody>
</table>

| Rhododendron luteum Sweet (1830) | | |
| Azalea pontica L. (1753) | Rhododendron luteum Sweet (1830) | Rhododendron luteum (Linnaeus, 1753), not Sweet, 1830. |
| | R. ponticum (Linnaeus 1753) | R. luteum Sweet 1830, not R. luteum (Linnaeus 1753) |
Table 5. Effect of the Secondary homonym rule in zoological nomenclature.

Comparison of the accepted names of the silver fir (Abies), the cultivated soya bean and its putative wild ancestor (Glycine), under the botanical Code with what would be the accepted names were the nomenclature of these organisms governed by the zoological Code.

<table>
<thead>
<tr>
<th>ICBN</th>
<th>IZN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abies alba Miller, <em>Gard. Dict.</em> ed. 8, no. 1 (1768)</td>
<td>Abies picea (Linnaeus, 1753) [Bluff &amp; Fingerh. (1825)], non Miller, 1768</td>
</tr>
<tr>
<td><em>Abies taxifolia</em> Desf., <em>Tabl. École Bot.</em> 216 (1804), non Poiret (1805)</td>
<td><em>Abies alba</em> Miller, 1768</td>
</tr>
<tr>
<td><em>Pinus pectinata</em> Lam., <em>Fl. Franç.</em> 2: 202 (1778), nom. illeg.</td>
<td><em>Abies taxifolia</em> Desfontaine, 1804, non Poiret, 1805</td>
</tr>
<tr>
<td><em>Abies pectinata</em> Lam. &amp; DC., <em>Fl. Franç.</em> 3: 276 (1805), non Poiret (1804)</td>
<td><em>Abies pectinata</em> Lamarck, 1778</td>
</tr>
<tr>
<td><em>Abies picea</em> (L.) Bluff &amp; Fingerh., <em>Comp. Fl. German.</em> 2: 541 (1825), non Miller (1768)</td>
<td><em>Abies pectinata</em> (Lamarck, 1778) [Lamarck &amp; DeCandolle, 1805], non Poiret, 1804</td>
</tr>
</tbody>
</table>


different treatment under the botanical and zoological Codes of the names of species that are now considered to belong to different genera from those in which they were first described.

The arguments in favour of the three procedures are respectively that, in the case of the Kew Rule, the name given by the person whose taxonomic judgement is accepted has precedence even though this may mean a complete departure from the previous names applied to the taxon. The current botany and bacteriology rule ensures that there is a good chance that the epithet remains unchanged, even with a change of genus, but if any change does occur, it is in the species being transferred and not in any that had previously been considered members of the genus concerned. The zoological rule, while ensuring maintenance of the earliest epithet, by creating a "secondary homonym" can induce a change in the nomenclature of a species whose taxonomy has in no way been changed. Indeed, the potential for the name of a species whose taxonomy is stable, being continually changed as the taxonomy of a different species changes, is a real possibility under the provisions of the zoological Code.

For example, much, but not all, recent taxonomic opinion considers congeneric the two Linnaean genera Lychnis and Silene in the flowering-plant family Caryophyllaceae (the "pink family"). Both have species bearing the epithet "sibirica": Lychnis sibirica L. (Sp. Pl. 436. 1753) and Silene sibirica (L.) Pers. (Syn. Pl. 1: 497. 1803), based on Cucubalus sibiricus L. (Syst. Nat. ed. 10. 2: 1031. 1769). Silene is conserved over Lychnis, and so, under the botanical Code, those who unite the genera must find a new specific epithet ("specific name" in "zoospeak") for Lychnis sibirica when it is treated as a Silene. Thus the accepted names for this species are either L. sibirica or S. samojedorum, depending on whether or not Lychnis is treated as a genus distinct from Silene. On the other hand, under the zoological Code, it is a species that is universally considered to be a Silene that suffers a name change according to the taxonomic status of Lychnis! [Even those who maintain the Linnaean genus Cucubalus exclude C. sibirica L. o S. sibirica (L.) Pers. from it]. For those who maintain Lychnis, this unquestioned species of Silene will continue to be called S. sibirica, but for those who treat Lychnis as a part of Silene, it must be given a completely new name (no other epithet has ever been applied to it), even although it is relatively unrelated to the other species with the epithet sibirica over which there is controversy as to whether to treat it as a Lychnis species or a Silene species.

(iv) Illegitimacy

The concept of illegitimacy per se is absent from the zoological Code but is found in the botanical and bacteriological Codes. There are basically two ways in which a name can be illegitimate, either by being published as a later homonym, or by being published as a superfluous name, that is, a name which, when published, included the type of an earlier name that ought to have been adopted under the rules. In the zoological Code, the first situation is termed that of "junior primary homonymy" and such a name is "permanently invalid"
which, although without the moral overtones of illegitimacy, appears to have exactly the same effect

Conclusions

In summary, I believe that we cannot afford the luxury of spending skilled professional person-years on the "recreation" of biological nomenclature. There are too many biosystematic problems to be solved to have to spend any more time than is absolutely necessary on nomenclatural ones. The above outline of the key issues distinguishing the existing Codes of biological nomenclature summarizes the issues that the Draft BioCode seeks to address – to enable there to be clear and simple rules for the scientific names of organisms in the 21st Century.

Acknowledgements

I am grateful to all those whose comments and advice have helped clarify this account of the key differences between the biological Codes of nomenclature. In particular I thank Dr. Paul Kirk, IMI, Egham for the information in Table 2 on numbers of homonyms, Professor Alessandro Minelli, Department of Biology, University of Padua, for drawing my attention to the early Italian work on an integrated biocode, and Professor Paul Dessart, Institut royal des Sciences naturelles de Belgique, Bruxelles, for examples of inter-Code homonyms.

References


Key Issues to be Addressed


meeting of the British Association for the Advancement of Science held at Manchester in June 1842. pp. 105-121.


Abstract

The draft BioCode presents a set of rules for future scientific names of all non-viral biological taxa which is simpler than those found in the existing three major Codes of nomenclature (those of Bacteriology, Botany and Zoology) from which it derives; it refers to, but does not replace, separate rules for the names of viruses and of plant cultivars. Such a Code would be the responsibility of an inter-Union (IUBS, IUMS) Committee operating in liaison with the existing nomenclatural authorities. Some noteworthy proposals are: (1) a uniform terminology; (2) non-alterable media (such as CD-ROM) are acceptable for publication of new names, but electronic networks (e.g. the World Wide Web) are not; (3) diagnoses of taxa must be in English or Latin; (4) new names must be registered; (5) names in use are not to be displaced for "nomenclatural" reasons; (6) no new inter-kingdom generic homonyms are permitted; (7) procedures for conservation and protection of names.

Features of the Draft BioCode

The draft "BioCode" is a proposed set of rules for the names of all taxa which are published after a future starting date. For the purposes of discussion this has been given as 1 January 2000, but that date is not to be regarded as an actual target (for instance the next International Botanical Congress at which the proposal will be considered is not until 1999, and the International Commission on Zoological Nomenclature has not made a commitment to adopt a BioCode).

Since a BioCode is directly concerned only with future names it can be simpler than the existing Codes, whose rules have to make detailed allowance for the evolving nomenclatural practices of the past 250 years. However, like successive editions of those Codes it has to provide that old (= all existing) names which are legitimate (as zoologists would say, potentially valid) labels for taxa must remain so. The BioCode cannot be insulated from the past.
During 1996 the current draft was published in *Taxon* (45:349-372) and the *Bulletin of Zoological Nomenclature* (53:148-166), and was made available on the World Wide Web (http://www.rom.on.ca/ebuff/biocode.htm); it was also distributed to participants at the International Congress of Systematic and Evolutionary Biology in Budapest, and those attending nomenclatural committee meetings at the IUMS Congress in Jerusalem. The draft is a tentative working document and needs not only further revision and development but a glossary, appendices and illustrative examples. It is nevertheless the product of many hours of what has been, for the participants, a process of mutual education (see Chapter 2).

One of the aims of the *BioCode* project is the harmonization of terminology across the whole field of taxonomic nomenclature, and during the discussions the first lesson learned was that while the existing *Codes* share most principles in common the terms used are (even in the English language alone) very different. In some cases the words employed are not self-explanatory, and they may be deceptive (for instance many "available" zoological names are not available for use). Even the word "name" itself is not equivalent in the present *Codes*: while in the zoological *Code* it is used only in the normal sense, in the Botanical one it also has the meaning [as in the expression "type of a name"] of the zoologists' nominal taxon, i.e. a taxonomic concept denoted by a name. The attached Table is reproduced from the draft *BioCode* and shows suggested ways in which some of these ambiguities may be overcome. In an enviable example of decisive action the proposed terminology has been incorporated in the 1996 edition of the International Code of Nomenclature for Cultivated Plants (see Ch. ??).

The layout of the draft *BioCode* conforms more to the botanical Code than to the zoological one, because an electronic copy of the former served as a template during the discussions, but many of the provisions are of "zoological" origin. Perhaps the most noteworthy example (at least for botanists) is the adoption of the so-called principle of coordination. This concerns three "groups" of nominal taxa (the family-, genus- and species-groups); a name established in one of these for a taxon at a particular rank is deemed to have been established also at all other ranks in that group. Thus a name applied to a genus is automatically established also at subgeneric rank, and vice versa (Art. 29), and a name for a subfamily is simultaneously established (with appropriate change in ending) for a family and for any other ranks (e.g. tribe) in the family-group (Art. 27). The same situation applies to specific and subspecific epithets (Art. 31). The principle results in a taxon keeping the same name regardless of the ranks accorded in the opinions of different workers, and its absence from the *Botanical Code* is one of the main differences between that *Code* and the Zoological one.

Another major difference between those *Codes* is the treatment of species-group epithets when, as a result of taxonomic opinion, two taxa whose names include the same epithet are placed in the same genus (see also Chapter 2). Clearly one or other epithet has to be replaced to avoid homonymy. In zoological practice the precedence of epithets is determined by their dates of original
Features of the BioCode

publication, so that it is always the later which is replaced. In botany, on the other hand, precedence is determined by the date of placement in the genus concerned (age of the combination), so that it may be the older epithet which is replaced. The retrospective alteration of practice in either field would cause so many name changes as to be intolerable, and even confining a new rule to future homonymous combinations would be confusing (despite the fact that such "secondary homonymy" affects only a small proportion of species names). Perhaps this is one area in which separate practices will need to continue.

Art. 18 of the draft BioCode states that a new name is unacceptable if it is a later homonym of a name established for a taxon in any biological "kingdom"; it is not possible to make this rule retrospective. In the BioCode, as in other Codes, names for taxa above the family-group (such as phyla, classes and orders) are not fully regulated: the principle of priority does not apply (Art. 19) and the nominal taxa are not necessarily typified (Art. 25).

The BioCode has to address the issue of what constitutes publication, the necessary first step in the establishment of a name. This question has become increasingly complex with the development of non-paper "hard copies" (such as laser discs) and of electronic networks from which texts and images can be down-loaded. Both these methods of circulating information require special equipment for decipherment, unlike printing; they differ in that only the former involves unalterable copies (entries on the World Wide Web, for example, can be modified or withdrawn at any time by their author or "publisher"). The draft BioCode proposes (Art. 5) that electronic networks should not be treated as publications for nomenclatural purposes, but that non-erasable distributed material such as disks are acceptable. The new edition of the zoological Code, currently in preparation, takes the same view, but recognizes that changing technology means that laser discs (for example) may rapidly become unreadable due to the obsolescence and consequent disappearance of the necessary equipment. To overcome this, that Code requires that printed copies of non-paper works must be deposited in several libraries, and it may well be that the BioCode should make a similar provision. In addition to being properly published, for a new name to become established under the BioCode (see Art. 8) it must be explicitly indicated as being new and be accompanied by a description of the taxon in English or Latin; and for taxa in the genus- and species-groups the name-bearing type must be designated.

In addition to these proposed requirements for establishment there is a further one: a new name will have to be registered (Art. 13) either by providing it and the "protologue" (i.e. the description and so on) to a registration office, or by publishing this material in an "official medium" if one is recognized for the field in question (the Journal of Systematic Bacteriology already has this purpose for bacterial names) or other journals performing this service routinely for their contributors. Under the provisions of the draft the formal date of the name for purposes of precedence over synonyms and homonyms would be that of its receipt by the registration office, but this is not the only possibility.
It is envisaged that registration offices would exist in various regions of the world and that they would form a collaborative network. The offices would not referee works and would have no powers of "censorship". The principle of registration offers the great advantage that it would bring names (and more importantly the taxa they denote) clearly into the general public domain; at present all non-bacterial names may exist, effectively unknown, anywhere in an almost limitless literature. Despite this merit, registration is likely to prove one of the BioCode's most controversial proposals; in recent discussions zoologists did not accept a registration scheme for new names, although it was not the same as that in the draft BioCode. There are certainly real difficulties of a practical nature, but the introduction of registration would not change the names of any taxa.

As with the existing Codes, the draft BioCode contains provisions (Arts 22-24) allowing the relevant Commissions or Committees to conserve (protect) names, or their "wide and persistent" use in a sense that does not accord with the original name-bearing type. However, unlike the proposed new edition of the Zoological Code the present draft of the BioCode does not include an automatic ("do-it-yourself") means of giving much-used names precedence over ancient but unused synonyms or homonyms. It will surely need one.

Art. 21 of the draft BioCode deals with the official adoption of Lists of names in particular taxonomic fields, following their formulation by workers in the areas concerned. Once a List has been adopted the nominal taxa in it would be deemed to have the date and typification indicated, and their names would be protected from earlier but unlisted synonyms and homonyms. Procedures allowing the adoption of analogous (but not identical) Lists are being proposed for the forthcoming edition of the Zoological Code (see Ride for a discussion).

The final section of the draft BioCode draft describes the status of the International Committee on Bionomenclature (ICB) which is planned to regulate the BioCode, and when necessary to amend it. This Committee would not replace the five existing international bodies which deal with bacterial, botanical, cultivated plant, viral and zoological nomenclature; these bodies would continue to adjudicate on matters within their realms, and they would require Secretariats (or at least support through a unified Secretariat) for their operation and to give advice to users of names. Clearly these Secretariats (and a registration system, if one comes into existence) will need adequate and assured funding on an international basis.

In the present context one specified duty of the ICB is worthy of note, that is its "power to resolve ambiguity concerning ... those rules that affect only certain categories of organisms. It shall, in particular — and for nomenclatural purposes only — assign to the jurisdiction of one of the traditional Codes those organisms that have been or still are treated under different Codes by different workers." This is a reasonable working definition of the so-called ambireginal taxa, which in some cases have two names which are at present equally "correct", but details of how best to deal with their names (past and
future) remain to be agreed. Much has been made of this problem, but it is due
to lack of communication rather than to inherent difficulty.

A commonly stated objection to a unified *BioCode* is that those who use
taxonomic names, in whatever field, will have to bear two *Codes* in mind: the
For most workers the latter category will dominate for many years. This
particular problem is perhaps over-emphasized, since the *BioCode* (Principle
VII and Art. 19) leaves the status of pre-"2000" names unchanged (i.e. all
acceptable names remain so). If and when Adopted Lists of names became
common the difficulty would be further diminished.

Whether or not the problems inherited from the past, and/or the widely felt
scepticism (and opposition; see e.g. Brummitt, Ch. 4), will prevent any *Bio-
Code* from becoming accepted remains to be seen. The naturalists of the early
19th-century could (should, one might say with hindsight) have constructed a
single *Code* of rules for all names, but they did not: for example in 1843 H.E.
Strickland, secretary of the British Association Code committee which includ-
ed "Mr Charles Darwin", wrote "we have preferred in this essay to limit our
views to zoology". It was an opportunity lost, but even by then obstacles had
arisen due to the divergent evolution of nomenclatures. It is now too late to
overcome them all, but at least a common language can be achieved.
Table 1. Equivalence of nomenclatural terms used in the Draft *BioCode* and in the current biological *Codes* (as enumerated in the text). The concepts covered by terms given as equivalent are not always exactly the same.

<table>
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4. The BioCode is Unnecessary and Unwanted

R.K. Brummitt
Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AE, UK

Abstract

Botanists are concerned at the way Bionomenclature is being pushed with minimal consultation. Its introduction would impose on botanists many changes to their nomenclatural rules which would have no chance of being accepted if proposed separately to an International Botanical Congress, and the stability of plant names is threatened. Conflicts between Codes could be easily resolved by minor amendments to existing Codes, and a new BioCode is unnecessary. Changes of terminology would only mean that botanists would have to learn two terms for situations where one term sufficed before. The imposition of two Codes to be used simultaneously would put comprehension of the rules of nomenclature beyond the reach of many taxonomists. Adoption of Bionomenclature is a serious threat to the control botanists have over their own Code, and there is a need to guard against major changes which have not yet been proposed but which may be proposed in the future. Any attempt by IUBS to impose Bionomenclature on an unwilling botanical community would be vigorously opposed.

Introduction

First of all I must thank David Hawksworth for inviting me to present my views in this debate on Bionomenclature even though I cannot attend the meeting. Secondly I must thank Professor Chaloner for reading it for me. I have contributed reluctantly, because hitherto I have declined to spend my time on something which I believe has no chance at all of being willingly adopted by the botanical taxonomic community. My comments are necessarily made from a botanical point of view; I cannot speak for zoologists and others, but I suspect that many of my concerns will apply to them also.

Background

Initial reactions to Bionomenclature have often been outspoken, one way or the other, and my own reaction is no different. I simply cannot believe that botanists as a whole will be so misguided or so naive as to vote for this proposal. Already it has had an unpopular reception, and the paper by Orchard et al. (1996) in Taxon voices the reactions of many. When members of the
nomenclatural Committee for Spermatophyta were asked to express their opinions, all nine of those who troubled to reply were negative to the idea (Committee for Spermatophyta unpublished proceedings, pp. 244-249, 1996). And in correspondence I have received from others I have detected a mood not so much of dismay as of growing anger.

Why should this be? As far as most of us involved in botanical nomenclature are concerned, the matter was first touched upon at the Nomenclature Sessions at the International Botanical Congress in Tokyo in 1993. Following the heavy defeat in the preliminary postal ballot (6 in favour, 135 against) of a proposal by Hawksworth concerning homonymy across the botanical-zoological divide, a motion from the floor was suggested by Greuter and formally moved by Hawksworth to set up a Special Committee “to investigate all borderline problems between the biological codes and all questions of harmonisation which were felt to be soluble” (Prodiera 14: 192-193, 1994). The motion merely “to investigate” sounded uncontroversial, and was passed.

But within two years a new BioCode had been drafted. It was not produced explicitly by the Special Committee set up at Tokyo, as noted by Greuter (1996, p. 291), but the people who proposed that Committee turned out to be just the same people who have been leading the IUBS initiative credited with doing it. In Taxon, Hawksworth (1995), informed us that discussions towards this end had in fact been going on since 1985, and that a request would be made to the 26th IUBS General Assembly to recommend adoption of the new Code by the appropriate nomenclatural authorities by November 1997. If discussions on all this had been going on since 1985, why were we not informed of this when the brief and apparently innocuous discussion took place at Tokyo in 1993? The opening sentence of Orchard et al. (l.c.) noting that “Many taxonomists ... will have been startled to find that proposals are well advanced to change radically the way they practice their science” sums up in very moderate language the reaction of many. Nomenclatural issues in botany are normally decided at International Botanical Congresses, and an ICSEB meeting is scarcely seen by the great majority of interested taxonomists as the appropriate forum for such debates. So an increasing number of botanists are suspicious at the moment that things are being fixed by a small and unrepresentative clique of activists, and they do not like it.

Stability

But we should not be too carried away by our initial emotional reaction. We would probably all agree that what matters most is stability of names, and the issues should be judged with this in mind. In committee correspondence it has been pointed out (Committee for Spermatophyta p. 247, 1996) that while David Hawksworth’s introductory paper (1995) opened with a quotation on stability, in fact there is little mention of stability in the text, nor is there any in the arguments advanced for Bionomenclature. It has been said many times, perhaps most recently by Silva (1996, p.5), that you cannot have stability of names without stability of the rules. But the introduction of Bionomenclature would be the biggest upheaval in our rules for a very long time.
A synopsis of the planned innovations in the *BioCode* compared with the existing botanical nomenclatural practice has been offered to us by Greuter & Nicolson (1996). This reads as a depressing catalogue of upsets. The present rule for citing authors of combinations is airily dismissed in eight lines as if it is of little importance. Under the new *BioCode*, citation of the transferring author (i.e. the author who actually published the name and who is cited outside the brackets) is to be optional, thus surely leading to wholesale potential confusion for taxonomists and non-taxonomists alike. The allowance of trinomials without the term subspecies between the specific name and the epithet (*BioCode* Art. 31.3) is a similar major break from established botanical practice. There are plenty of other far-reaching changes to be imposed upon us, such as introduction of the complicated "co-ordinate status" which would radically affect priority of infrageneric and infraspecific names in future. If any of these were independently proposed to a Botanical Congress as a change to the present botanical *Code*, they would be voted out by a big majority in the preliminary postal vote. Now we are being asked to vote them all in, in one operation.

Greuter (1996) has tried to persuade us that the changes in the rules will result in only relatively minor changes of names, but I have serious doubts about it. Although it is difficult at the moment to predict exactly what changes will be required, the fact that he tells us (p. 292) that the *BioCode* will be retroactive in its provisions on the form and spelling of names, and also in rules on choice between competing names, does not sound to me like good news for stability at all. His assurance that "no unification of the spelling rules for plants and animals is presently envisaged" only raises in my mind the spectre of wholesale changes of spelling being imposed on us in the next phase of this operation. We are promised (Greuter & Nicolson, 1966, p. 344) that details of the retroactive standardization rules will be covered in a future special Annex, but we have not seen this, and meanwhile we are promised only that no standardization will be imposed in terminations of names at family rank and above. There is no such assurance for the names of our species. Are we really to be convinced that Bionomenclature is going to promote stability? It seems to me that just the opposite, potential widespread instability, is being offered to us. I am in favour of stability. That is why I am totally opposed to Bionomenclature.

**Arguments for Change**

As Orchard et al. (1996) have sensibly noted, most of the main issues of conflict which have been identified between the *Codes* can actually easily be resolved by minor changes in those *Codes*. If there is a case for trying to reduce inter-regnal homonymy in the future, all we need is a recommendation (or, if people want to go further, a rule) to be written into the respective *Codes*. If there is ambiguity as to whether certain protist groups are covered by the botanical or zoological *Codes*, surely it is up to the people working on these groups to resolve their identity crises without troubling the very much larger number of people who work on higher organisms. It is just not necessary to produce a new *Code* to solve problems like these.
As for the desire for the harmonization of terminology, this is a vain hope after two centuries of divergent usage. We cannot go back and change the past literature. We cannot suddenly substitute 'acceptable' in place of 'legitimate', and so on, in all the botanical literature of the past, and botanists will always have to be familiar with the terminology employed up to now. So why suddenly confuse them by telling them they must in future use the word 'acceptable' instead of the word 'legitimate' which has been used in all literature until now and means exactly the same thing? If there is a need for botanists and zoologists to understand each other's terminology better, then the best we can do is to put a page of equivalents as an appendix to each Code for easy reference in future. It seems to me absurd to impose a dual terminology on botanists who have hitherto had unambiguous single terms.

So what advantage does producing a new Code offer to those promoting it? Again I take my guidance from Greuter (1996, p. 293) who offers just two words: or, expediency and continuity. Expediency? What is expedient about imposing on botanists two Codes to be used simultaneously, one for names published in the past and the other for names published from a future date? Apparently, two different Codes may apply to names of two different species within the same genus. What is being proposed is not harmonization of Codes, it is proliferation of Codes. Hitherto botanists have used only one Code and zoologists have used only one Code. In future, thanks to what is being passed off as harmonization, we would all have to use two Codes. Nobody at all benefits from this. Everybody loses. The prospects are appalling. I have to teach courses in plant nomenclature to trainee taxonomists. How am I supposed to explain that we have just agreed to have two separate Codes of nomenclature, to be used simultaneously and employing different terminology? Budding taxonomists will assume that the profession is mad, and find employment elsewhere. Or perhaps the brighter ones will launch a campaign for harmonization of the two Codes which cover plant names, to bring us back to sanity. Continuity? I am at a loss for words when somebody interprets introducing a new Code and new terminology as continuity. If the botanists behind this upheaval just knew the sheer frustration which they, in a different context, have caused to many taxonomists (including myself) by the mere renumbering of Articles in the latest edition of the botanical Code, they might be a lot more sympathetic with the wishes of the vast majority to avoid changes wherever possible. What is being offered now will put comprehension of the rules of nomenclature beyond the reach of many taxonomists.

Further Implications

So, if the problems can be solved by simple changes to existing Codes, and if botanists will find two Codes and two terminologies intolerable, and if there is the possibility of widespread instability, why have we seen so much publicity, glossy publications from IUBS, promotion on the internet, and all the general hype for Bionomenclature? Again in committee correspondence (Committee for Spermatophyta pp. 245, 247, 1996) members have noted that the new Bio-Code incorporates the Names in Current Use principle which was proposed to the Tokyo Congress by essentially the same group as is now promoting Bio-
unnecessary and unwanted nomenclature. This failed to gain acceptance at the last Congress, and there is a widespread feeling that it has even less chance of success at the next. There is thus a very natural suspicion that Bionomenclature is being used as a back-door route for the introduction of the controversial Names in Current Use principle.

But there are even deeper and more fundamental issues at stake. I was interested to note recently in correspondence in a committee for producing a new World Flora that Werner Greuter advised not adopting the rank of variety because under Bionomenclature the rank of variety might be eliminated at the Congress after next. This is apparently not being proposed at the next Congress, but it might happen at a later one. (In the present draft BioCode, the section on ‘Species and Infraspecific Taxa’ refers to subspecies (Art. 3.1.3) but not variety, though Art. 4 does allow the use of varietal rank.) This made me wonder if there is a hidden agenda behind Bionomenclature. And I asked myself what control botanists would have over their own nomenclatural rules in future to enable them to resist changes like eliminating the rank of variety. It would not be appropriate to amend the BioCode at a Botanical Congress; more likely at an ICSEB meeting under IUBS. Botanists would probably be outnumbered by zoologists, but, more important, taxonomists of all kinds could be outnumbered by others who have little understanding of the difficulties involved.

Is this going to happen, and could it perhaps be the main motivation for some of those promoting Bionomenclature? My suspicions that this could indeed happen were confirmed very recently when I read a paper given by Werner Greuter at a meeting in Mar del Plata, Argentina, in 1994 (Greuter, 1997). This is of such fundamental importance to the debate here in Budapest today that I am obliged to quote the whole of one paragraph. It reads:

“One consequence of the present, internationally supported endeavours of a unified approach to biological nomenclature should not be overlooked. They are a serious challenge or threat to the control kept by botanists, and of the Nomenclature Sections of Botanical Congresses with their little varying attendance, over the rules of botanical nomenclature. Other user groups, such as are represented in the International Union of Biological Sciences, now want to have their say and take part in the decisionary process. Whether this be for the better or worse remains to be seen. Whatever the outcome, botanical nomenclaturalists will be well advised to pay increased attention to the wishes and needs of other biologists.”

The frankness of this statement is most commendable, and I warmly applaud Werner Greuter for having the courage to make it. But the implications for taxonomic botany and for stability of names are, in my opinion, horrendous. Even one of the leading proponents of Bionomenclature is not sure whether it is for the better or worse, but we are being pushed willy-nilly towards something which is totally unpredictable and over which we will have no control.
Botanists would be crazy to vote for such a programme, giving to others more or less carte blanche to do as they please with our rules and the names we use.

IUBS has recently been given an unusually high profile in the botanical taxonomic world. In the light of Werner Greuter's above comments, the article in *Taxon* by the Executive Director of IUBS (Younès, 1996) could be seen by some as an implied reminder to botanists that IUBS is their governing body and they will have to fall into line if required to do so. I very much hope that this is not the case. Those involved should remember the title of the paper by Orchard *et al.* (1996): "Harmonized bionomenclature — a recipe for disharmony". Any attempt by the officers of IUBS to impose Bionomenclature from above on an unwilling botanical community, or to take over direct control of our existing nomenclatural system, would be deeply resented. Two of my correspondents have already indicated to me that if this should happen they would be in favour of botany opting out of IUBS and maintaining its own nomenclatural system.

Let us by all means have a discussion. We are all concerned with nomenclatural stability, but there are different approaches to this. I support the right of anybody to put forward any proposals, however extreme. But those who do so must equally allow the right of others to oppose them. In the aftermath of the Tokyo Congress I was very surprised at what I myself considered extremist interpretations of motions which had been passed there after minimal discussion. When David Hawksworth (1993a) announced that "Priority of publication thus counts for little in botanical nomenclature" (thus contradicting one of the Principles of the Code), and when in correspondence he recommended people to ignore priority and adopt names which suited them, claiming to have done so himself without bothering to make formal proposals required under the Code, I felt impelled to respond (Brummitt, 1994). Although my comments were published in a journal of rather restricted circulation, I received many messages of support from a wide area. My concluding comments were "Stability will not be achieved by encouraging everyone to do as they like. Anarchy leads only to instability". And when in a very similar paper by David Hawksworth (1993b) he concluded that "Nomenclature from the year 2000 promises to be a very different animal from that we have been used to during this century", I wondered what other major surprises he has in store for us. Like many others, I am concerned that we are being pushed into things about which we are not yet informed.

**Conclusion**

A considerable part of my working life has been devoted to trying to achieve stability of plant names. I am not averse to change when things can be improved, and I was a strong supporter of the major changes adopted at the Tokyo Congress to extend the options for conservation and rejection of names (see *Englera* 14: 97, 1994). Some of my correspondents have told me that they think my views are too far to the left in the spectrum of attitudes to nomenclature, and they are entitled to say so. But I cannot support what I consider are extremist views which I believe will lead plant nomenclature into
deep trouble. We need one set of rules in botany which will allow maximum stability while giving taxonomists an acceptable tool to work with. To me Bionomenclature offers not stability but immediate instability of the rules and potential widespread instability of names, and there will be two sets of rules instead of one, which taxonomists and others will deplore. But the long term implications for the control of our rules are already also arousing deep concern in the botanical community. In whose hands will control of botanical nomenclature be in the next century?

References

5. Lists of Protected Names

W.D.L. Ride, Geology Department,
The Australian National University, G P O Box 4,
Canberra, ACT 2601, Australia

Abstract

Since the mid-18th Century, biologists have been required to use judgement as to whether any particular scientific name has been properly established and is the correct name for a particular taxon. The required judgements are: whether the name was published appropriately, its date of establishment, its objective basis, and whether or not any other name has been established equally properly for the same taxon (i.e. its precedence in the event of synonymy). At the end of the 20th Century, the burgeoning scientific literature, new information processes, and requirements to conserve names are making such judgements increasingly insecure and burdensome. Listing is considered as a means of facilitating the work of biologists in this regard. The conditions that might justify listing to achieve particular purposes are considered. The proposals in the draft of the proposed BioCode are reviewed in the light of these. The consequences of adopting lists, in both principle and practice, are explored.

Introduction

Lists of names of animal and plant species have long been accepted as authoritative sources of scientific names used by biologists. In fact, the current rules of botanical and zoological nomenclature can be regarded as mechanisms developed to enable additions to be made legitimately to a number of mid-18th Century lists. These foundation lists are nominated in Art. 3 of the International Code of Zoological Nomenclature, and in Art. 13 of the International Code of Botanical Nomenclature.

Under these Codes, every scientific name proposed after the founder lists is required to meet certain criteria specified in the Codes before it is legitimate (available) and can be used as the correct (valid) name of a taxon. Broadly speaking, these criteria require the user to ascertain that the name was properly established — and when; that it was formed correctly; and that it is applicable to the taxon in question (i.e. that it was based upon a specimen(s) now regarded as belonging to that taxon). Moreover, the user must be satisfied that no other equally legitimate name exists that might have precedence over it for the same taxon.
To most biologists, the process of determining the legitimacy of names is cumbersome, requires familiarity with legalistic rules and a terminology that have little to do with the practice of biology, and may require considerable research into early literature that is often difficult to access. For these reasons, in practice, most biologists using names leave the processes of determining the legitimacy and applicability of names to specialists who compile or update modern taxonomic lists. Thus, most biologists today ask only to know that the lists that they use as sources for names are nomenclaturally reliable and taxonomically up-to-date.

But since each of these modern lists is the result of a blend of nomenclatural judgement, and taxonomic hypothesis, no list prepared by a biologist (or even by a national organization — such as the Faunal Catalogue of Australia and the Flora of Australia) can be regarded as the final arbiter.

The question must now be asked whether the time has come for at least the nomenclatural component of this instability to be eliminated and cumbersome bibliographic research replaced by taking advantage of what information technology now offers by providing lists (finalized by authority) of all legitimate names. These names would be made beyond challenge on purely nomenclatural grounds by the act of listing, and the lists containing them would be accessible by means of international networks. All names would be equally accessible. For the first time, there would be no such thing as a forgotten name or an overlooked name; upset to established names as the result of the emergence of such names would become a thing of the past. Moreover, the consequences of faulty judgements of legitimacy and precedence would be eliminated and, if the lists were also definitive in such things as typification, the rediscovery of acts affecting a name and its synonyms (such as as earlier type fixations) would also be a thing of the past.

To complete the nomenclatural benefit, a register of new names could also be established. Such a register, if made obligatory as a condition of legitimacy, would give biologists access to all new names published after the most recent up-dates of the lists irrespective of how obscure their place of initial publication was. At intervals, these newly registered names could be evaluated and incorporated into the lists — thus establishing their legitimacy.

While such authoritative lists of names would establish a fresh start in nomenclature and, as Linnaeus' works did in the mid-18th Century, would provide biologists with all the names that they are ever likely to want to use for known species (whatever taxonomic arrangements are adopted for them), they would not solve the problem of the instability and confusion that results from name-changing due to taxonomic rearrangement (such as happens when taxa with well-known names are combined with taxa with less well-known, but older, names).

Most nomenclaturists would hold that this latter source of instability is inevitable and has to be accepted as a consequence of ensuring separateness between taxonomy and nomenclature (see Ride, 1986, 1988). Nevertheless,
even if listing (as I have described it above) does not deal with the taxonomic problems, a mechanism must be available whereby its worst effects may be nullified. Both of the current Codes have mechanisms which, although cumbersome, can be used to deal with most cases without interfering with taxonomic freedom.

The idea of introducing lists to make a fresh start for nomenclature is not new. The bacteriologists did it in 1976 (Sneath, 1986). They established lists, eliminated unnecessary synonyms (known and unknown), declared a new starting date, and achieved a register of new names by requiring legitimate publication in a single journal (the *International Journal of Systematic Bacteriology*). But what can be achieved in a relatively small group, like the bacteria, with only about 2300 taxa requiring names, may not be achievable in the nomenclature of the very much larger groups of plants and animals. Moreover, it may not even be desirable. For instance, there are some animal taxa that are so poorly known, and in which there is so little literature, that the present system does not pose a difficulty.

So the questions are: firstly, can a process of listing be achieved; secondly, is it necessary and desirable at the present; and finally, can listing provide a solution that would enable the conservation of well-known names in use when upset by taxonomic studies?

**Desiderata and Options**

Unless the names in the lists are secure against names that are not listed, listing will achieve little more than bibliographic convenience. In addition, the lists must contain at least all the already established, legitimate names that would come into use in any conceivable taxonomic arrangement. In zoology, this would include all specific epithets that might be used as the names of subspecies and all generic names that might be used as names of subgenera. Merely listing the names of taxa currently recognized in one or several modern taxonomies would not be sufficient.

The lists must not be the cause of name-changing. For this reason, they must be compiled at a high level of accuracy. Incorrect entries will be the cause of names correctly used in the literature being replaced by variants in spelling or by incorrectly dated or typified names, legitimized by being listed. Furthermore, lists must be assembled with knowledge of current usage so widely-used names (that are, in fact, junior synonyms) are not inadvertently displaced by forgotten or obscure names.

The size of the task is enormous. To try to achieve it in botany or zoology as the bacteriologists did, in a single operation, would not be possible. Clearly it would have to be achieved in stages.

If these desiderata are to be met, what are the options?
Lists of Protected Names

Option 1

Clearly, the first option would be to do no more than is currently done under the present Codes. Internationally appointed committees would continue to deal with problematical names and nomenclatural upsets on a case-by-case basis. The decisions would accumulate as lists, i.e. as the Appendices of the International Code of Botanical Nomenclature, and the Official Lists.

The Official Lists, issued by the International Trust for Zoological Nomenclature, exemplify these accumulations of decisions. They contain names that are certified by the International Commission for Zoological Nomenclature as having been established (i.e. are available) for zoological nomenclature. No special protection is conferred by listing, per se, against unlisted names, but in some cases the precedence of names listed may have been reversed by a decision of the Commission (made under the Plenary Power — see later) and recorded in the Official List. Such changes of precedence may also affect unlisted synonyms when these are named in the decision. In every case (despite any conflicting literature) the authorship, date, publication and typification recorded in the List is made with authority and can only be challenged by application to the Commission to have it changed (Code, Art.78f).

Because the presence of each name in the Official List is the result of a decision by the Commission to conserve its use, the Official List is to some degree a List of Names in Current Use as proposed in the BioCode (see below). But it is important to recognize that, in most cases, a name is included only following the careful evaluation of a known threat and, even then, the decision to protect that name relates to the circumstances of that threat alone.

Directly comparable provisions are present in the International Code of Botanical Nomenclature (Art. 14) which also requires that names can only be added to the list of conserved names as the result of individual case studies by mandated committees (Art. 14.11).

Option 2

The second option would be to enable the kind of list described in the preceding sections to be developed in stages (or parts) so that the current rules of nomenclature would continue to apply to unlisted groups, while others might be listed.

Such a proposal is currently being developed in the fourth edition of the International Code of Zoological Nomenclature. It is proposed that enabling provisions will make it possible for committees established by international bodies concerned with the systematics of major groups of organisms (such as the International Congresses of Entomology, Ornithology, etc.) to propose lists for approval. Better known groups would be provided for initially, while taxonomists in others would continue to operate as at present.
Option 3

A third way forward (and one which would attempt to deal with problem of instability resulting from taxonomic revisions at the same time) would be to give priority to listing a selected group of names chosen because of their importance for a variety of uses (e.g. names for food species, taxa protected by international agreements, organisms of medical importance, etc.). Names in this initial list would have precedence over all names (and would not merely be protected against displacement by unlisted names).

A list established on such a principle could be expanded to take in all names, the basis of choice being that names listed would be names in use.

What is Proposed in the Draft BioCode

The draft BioCode proposes the establishment of a List of Names in Current Use with the objective being:

"In order to stabilize the nomenclatural status of names in current use, and to prevent their being displaced by names no longer in use ..." (BC Art. 21.1). The stated nomenclatural consequence would be that a listed name would be:

"treated as if conserved against earlier homonyms and unlisted competing synonyms;" and it would be "accepted as established in the place and on the date cited in the list; and its type, when listed, its spelling and, if specified, its gender are treated as if conserved." (BC Art. 21.2).

The sole determinant for inclusion in the list would be that each listed name would be a name in use. Therefore, if it is envisaged that the list will eventually cover all names in use, what is proposed in the BioCode is what currently holds in bacteriology, namely a comprehensive list of the names currently used for animal and plant taxa. Names not in use ("useless" names in Sneath's sense, Sneath, op. cit.) will be omitted (i.e. Option 3, above) and would henceforth not compete with any listed name; unlike the situation in bacteriology, however, an unlisted name could be taken up provided it does not compete with a listed name (Arts 19.1, 21.9).

Reactions: A Zoological Perspective

My view of the probable reactions among zoologists to the proposals in the draft BioCode is based upon the history of similar proposals and reactions to

1 The Draft BioCode also proposes mandatory registration of new names as a condition of legitimacy. In what follows below, I discuss only the proposal to list already-established names, but, in doing so, I emphasize once more, my conviction that to provide lasting benefit listing deals only with part of the problem (i.e. the past). Registration of new names is needed as well to enable updating to proceed with a minimum of labour, and to remove the difficulties of having to search the enormous modem literature.
them. Reactions have been widely divergent reflecting the huge diversity in needs and outlook among specialists working with groups of organisms as different as birds and bryozoans, in different parts of the world (e.g. Australia and Europe), and in different parts of the profession (e.g. veterinarians and taxonomists).

The first proposal to establish a list of names in use as a mechanism for stabilizing usage in nomenclature was made at the International Congress of Zoology at Graz immediately after that which adopted the International Rules of Zoological Nomenclature (1901). It was rejected (Hemming, 1958, p.9), but at the Seventh International Congress of Zoology (Boston, 1907), the International Commission on Zoological Nomenclature, recognizing that strict application of the rule of priority in all cases (forced upon it at the Congress that adopted the first Rules) was not in the interests of stability, announced that, despite earlier disapproval, it would prepare an **Official List of Most Frequently-used Zoological Names** "of several thousand such approved names, with a request to zoologists that no proposition for a change of any name in [the] said list be published until such proposition together with reasons therefor shall have been submitted to the Commission, and have received its sanction under the Code" (Melville, 1995, p. 33).

From the outset, the proposal met with strong opposition. There were those who thought that the List should contain only names that met the Rules despite being commonly used. Others expressed the directly contrary view that the List should be widened to include some names that, although not properly established, or were used wrongly, nevertheless deserved protection because of usage.

At the Ninth International Zoological Congress (Monaco, 1913), a number of committees appointed to formulate the contents of parts of the proposed List reported. Again, vigorous protests were received. "Some zoologists protested against the proposed list on the ground that this was the beginning of a list of *nomina conservanda* to which they would not submit; others demanded that the Secretary agree that the list be made without reference to the law of priority; some practically challenged the right of the Commission to undertake the work; others flatly refused to cooperate; others agreed to cooperate and did so; others promised aid that has thus far not been forthcoming" (Stiles, 1914, p.856; quoted in Melville, 1995).

While the Congress reached no agreement on the "List of most frequently-used names", the Congress passed two resolutions that determined the future direction by which names in use could be protected when necessary despite the rule of priority, and which gave limited power to the Commission to consolidate its decisions in a published list. Firstly, the Commission was given a new power, the Plenary Power, which would enable it, under certain conditions, to suspend any provision of the Rules "in any case in which, in the opinion of the Commission, its application would result in more confusion than uniformity." Secondly, the Commission was empowered to establish an **Official List of Generic Names**, which although not protected by the action of
listing, nevertheless, would be certified as having complied with the Rules. The relationship between the Plenary Power and the List was clarified subsequently in a number of Opinions issued by the Commission in 1915 in which it declared that names which did not comply with the Rules could only be listed as the result of individual decisions that considered the merits of each case separately. Other names which complied with the Rules could be listed en bloc.

Although the names of species and subspecies could be conserved by means of the Plenary Power, from 1913, the power to list them (as for generic names) was not given to the Commission until much later (Paris Congress, 1948).

The Plenary Power has evolved since then to meet public opinion and enable some cases to be decided by individual zoologists without recourse to the Commission. In 1961 the concept of "nomen oblitum" was introduced into the Code to automatically eliminate the displacement of names in use by forgotten names (i.e. names that had not been in use for the previous 50 years) but did not find favour (see Ride, 1972, pp. 183-188). It was replaced by a return to a non-automatic process (i.e. one requiring a decision under the Plenary Power in each case) but the task of applicants was made easier by making it unnecessary for a proponent for the conservation of a name to argue that stability or universality are upset, or confusion caused (as is required for the normal exercise of the Plenary Power). Objective definitions of usage and disuse were provided which, when met and not contradicted, satisfied the requirements ipso facto. Nevertheless, the process is protracted and the cause of much delay.

At the current Congress (ICSEBV, 1996), two further changes were adopted. These are:

(1) To implement Option 2 for listing (referred to above) by giving power to the Commission to adopt Lists of Available Names put forward by international bodies of zoologists concerned with any major group of animals; lists will include all names known to be available (legitimate) in the taxonomic group concerned and the Commission is empowered to certify them as such.

The proposal makes no provision to deal with the problem of maintaining usage when there is an upset due to taxonomic revision. Listed names are not conserved against each other except by a ruling under the Plenary Power that may determine the relative precedence of listed names (such decisions may be made at the time of listing).

Since inclusion in the Lists is not determined by usage, proposers will be expected to include all names (whether in use or not) that might be brought into use in any future taxonomic arrangement. Even homotypic synonyms (i.e. objective synonyms, synonyms which share the same type) would be included if there is any possibility that they may be required as replacement names in cases of secondary homony of the senior synonym.
Lists of Protected Names

(2) Upset resulting from taxonomic studies will continue to be provided by the Code; but with machinery that experience has shown will enable most cases to be determined by zoologists without referral to the Commission. Precedence based on Priority alone must be disregarded if the senior synonym has not been used in literature published since 31 December 1899 and, at the same time, the junior synonym has a considerable and recent use (defined) during a stipulated period.

In exceptional cases, not covered by these two amendments, the Commission will use the Plenary Power to determine the outcome.

Nothing in the provision implies that a name proposed (say in the 18th or 19th Centuries), "self-destructs" if it has not been used since.

I do not pretend that this proposal will not meet opposition. Olson's strong reaction to Bock's attempt to produce a list of family-group names in ornithology as a preliminary to developing a list of family names in that field (Bock, 1994; Olson, 1996) will find an echo among many to whom historical perfection is more important than to achieve a reasonable level of nomenclatural scholarship, and then be prepared to accept the benefit of reaching finality. And to draw a line across the page and start again.

A List of Protected Names

Although the currently proposed changes to the International Code of Zoological Nomenclature make it possible for zoologists to introduce Lists of the kind described in my opening statement (Option 2), they do not solve the problem of protecting important names of species (such as names for food species, taxa protected by international agreements, organisms of medical and veterinary importance, etc.) against disturbance as the result of taxonomic revisions. These disturbances range from the splitting of genera, changes in generic allocation, and the splitting or combining of taxa in such a way that the old and familiar name becomes a junior synonym of a less well-known name also in use.

The most recent discussion among zoologists relevant to this issue followed the ICSEB IV Congress in Maryland in 1988, at which a proposal was considered to establish a protected "List of Names in Current Use" (see Savage, 1990).

The reaction of many to Savage's article made it clear that unless there is a remarkable and unexpected change in opinion, many zoologists would resist the new fourth edition of the zoological Code containing (or even opening the door to) a process by which current usage would become the primary determinant as to whether and how a zoological name would be used in future. In brief, despite the fact that few zoologists today would question the need to conserve names of common and important taxa against destabilizing consequences of the rule of priority, and the discovery of such things as previous and incorrect typification, many are strongly opposed to a proposition that
might open the door to current taxonomic lists (e.g. checklists, faunal lists, etc.) becoming the officially sanctioned nomenclators (i.e. new "founder lists").

The proposal in the draft *BioCode* can expect the same opposition unless it is either strictly limited to names in use that warrant conservation or like the present *Appendices* and *Official Lists* result from decisions taken to protect particular threatened usages.

**Conclusion**

Let us be warned by experience. Those promoting listing for the purposes outlined in this paper, no matter how desirable, still have much persuading to do among their colleagues. In biological nomenclature there is no benefit in dismissing even a minority, if sizable, if that minority is then to be expected to comply voluntarily with rules whose only sanction is to cause the infringer to be out of step with other users of names.

I suspect that the solution now proposed in the forthcoming fourth edition of the *International Code of Zoological Nomenclature* will be accepted because it is an enabling provision only that does not in any way dictate the name that shall be used for a taxon. The real work of persuasion will be done by the biologists and users in the various major groups. They, not the makers of *Codes*, will decide whether the time is ripe.

The *BioCode* provision that fixes usage will be more difficult to find acceptance for unless it is made clear the the List is confined to a very limited group of species. However, the proposal, if limited to organisms of particular importance, may succeed. Even in zoology, the time may have come when an interested body could propose successfully a list of names such as those in use for animals in the IUCN Red Data Book, important vectors of diseases of humans and livestock, important agricultural pests, names of domesticated animals, names of animals occurring in legislation, etc., requesting that its contents be placed on the *Official List*. Such an action would not confer total protection in usage, as envisaged in the draft *BioCode*. Nevertheless, it would send a strong signal to the users of names that the Commission intends to maintain the usage of names of important organisms and will do so if a threat develops to the usage of any of those names by using the normal provisions of the *Code* to ensure its precedence.

**Postscript**

Back in 1915, Secretary Stiles of the International Commission for Zoological Nomenclature wrote:

"A long list of Nomina Conservanda has been proposed ...and this has brought to the Secretary a storm of protests together with appeals to establish some sort of list so that nomenclature can be more stable."
"The outlook for settling all cases by any one method in our generation is hopeless - unless we can change human nature. Our lives in general are made up of a series of compromises in order to carry out principles; nomenclature can hardly hope to escape this same necessity." (Stiles, 1916, pp.214-5)

References


Stiles, C.W. (1914) *IXe Congres International de Zoologie* (Monaco 1913).

6. Registration of Cultivated Plant Names under the Provisions of the International Code of Nomenclature for Cultivated Plants (ICNCP)

Piers Trehane
International Registrar for Conifers, c/o The Royal Horticultural Society's Garden, Wisley, Woking, Surrey GU23 6QB, UK

Abstract

With the principle of registration of new taxonomic names being adopted by the botanical community and with registration being one of the cornerstones upon which the proposed BioCode is founded, the author describes the International Registration Authority (IRA) system and examines some of the advantages and problems which have resulted from the voluntary registration of cultivar epithets since the 1950s.

Introduction

The International Code of Botanical Nomenclature (ICBN or Botanical Code) governs the botanical names in Latin form for both cultivated and wild plants while the provisions of the International Code of Nomenclature for Cultivated Plants (ICNCP or Cultivated Plant Code) governs the formation and use of names for “distinguishable groups of cultivated plants, whose origin or selection is primarily due to the intentional actions of mankind”. For a history of the development of the ICNCP, see Stearn (1986).

The term “cultivated plants” as defined above for the purposes of the ICNCP may arise by deliberate hybridization or by accidental hybridization in cultivation, by selection from existing cultivated stock, or may be a selection from variants within a wild population and maintained as a recognizable entity solely by continued propagation.

The ICNCP deals with the definition, formation and use of names for three taxonomic groups (categories) of cultivated plants; the cultivar, the cultivar-group and the graft-chimaera each of which must be unique within its denomination class. The order of the nomenclatural process for fixing the names of these groups is (1) publication, (2) establishment and (3) acceptance. As can
Registrations of Cultivated Plant Names

already be seen, the ICNCP in its current (6th.) edition (Trehane et al., 1995), employs the terminology recommended by the Committee on Bionomenclature (Hawksworth, 1995).

There is an interlocking relationship between the above two Codes in so far as they both deal with the scientific names for plants. The ICBN essentially deals with the formation and use of plant names in Latin form, whereas the ICNCP (except for graft-chimaeras at generic rank) deals with the final part of the name, the epithet, used for what might be termed man-made plants and which, since 31 December 1958 has had to be formed in a modern language.

The ICNCP has been developed with a number of user-groups in mind. The plant taxonomist, statutory or non-statutory registration authorities, the seed and plant trade (in the widest possible sense), those who compile accurate lists of names for whatever purpose, teachers of plant sciences, journalists, librarians and historians are just some of the major groups who work in or on the fringes of agriculture, forestry and horticulture and who require the international standards for nomenclature that the Code provides.

The denomination class referred to above is the taxonomic unit within which no repetition of a cultivar or cultivar-group epithet will normally be permitted. With a few exceptions, the denomination class is the genus so that a parallel with the other Codes can be drawn in so far that epithets have to be unique within the genus. There are a few permitted exceptions to this principle in cases where historical Latin epithets such as "Alba" and "Variegata" have been used as cultivar epithets within different species and for precision these have to be appended to a specific or other infraspecific epithet.

Since the early 1950s the International Society for Horticultural Science (ISHS), through its Commission for Nomenclature and Registration, has been responsible for setting up and maintaining a world-wide system of International Registration Authorities (IRAs) within the disciplines of agriculture, horticulture and forestry. The primary functions of an IRA are:

- (a) To register cultivar and cultivar-group epithets in the denomination class for which they have accepted responsibility and to ensure their establishment.

- (b) To publish full lists of all cultivar and cultivar-group epithets in that denomination class.

- (c) To maintain records, in as great a detail as is practical, of the origin, characteristics and history of each cultivar and cultivar-group in that denomination class.

It is **not** the function of an IRA:

- (a) To conduct trials.
(b) To judge if one cultivar or cultivar-group is more meritorious or more useful than another.

(c) To judge distinctness of cultivars or cultivar-groups.

IRAs exist to record names or, more accurately, epithets within a denomination class and they are not appointed to perform acts of taxonomy.

IRAs may be categorized into four main groups.

1 Institutional organizations such as university departments, arboreta, institutes of horticulture and other research establishments with the facilities for maintaining living plant collections. The Arnold Arboretum of Harvard University has long been IRA for a number of woody plant genera such as *Cornus*, *Fagus* and *Ulmus*. Mango cultivars have been registered by the Indian Agricultural Research Institute while the New Zealand endemics *Hebe*, *Leptospermum*, *Pittosporum* and *Phormium* come under the authority of the Royal New Zealand Institute of Horticulture.

2 Specialist plant societies such as the South African Aloe Breeders Association, International Aroid Society, Bromeliad Society International, International Camellia Society, Australian Hibiscus Society, Magnolia Society and American Rose Society. In the UK, the Royal Horticultural Society had been appointed IRA for a number of groups; *Clematis*, conifers, *Dahlia*, *Delphinium*, *Dianthus*, *Lilium*, *Narcissus* and orchids.

3 Governmental organizations have been taking an increasing interest in cultivar registration. The International Poplar Commission of the Food and Agriculture Organization of the United Nations (FAO) has been recording information on *Populus* since 1955 while the Australian Cultivar Registration Authority has been most enthusiastic in registering cultivars within their endemic genera.

4 Exceptionally, registration has been entrusted to individuals when particular experience by that individual is recognized. The cultivars of *Kalmia*, *Escallonia* and *Hydrangea* are catered for in this way.

There are currently (1996) some 45 IRAs appointed to deal with cultivar epithets in some 80 taxonomic groups ranging from family to species. In cases where the number of cultivars is enormous, some IRAs elect to appoint regional representatives to act as collecting points for new registrations. Such local registrars can filter-out clearly unacceptable names and can help surmount linguistic and cultural barriers. Any additions and amendments to the growing list of IRAs and their regional representatives is published in the newsletter, *Hortax News* (Trehane, 1996).

IRAs fix the limits of its denomination class (or classes) following consultation with, and agreement from, the International Commission for Nomenclature of Cultivated Plants. As examples of departure from the genus being the denom-
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Incongration class, mangoes (*Mangifera indica*) represent one class (covered by an IRA) whilst the remaining taxa within *Mangifera* combine to be the remaining denomination class. In conifers, the morphologically similar genera *Chamaecyparis* and *Cupressus* have been united as a single denomination class. In crop plants, especially where confusion cannot be permitted in cultivars which appear similar at some stage of growth, variance of the genus rule has been a long-standing practice: the cultivars of *Lotus*, *Medicago*, *Onobrychis*, *Onithopus* and *Trifolium* are deemed to form a single denomination class.

Organizations appointed as IRAs have to be able to demonstrate their ability to provide for both the time and costs of publication of Checklists and Registers and have to demonstrate their undertaking to operate within the provisions of both the ICBN and the ICNCP.

As soon as possible, a new IRA should compile a preliminary Checklist of all known established cultivar and cultivar-group epithets. This should be circulated to various specialist authorities for comment and amendment. Following the addition of comments and amendments the Checklist should be published. This will then act as a guide to stimulate the submission of further information and also acts as a tentative International Register.

At a reasonable interval after the Checklist has been published, so that further corrections, amendments, omissions and additions may be included, the IRA will publish a comprehensive International Register. Subsequently and at regular intervals there should be supplements to the International Register, incorporating newly registered cultivar and cultivar-group epithets, together with any corrections and amendments to those previously published. Periodically, fully revised editions of the International Register should be issued, incorporating all supplementary lists, together with the accumulated corrections and amendments.

An International Register is to list the epithets of all cultivars and cultivar-groups that have been established in the denomination class(es) concerned, whether they are still known to be in cultivation or not. If required, cultivars considered to be extinct may be indicated as such, but it has to be borne in mind that it can be extremely difficult to determine whether a particular cultivar is or is not still in cultivation. It is especially important to remember that some names of cultivars and cultivar-groups, although no longer cultivated or used, will be of historical importance and should be cited. Further, many cultivars are stored indefinitely in germ-plasm banks and have the potential to re-emerge at any time that man demands. The re-use of epithets is only rarely permitted.

In effect, any epithet which has been published should be included in an International Register, since any printed reference is permanent and a potential source of confusion with any other use of the same epithet.

The International Register is to include all synonyms (including trade designations and any translations or transliterations that have been used) and should clearly indicate in each case which is the accepted epithet. Trade designations
are epithets used solely for marketing purposes, even though they may be unacceptable as cultivar epithets and may include translated epithets which in themselves are also unacceptable under the rules of the ICNCP. Any unacceptable name is to be listed but may not be formally registered as such; in each case, the reasons for unacceptability is noted.

Cultivated plants are increasingly sold under trade-marks. These marks masquerade as names but cannot be considered cultivar epithets since their ownership is defined under national or transnational statutory provisions — they are not freely available for all to use and because they are not part of the public domain, defy Principle 6 of the ICNCP. Nonetheless their use is a reality and IRAs should record their usage so as to avoid confusion with properly established epithets.

As part of the registration process, a form needs to be submitted to the IRA dealing with the appropriate taxonomic group. Details of the originator (the person who breeds, hybridizes, raises or discovers a plant or group of plants and who recognises the novel attributes of the cultivar) are to be given along with the nominant (the person who coins the epithet of a new cultivar). The introducer of the new cultivar is also to be given as is the name of the registrant — that person who actually fills in the form and submits it to the IRA.

Cultivar epithets have authors and dates just as do other biological names of organisms. The date of a cultivar epithet is that of its establishment and the author is that person who causes the epithet to be established. An exception is made for those epithets being established within an International Register, in which case the registrant is author — not the registrar compiling the register. This serves as a small reward for someone going to the effort of filling in a registration form. Generally speaking the registrant will be the same as the originator and nominant but this is by no means always the case. The author and date of a cultivar or cultivar-group epithet is seldom cited in publications but nonetheless this information is used for purposes of precision in an International Register.

The overall picture I have outlined may appear a rather perfect system but in the real world our registration system often fails us. The reasons are many but one central problem stands out: registration by an IRA is not compulsory and indeed the availability of the registration system is not fully known. The organizations behind the promotion of IRAs must bear part of the blame for this general unawareness. There is no funding or infrastructure to actually promote the existence of the collective IRA system. However the publication of the current ICNCP (Trehane et al., 1995) has done much to heighten awareness of the registration process and much interest and even commitment to the rules of the Code is now being shown by national organizations. Already the work-load of IRAs has increased due to the amount of international publicity given to the new edition of the Code (cf. Alexander, 1996).
In some groups registration works very well when there is some incentive for the act of registration to occur. In Hosta, Hemerocallis, Narcissus and Paeonia (to name but four examples) the success rate is very high for the simple reason that in order to exhibit a cultivar at a flower show, exhibition or trial, its cultivar epithet has had to have been registered with the appropriate IRA. Without an established name, a novel cultivar may not be given an award. Responsible horticultural societies do support the IRA system — for example, in the UK the Royal Horticultural Society will not give an award to any cultivar which does not carry a properly established epithet.

Probably the best example of registration at work is found in orchids. Orchid nomenclature is rather specialized in so far that their IRA does not currently record cultivar epithets but records the names of greges (orchidists call them grexes). The grex is hardly a taxonomic unit, rather it is the product of a particular cross which may contain a degree of variation not acceptable in cultivars. Formation and use of grex names is regulated under the provisions of the Handbook on Orchid Nomenclature and Registration (Greatwood et al., 1993) which is updated following the triennial meetings of the International Orchid Commission. The existence of this commission at the top of a hierarchy of national orchid societies ensures that orchid registration is well known and understood amongst orchid enthusiasts. For a cost of $12, an orchidist may register a new grex name which is entered into a computer database with full searching facilities so that the pedigree history of any one grex may be retrieved.

About 8000 orchidists have registered greges since records began in 1856 and some 2000 can be said to be presently active — a true testament to success. Around 3500 registration applications are received each year with perhaps only ten per cent being returned with unacceptable names or because the grex has already been registered by someone else. The list of registered greges is now around 102,000 (statistics from P. Hunt, pers. comm.) and following official publication in the bi-monthly Orchid Review is periodically published on CD-ROM (although not by the IRA) allowing anyone to search the database for a variety of purposes. The success of the Orchid Register can be put down to: (a) a competent Registrar; (b) peer-group pressure; (c) the financial commitment of its sponsoring organization; and (d) the promotion of the system by its governing body.

The success of daffodil registration may also be attributed to the first three of these factors. While there is no official governing body responsible for daffodil names, the Royal Horticultural Society in the UK has had a long tradition of involvement with these cultivars dating from its first Daffodil Conference in 1884. Its pioneering work done co-ordinately with similar initiatives in the USA, Australia, New Zealand and other parts of the world has led to publication of the International Daffodil Checklist (Kington, 1989) into which world knowledge has been accumulated. The number of daffodil raisers throughout the world is quite small with 111 registrants making an overall average of 180 new applications over a five year period — 229 in the year ending June 1996. Of the 111 registrants, 22 may be considered as regular registrants having made at least
one application in three of the five years (Kington, *pers. comm.*). Largely due to the personal commitment of the Registrar, the resulting International Daffodil Register when published is likely to be the register against which others will be judged. It is quite possible that in the near future, a new starting point for naming daffodil cultivars may be permitted by the International Commission for Nomenclature of Cultivated Plants now that the historical trawl for old names (those established since 1 May, 1753) nears completion.

By contrast, pity the poor Conifer Registrar! Since many conifer cultivars were historically given what appear to be species names or even trinomina, I have to analyze every conifer name published since 1753 (the starting point for all cultivar epithets). Conifers are often very long-lived (unlike orchid greges which may only be extant for a year before they are superseded by the next crossing). Aged conifer specimens are known in botanical collections and in gardens of the world; many of these specimens have been given names which would now be interpreted as being cultivar names.

Modern conifer cultivars are continually being recognized and yet there is no pressure on the originator or introducer to go through the process of registering new cultivar epithets. Indeed there is no incentive for them not to check as to whether an epithet has prior use. Nurserymen, quite understandably, are far more interested in making a living from their new plants than seeing to nomenclatural niceties, especially when their only material reward is an official Registration Certificate to hang on their office wall! There is no financial charge for registering a conifer cultivar epithet.

As Registrar, I have to constantly scan the literature, including the plethora of annual nurseryman’s catalogues to spot a new name and then have to use all my persuasive powers to get someone to spend time completing a registration form.

There is no world conifer society to support the Conifer Register and most of the work is done by the Registrar and a small band of regional representatives in the major conifer-growing countries. A core of enthusiasts in a plant-group is a major asset to a Registrar and, as can be seen in the Appendix following, many IRAs have been formed from a society or other establishment with a history of involvement with a particular group of plants.

As I ponder the problems of registration procedures, I seek solutions and inevitably come up with fantastic ideas which I now share.

- Would it not be desirable for an international system to be in place that prohibited exhibition or sale of a new cultivar unless its cultivar epithet was formally registered? In many countries it is already the case that vegetable and fruit cultivars have to be listed in various statutory registers before they may be admitted to the market.

- Would it not be helpful if, in various parts of the world, regional representatives could accept registrations on behalf of the Registrar? They could filter-out obvious problems including linguistic ones and speed-up the
Registrations of Cultivated Plant Names

whole process of registration. Imagine if the date of the name became the date of receipt of an application by a Registrar or his Regional Representative.

- What an opportunity this would provide to check for homonymy and that the formation of an epithet was in accordance with the rules of the Code before it came into use;

- What a help it would be if all established names, registered or not, were made available in a world-wide listing so that anyone could check to see if a proposed epithet had already been used and if it had been, what cultivar that epithet represented. Imagine all conifer names being available for inspection at a World-Wide Web site. In the future there would be little excuse for ignorance of existing epithets and this alone would greatly reduce the number of homonyms.

- Imagine that registration was for free for everyone. It would need to be free of cost to the registrant since so many raisers of new cultivars are amateur growers who must not be put off improving our garden flora by prohibitive fees having to be paid to a bureaucracy.

Of course I talk a fantasy — or do I? Throughout the world, governments, inter-governmental and non-governmental agencies require standard lists of names for a variety of purposes. For cultivated plants such lists are required for marketing legislation, for plant health regulations and for application of intellectual property rights. As I have stated elsewhere (Trehane, 1995) a fundamental philosophy with the European Union (EU) must be to work towards seeing that within the Union, a plant may only be marketed under a single name. The practice of selling a plant under more than one name in different parts of the market will simply not be upheld. With increasing world-wide trade in plant material this should become an intercontinental ideal.

It is up to those interested in stabilizing the names of cultivated plants to get this problem sorted before alternative systems are imposed by an intergovernmental statutory bureaucracy that knows little or nothing about the traditions of cultivated plant taxonomy and nomenclature.

Given proper financial resources and statutory backing, the provision of standard lists for names of cultivated plants, accompanied by a registration procedure is well within our technological grasp.

At the moment the ICNCP has "no force beyond that deriving from the free assent of those concerned with cultivated plants". I would like to believe that within the next twenty years, the ICNCP becomes the fully accepted international standard for naming cultivated plants and that registration will play the key role in admitting new names to the world-wide catalogue of recognised names of agricultural, horticultural and forestry plants.
Acknowledgements

I would like to thank Chris Brickell and my fellow registrars at the Royal Horticultural Society, Dr Alan Leslie, Sally Kington and Peter Hunt for their valuable contributions to this paper.

References


APPENDIX

CURRENT LIST OF INTERNATIONAL REGISTRATION AUTHORITIES

A number of International Registration Authorities have regional representation in particular parts of the world and these are listed below the IRA responsible for their appointment. Anyone wishing to register a cultivar or cultivar-group epithet, or who seeks information about an epithet, is strongly recommended to contact the regional representative in the first instance.

Note 1: The dates given indicate when an IRA was first appointed (this information is not complete, especially for earlier IRAs): in some cases responsibility has been subsequently transferred to a separate organization or individual, and the later has continued to gather the information.

Note 2: The fax numbers provided are international numbers: local callers do not dial the country code shown in brackets and may have to prefix the remaining number with another digit.

GENERAL SECTION

Bulbous, cormous and tuberous-rooted plants, excluding *Dahlia* Cav., *Lilium* L., and *Narcissus* L. (1955)
ROYAL GENERAL BULBGROWERS' ASSOCIATION (KAVB), Attn: Drs Johan van Scheepen, Royal General Bulbgrowers' Association, Postbus 175, NL-2180 AD Hillegom, The Netherlands. (Fax: (31) 252 51 97 14)

Hardy herbaceous perennials, excluding those genera or other groups for which other IRAs have been appointed (1980)
INTERNATIONALE STAEDEN UNION (ISU), Attn: Dr Josef Sieber, Institut für Stauden und Gehölze, Versuchanstalt für Gartenbau Weihenstephan, Murstrasse 22, D-85356 Freising, Germany. (Fax: (49) 816 18 36 16)

Woody plants, excluding those genera or other groups for which other IRAs have been appointed (1958)
THE AMERICAN ASSOCIATION OF BOTANICAL GARDENS AND ARBORETA, Attn: Dr Steven Clemants, Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, New York 11225, United States of America. (Fax: (1) 718 857 2430, E-mail: steveclemants@bbg.org)

REGIONAL SECTION

Australian plant genera, excluding those genera or groups for which other IRAs have been appointed (1958)
AUSTRALIAN CULTIVAR REGISTRATION AUTHORITY, Attn: Mr Iain Dawson, Australian National Botanic Gardens, GPO Box 1777, Canberra, ACT 2602, Australia. (Fax: (61) 6 250 9599, E-mail: idawson@anbg.gov.au)

TAXONOMIC SECTION

*Acacia* Mill. (1958)
AUSTRALIAN CULTIVAR REGISTRATION AUTHORITY, Attn: Mr Iain Dawson, Australian National Botanic Gardens, GPO Box 1777, Canberra, ACT 2602, Australia. (Fax: (61) 6 250 9599, E-mail: idawson@anbg.gov.au)
Biology International, Special Issue No. 34 (1997)

*Aloe* L. (1970)
The SOUTH AFRICAN ALOE BREEDERS ASSOCIATION, Attn: Mr A. J. Bezuindenbou, South African Aloe Breeders Assoc., P.O. Box 59904, Karen Park, 0118, Pretoria, Republic of South Africa.

*Amelanchier* Medik. (1980)
DEPARTMENT OF HORTICULTURE SCIENCE, UNIVERSITY OF SASKATCHEWAN, Attn: Dr Richard St Pierre, Department of Horticulture Science, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0, Canada.

*Andromeda* L. (1970)
The HEATHER SOCIETY, Attn: Mr A. W. Jones, Otters Court, West Camel, Somerset BA22 7QF, United Kingdom.

The INTERNATIONAL AROID SOCIETY, Attn: Mr John Banta, Route 2, Box 144, Alva, Florida 33920, United States of America.

*Begonia* L. (1958)
The AMERICAN BEGONIA SOCIETY, Attn: Mrs Carrie Karegeannes, 3916 Lake Boulevard, Annandale, Virginia 22003, United States of America.

*Bougainvillea* Comm. ex Juss. (1966)
INDIAN AGRICULTURAL RESEARCH INSTITUTE (IARI), Attn: Dr Brijendra Singh, Division of Floriculture and Landscaping, Indian Agricultural Research Institute (IARI), New Delhi, 110012, India.

*Bromeliaceae* Juss. (1980)
The BROMELIAD SOCIETY INTERNATIONAL., Attn: Ellen Baskerville, Marie Selby Botanical Gardens, 811 South Palm Avenue, Sarasota Florida 34236, United States of America. (Fax: (1) 941 951 1474, E-mail: mizellen@worldnet.att.net)

*Bruckenthalia* Rchb. (1970)
The HEATHER SOCIETY, Attn: Mr A. W. Jones, Otters Court, West Camel, Somerset BA22 7QF, United Kingdom.

*Buxus* L. (1966)
The AMERICAN BOXWOOD SOCIETY, Attn: Mr Lynn R. Baidorf, U.S. National Arboretum, 3501 New York Avenue NE, Washington, DC 20002, United States of America. (Fax: (1) 202 245 45 75)

*Callistephus* Cess. (1958)
INSTITUT FÜR ZIERPFLANZENBAU, Attn: Prof. Dr K. Zimmer and Mrs Renate Noack, Institut für Zierpflanzenbau, Herrenhäuser Strasse 2, D-30419 Hanover-Herrenhausen, Germany. (Fax: (49) 511 76 22 654)

*Calluna* Salisb. (1970)
The HEATHER SOCIETY, Attn: Mr A. W. Jones, Otters Court, West Camel, Somerset BA22 7QF, United Kingdom.

*Camellia* L. (1962)
The INTERNATIONAL CAMELLIA SOCIETY, Attn: Mr T. J. Savige, Hawksvlew, Wirlinga, New South Wales 2640, Australia.

Regional Representation, Australia:

THE AUSTRALIAN CAMELLIA SOCIETY, Attn: Mr Ray Garnett, 36 Hardinge Street, Beaumaris, Victoria 3193, Australia.

Regional Representation, New Zealand:

THE NEW ZEALAND CAMELLIA SOCIETY, Attn: Mrs Yvonne Cave, Seafield, RD4 Wanganui, New Zealand.
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Regional Representation, North America:

- The American Camellia Society, Attn: Mrs Edith Mazzei, Concord, 1486 Yosemite Circle, California 94521, United States of America.

- Chaenomeles Lindl. (1962)
  The Arnold Arboretum, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@arnarb.harvard.edu)

- Clematis L. (1986)
  The Royal Horticultural Society, Attn: Miss V. A. Matthews, 7350 SW-173rd. Street, Miami, Florida 33157-4835, United States of America. (Fax: (1) 305 233 1483)

- Conifers (1964)
  The Royal Horticultural Society, Attn: Mr Piers Trehane, Royal Horticultural Society's Garden, Wisley, Woking, Surrey GU23 6QB, United Kingdom. (Fax: (44) 1483 211750, E-mail: coneman@indhort.demon.co.uk)

Regional Representation, Australia:

- The Conifer Society of Australia, Attn: Dr Roger Spencer, Royal Botanic Gardens Melbourne, Birdwood Avenue, South Yarra, Victoria 3141, Australia. (Fax: (61) 3 9252 2350)

Regional Representation, North America:

- The American Conifer Society, Attn: Mrs Susan Martin, U.S. National Arboretum, 3501 New York Avenue NE, Washington, DC 20002, United States of America. (Fax: (1) 202 245 45 75)


- Cornus L. (1962)
  The Arnold Arboretum, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@arnarb.harvard.edu)

- Cotoneaster L. (1966)
  The Sir Harold Hillier Gardens and Arboretum, Attn: Mr Allen Coombes, Sir Harold Hillier Gardens and Arboretum, Jermyns Lane, Ampfield, Romsey, Hampshire S051 OQA, United Kingdom. (Fax: (44) 1794 368027, E-mail: hillarb@compuserve.com)

- Cyperaceae Juss. (1990)
  The Hardy Plant Society, Attn: Dr Alan C. Leslie, Monksilver, 72 Boxgrove Road, Guildford, Surrey GU1 1UD, United Kingdom. (Fax: (44) 1483 211750)

- Daboecia D. Don (1970)
  The Heather Society, Attn: Mr A. W. Jones, Otters Court, West Camel, Somerset BA22 7QF, United Kingdom.

- Dahlia Cav. (1966)
  The Royal Horticultural Society, Attn: Mr David Pycraft, Royal Horticultural Society's Garden, Wisley, Woking, Surrey GU23 6QB, United Kingdom. (Fax: (44) 1483 211750)

Regional Representation, India:

- The Dahlia Society of India, Attn: Mr K. Samadder, 4 Thakur Ramkrishna, Park Row, Calcutta 25, India 700 025.

Regional Representation, The Netherlands:

- Royal General Bulbgrowers' Association (KAVB), Attn: Drs Johan van Scheepen, Royal General Bulbgrowers' Association, Postbus 175, NL-2180 AD Hillegom, The Netherlands. (Fax: (31) 252 51 97 14)
Delphinium L., perennials only (1955)

The Royal Horticultural Society, Attn: Dr Alan C. Leslie, Royal Horticultural Society's Garden, Wisley, Woking, Surrey, GU23 6QB, United Kingdom. (Fax: (44) 1483 211750)

Dianthus L. (1958)

The Royal Horticultural Society, Attn: Dr Alan C. Leslie, Royal Horticultural Society's Garden, Wisley, Woking, Surrey GU23 6QB, United Kingdom. (Fax: (44) 1483 211750)

Regional Representation, North America:

American Dianthus Society, Attn: Mr R. B. Lee, P.O. Box 22232, Santa Fe, New Mexico 87502, United States of America.

Erica L. (1970)

The Heather Society, Attn: Mr A. W. Jones, Otters Court, West Camel, Somerset BA22 7QF, United Kingdom.

Escallonia Mutis ex L. f. (1966)

Dr Elizabeth McClintock, 1551 9th Avenue, San Francisco, California 94122, United States of America.

Fagus L. (1962)

The Arnold Arboretum, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@arnarb.harvard.edu)

Forsythia Vahl (1962)

The Arnold Arboretum, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@arnarb.harvard.edu)

Fuchsia L. (1966)

The American Fuchsia Society, Attn: Mrs Delight A. Logan, 8710 South Sheridan Avenue, Reedley, California 93654, United States of America.

Gesneriaceae Dumort., excluding Saintpaulia H. Wendl. (1958)

The American Gloxinia and Gesneriad Society Inc., Attn: Judy Becker, 432 Undermountain Road, Route 41, Salisbury, Connecticut 06068, United States of America.

Gladiolus L., excluding species and early flowering cultivars (1970)

The North American Gladiolus Council, Attn: Mr Samuel N. Fisher, 11734 Road 33 1/2, Madera, California 93638, United States of America.

Gleditsia L. (1962)

The Arnold Arboretum, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@arnarb.harvard.edu)

Hebe Comm. ex Juss. (1958)


Regional Representation, United Kingdom:

The Hebe Society, Attn: Mrs Jennifer Hewitt, Haygarth, Cleeton St Mary, Kidderminster, Worcestershire DY14 0QU

Hedera L. (1976)

The American Ivy Society, Attn: Dr Sabine M. Sulgrove, 2624 Centre Creek Circle, Spring Valley, Ohio 45370, United States of America.

Hemerocallis L. (1955)

The American Hemerocallis Society, Attn: Mr W. C. Monroe, 7015 Chandler Drive, Baton Rouge, Louisiana 70808, United States of America.
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Hibiscus rosa-sinensis L. (1980)

THE AUSTRALIAN HIBISCUS SOCIETY, Attn: Mr Christopher Noble, 61 Cockatoo Court, Caboolture, Queensland 4510, Australia.

Hosta Tratt. (1966)

THE AMERICAN HOSTA SOCIETY, Attn: Mr David H. Stevenson, University of Minnesota Landscape Arboretum, P.O. Box 39, 3675 Arboretum Drive, Chanhassen, Minnesota 55317, United States of America. (Fax: (1) 612 443 2521, E-mail: steve021@maroon.tc.umn.edu)

Regional Representation, United Kingdom:
THE BRITISH HOSTA & HEMEROCALLIS SOCIETY Attn: Mr Roger Bowden, Sticklepath, Okehampton, Devon EX20 2NN, United Kingdom (Fax: (44) 1837 840482)

Hydrangea L. (1958)

Dr Elizabeth McClintock, 1551 9th Avenue, San Francisco, California 94122, United States of America.

Ilex L. (1955)

THE HOLLY SOCIETY OF AMERICA, Attn: Mr Gene K. Eisenbiess, U.S. National Arboretum, 3501 New York Avenue NE, Washington, DC 20002, United States of America. (Fax: (1) 202 245 45 75)

Iris L., bulbous species, see under Bulbous plants etc.

Regional Representation, United Kingdom:
THE BRITISH IRIS SOCIETY, Attn: Mrs Jennifer Hewitt, Haygarth, Cleeton St Mary, Kidderminster, Worcestershire DY14 0QU

Iris L., excluding bulbous species (1955)

THE AMERICAN IRIS SOCIETY, Attn: Mr Keith Keppel, PO Box 18145, Salem, Oregon 97305, United States of America.

Regional Representation, Australia:
IRIS SOCIETY OF AUSTRALIA, Attn: Helen Reid, 16 Farnsworth Street, Sunshine, Victoria 3020, Australia.

Regional Representation, France:
SOCIETE FRANCAISE DES IRIS ET PLANTES BULBEUSES, Attn: Jean Peyrard, 101 avenue de la Republique, 38170 Seyssinet, France.

Regional Representation, Germany:
GESSELLSCHAFT DER STAUDENFREUNDE E.V., Attn: Gisela Dathe, Tannenring 57, 65207 Wiesbaden, Germany.

Regional Representation, New Zealand:
NEW ZEALAND IRIS SOCIETY, Attn: Heather Collins, 156 State Highway 1, Winchester, South Canterbury, New Zealand.

Regional Representation, former USSR territories:
RUSSIAN IRIS SOCIETY, Attn: Sergey Loktev, P.O. Box 54, 129226 Moscow, Russia.

Regional Representation, United Kingdom:
THE BRITISH IRIS SOCIETY, Attn: Mrs Jennifer Hewitt, Haygarth, Cleeton St Mary, Kidderminster, Worcestershire DY14 0QU, United Kingdom.

Jovibarba Opiz (?1980)

THE SEMPERVIVUM SOCIETY, Attn: Mr Peter J. Mitchell, 11 Wingle Tye Road, Burgess Hill, West Sussex RH15 9HR, United Kingdom. (Fax: (44) 1444 236848)

Juncaceae Juss. (1990)

THE HARDY PLANT SOCIETY, Attn: Dr Alan C. Leslie, Monkseiver, 72 Boxgrove Road, Guildford, Surrey GU1 1UD, United Kingdom. (Fax: (44) 1483 211750)
Kalmia L. (1978)
Dr Richard A. Jaynes, Broken Arrow Nursery, 13 Broken Arrow Road, Hamden, Connecticut 06518, United States of America.

Lagerstroemia L. (1970)
The United States National Arboretum, U.S. National Arboretum, 3501 New York Avenue NE, Washington, DC 20002, United States of America. (Fax: (1) 202 245 45 75)

Lantana L. (1970)
The Arnold Arboretum, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@amarb.harvard.edu)

Leptospermum J. R. Forst. & G. Forst. (1958)

Lilium L. (1958)
The Royal Horticultural Society, Attn: Dr Alan C. Leslie, Royal Horticultural Society's Garden, Wisley, Woking, Surrey GU23 6QB, United Kingdom. (Fax: (44) 1483 211705)
Regional Representation, Australia:
The Australian Lilium Society, Attn: Mr R. Macgregor, 426 Belgrave Gembrook Road, Emerald, Victoria 3782, Australia.
Regional Representation, Czech Republic:
Ing. B. Mičulka, 687 06 Velehrad 225, Czech Republic.
Regional Representation, The Netherlands:
Royal General Bulbgrowers' Association (KAVB), Attn: Drs Johan van Scheepen, Royal General Bulbgrowers' Association, Postbus 175, NL-2180 AD Hillegom, The Netherlands. (Fax: (31) 252 51 97 14)
Regional Representation, New Zealand:
The New Zealand Lily Society, Attn: Mrs M. L. Lepper, P.O. Box 1394, Christchurch, New Zealand.
Regional Representation, Russia:
Dr A. V. Otroshko, Postbox 3, Moscow 107061, Russia.

Magnolia L. (1962)
The Magnolia Society Inc., Attn: Dorothy J. Callaway, Sweetbay Farm, 4260 Enon Road, Coolidge, Georgia 31738, United States of America. (Fax: (1) 912 227 0578)

Malus Mill., ornamental cultivars only (1958)
The Arnold Arboretum, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@amarb.harvard.edu)

Mangifera indica L. (Mango) (1970)
The Indian Agricultural Research Institute, Attn: Dr S. N. Pandey, Div. of Fruits & Horticultural Tech., Indian Agricultural Research Institute, New Dehli 110012, India.

Narcissus L. (1955)
The Royal Horticultural Society, Attn: Mrs Sally Kington, Royal Horticultural Society, P.O. Box 313, Vincent Square, London SW1P 2PE, United Kingdom. (Fax: (44) 171 630 6060)
Regional Representation, Australia:
The National Daffodil Association of Australia, Attn: Mr Tony Davis, 4 Carandini Street, Melba, ACT 2615, Australia.
Regional Representation, Czech Republic:
Narcis Kládo, Attn: Ing. Vladimír Domšík, Konevova 40, 400 00 Ústí nad Labem, Czech Republic.
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Regional Representation, The Netherlands:
ROYAL GENERAL BULBGROWERS’ ASSOCIATION (KAVB), Attn: Drs Johan van Scheepen, Royal General Bulbgrowers’ Association, Postbus 175, NL-2180 AD Hillegom, The Netherlands. (Fax: (31) 252 51 97 14)

Regional Representation, New Zealand:
The NATIONAL DAFFODIL SOCIETY OF NEW ZEALAND, Attn: Mr Max Hamilton, Boyd Road, RDI, Hamilton, New Zealand.

Regional Representation, North America:
The AMERICAN DAFFODIL SOCIETY, Attn: Mrs Mary Lou Gripshover, 1686 Grey Fox Trails, Milford, Ohio 45150, United States of America. (Fax: (1) 513 248 0898)

Nelumbo L. (1988)
The INTERNATIONAL WATER LILY SOCIETY, Attn: Mr Philip R. Swindells, Vale Lodge, Ropley, Harrogate, North Yorkshire HG3 3AY, United Kingdom. (Fax: (44) 1423 568080)

Nymphaea L. (1988)
The INTERNATIONAL WATER LILY SOCIETY, Attn: Mr Philip R. Swindells, Vale Lodge, Ropley, Harrogate, North Yorkshire HG3 3AY, United Kingdom. (Fax: (44) 1423 568080)

Orchidaceae Juss. (1972)
The ROYAL HORTICULTURAL SOCIETY, Attn: Mr Peter F. Hunt, P.O. Box 1072, Frome, Somerset BA11 5NY, United Kingdom. (Fax: (44) 171 630 6060 or (44) 1483 211705 E-mail: orcreg@rhs.org.uk)

Paeonia L. (1974)
The AMERICAN PEONY SOCIETY, Attn: Mrs Greta Kessenich, 250 Interlachen Road, Hopkins, Minnesota 55343, United States of America.

Pelargonium Aiton (?1970)
The AUSTRALIAN GERANIUM SOCIETY, Attn: Mrs J. D. Llewellyn, "Nynde", 56 Torokina Avenue, St Ives, New South Wales 2075, Australia.

Penstemon Schmidel (?1966)
The AMERICAN PENSTEMON SOCIETY, Attn: Dr Dale T. Lindgren, University of Nebraska, West Central Center, Route 4, Box 46A, North Platte, Nebraska 69101, United States of America.

Petunia Juss. (1966)
INSTITUT FÜR ZIERPFLANZENBAU, Attn: Prof. Dr K. Zimmer and Mrs Renate Noack, Institut für Zierpflanzenbau, Herrenhäuser Strasse 2, D-30419 Hannover-Herrenhausen, Germany. (Fax: (49) 511 76 22 654)

Philadelphus L. (1938)
The ARNOLD ARBORETUM, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@arnarb.harvard.edu)

The ROYAL NEW ZEALAND INSTITUTE OF HORTICULTURE INC., Attn: Mr L. J. Metcalf, "Greenwood", Stringers Creek, RDI, Richmond, Nelson, New Zealand.

Pieris D. Don (1962)
The ARNOLD ARBORETUM, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418, E-mail: spongberg@arnarb.harvard.edu)

Pittosporum Banks ex Sol. (?1974)
The ROYAL NEW ZEALAND INSTITUTE OF HORTICULTURE INC., Attn: Mr L. J. Metcalf, "Greenwood", Stringers Creek, RDI, Richmond, Nelson, New Zealand.

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Plumeria L. (1980)
The Plumeria Society of America Inc., Attn: Mr John P. Oliver, P.O. Box 22791, Houston, Texas 77227-2791, United States of America.

The Hardy Plant Society, Attn: Dr Alan C. Leslie, Monksilver, 72 Boxgrove Road, Guildford, Surrey GU1 1UD, United Kingdom. (Fax: (44) 1483 211750)

Populus L., forestry cultivars (1955)
The International Poplar Commission, Attn: Mr J. B. Ball, Secretary, International Poplar Commission, Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy. (Fax: (39) 6 522 5137, E-mail: james.ball@fao.org)

Potentilla fruticosa L. sensu lato (1966)
Agriculture Canada Research Station, Attn: Dr Campbell G. Davidson, Agriculture Canada Research Station, Unit 100-101 Route 100, Morden, Manitoba R6M 1YS, Canada. (Fax: (1) 204 822 6841)

Proteaceae Juss., South African genera only (1980)
Directorate of Plant Quality Control, South Africa Department of Agriculture, Attn: Mr M. S. Joubert, Directorate of Plant Quality Control, Department of Agriculture, Private Bag X258, Pretoria 0001, Republic of South Africa. (Fax: (27) 12 319 6055)

Pyracantha M. Roem. (1966)
The United States National Arboretum, U.S. National Arboretum, 3501 New York Avenue NE, Washington, DC 20002, United States of America. (Fax: (1) 202 245 45 75)

Rhododendron L., including Azalea L. (1955)
The Royal Horticultural Society, Attn: Dr Alan C. Leslie, Royal Horticultural Society's Garden, Wisley, Woking, Surrey GU23 6QB, United Kingdom. (Fax: (44) 1483 211750)

Rosa L. (1955)
The American Rose Society, Attn: Mr Michael C. Kromer, American Rose Society, P.O. Box 30,000, Shreveport, Louisiana 71130-0030, United States of America. (Fax: (1) 318 938 5405)

Regional Representation, Australia:
- The Australian Rhododendron Society, Attn: Mr Graeme Eaton, 1386 Mount Dandenong Tourist Road, Mount Dandenong 3767, Victoria, Australia.

Regional Representation, Japan:
- The Japan Rhododendron Society, Attn: Mr Y. Sasaki, 172-9 Nissato-machi, Souka City, Saitama Prefecture, Japan.

Regional Representation, New Zealand:
- The New Zealand Rhododendron Association, Attn: Mr M. D. Cullimore, P.O. Box 161, Awanui 05522, New Zealand.

Regional Representation, North America:
- The American Rhododendron Society, Attn: Mrs J. W. Murray, 21 Squire Terrace, Colts Neck, New Jersey 07722, United States of America.

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Regional Representation, Italy:
ASSOCIAZIONE ITALIANA DELLA ROSA, Villa Reale, 20052 Monza.

Regional Representation, Japan:
JAPAN ROSE SOCIETY, Attn: Dr Takeo Nagata, 3-9-5 Oyamadai Setagaya-ku, Tokyo 158.

Regional Representation, The Netherlands:
RAAD VOOR HET KWEKERSRECHT, Postbus 104, NL-6700 AC Wageningen. (Fax: (31) 3174 258 67)

Regional Representation, New Zealand:
NATIONAL ROSE SOCIETY OF NEW ZEALAND, Attn: Heather MacDonnell, P.O. Box 66, 17 Erin Street, Bunnthorpe, Palmerston North.

Regional Representation, Republic of South Africa:
THE ROSE SOCIETY OF SOUTH AFRICA, Postbus 28188, 0132 Sunnyside, Pretoria.

Regional Representation, Switzerland:
CIOPORA, 4 Place Neuve, Geneva.

Regional Representation, United Kingdom:
THE ROYAL NATIONAL ROSE SOCIETY, Attn: Mrs Jill Bennell, The Royal National Rose Society, Chiswell Green, St Albans, Hertfordshire AL2 3NR (Fax: (44) 1727 850360)

Rosularia (DC.) Stapf (1980)
THE SEMPERVIVUM SOCIETY, Attn: Mr Peter J. Mitchell, 11 Wingle Tye Road, Burgess Hill, West Sussex RH15 9HR, United Kingdom. (Fax: (44) 1444 236848)

Saintpaulia H. Wendl. (1966)
THE AFRICAN VIOLET SOCIETY OF AMERICA INC., Attn: Ms Iris Keating, 149 Loretto Court, Claremont, California 91711, United States of America.

Saxifraga L. (1994)
The SAXIFRAGE SOCIETY, Attn: Dr John Whiteman, 63 Elithorne Avenue, Hanwell, London W7 2JZ, United Kingdom.

Sempervivum L. (?1980)
The SEMPERVIVUM SOCIETY, Attn: Mr Peter J. Mitchell, 11 Wingle Tye Road, Burgess Hill, West Sussex RH15 9HR, United Kingdom. (Fax: (44) 1444 236848)

Syringa L. (1958)
ROYAL BOTANICAL GARDENS, Attn: Mr Freek Vrugtman, Royal Botanical Gardens, Box 359, Hamilton, Ontario L8N 3H8, Canada. (Fax: (1) 905 577 0375)

Tagetes L. (?1970)
INSTITUT FÜR ZIERPFLANZENBAU, Attn: Prof. Dr K. Zimmer and Mrs Renate Noack, Institut für Zierpflanzenbau, Herrenhäuser Strasse 2, D-30419 Hannover-Herrenhausen, Germany. (Fax: (49) 511 76 22 654)

Ulmus L. (1962)
THE ARNOLD ARBORETUM, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418. E-mail: spongberg@arnarb.harvard.edu)

Viburnum L. (1958)
The UNITED STATES NATIONAL ARBORETUM, U.S. National Arboretum, 3501 New York Avenue NE, Washington, DC 20002, United States of America. (Fax: (1) 202 245 45 73)

Weigela Thunb. (1966)
The ARNOLD ARBORETUM, Attn: Dr Stephen A. Spongberg, Arnold Arboretum, Jamaica Plain, Massachusetts 02130, United States of America. (Fax: (1) 617 524 1418. E-mail: spongberg@arnarb.harvard.edu)
7. **The Form of Names**

W. Greuter
Botsanischer Garten & Botanisches Museum Berlin-Dahlem
Freie Universität Berlin, D-14 191 Berlin, Germany

Abstract

Provisions governing the form of names in the botanical, zoological and bacteriological Codes are fairly similar. Disparities include rank-specific terminations in suprageneric names and the form (uni- or binominal) of sub-generic names — for which problems novel solutions are foreshadowed. The BioCode offers the opportunity, by retroactive ruling, to achieve uniformity when desired, while also providing for the maintenance of traditional differences of usage. The present draft takes into account the uncertainties and controversies in matters of grammar and orthography prevailing under the extant Codes. As any future Code, the BioCode must operate in a context of declining scholarly knowledge of Latin and Greek. In order to live up to their innate perfectionism, future taxonomists will want to dispose of practical guidance by means of exhaustive lists of words and word elements, each with its appropriate spelling and, where applicable, gender and compounding form (genitive stem). Such definite sets of agreed standards are the most user-friendly tool for keeping biological nomenclature tidy at little cost for maximum profit. Standardization of gender and spellings, in particular, will ease the memorizing of names and expedite their correct use. Restriction of the citation of nomenclatural authorities to the taxonomic and nomenclatural contexts that require them is advocated as a further step toward nomenclatural expediency.

Introduction

Provisions governing the form of names are usually thought of as unimportant, trivial matters of little if any consequence. I tend to agree. Yet, curiously, it is the corresponding articles and recommendations that, in my experience, invariably engender the most heated and often acrimonious nomenclatural debates. No wonder that many, perhaps a majority of those who are spectators to such rather superfluous exchanges, which are in many respects a sheer waste of time and printed space, tend to be disgusted. They may even envisage radical solutions, in order to rid nomenclature once and forever of questions of grammar and proper spelling that do not impinge even marginally on scientific biological matters.

In the domain of zoological nomenclature we have just witnessed such an attempted (though eventually unsuccessful) revolution of the pragmatists, proposing to abandon gender and inflexion for scientific names of animals. Curiously, it transpires the apostles of this extreme simplification were
fighting among themselves, over some details, at least as acrimoniously as their colleagues with traditional scholarly views. Obviously the simplistic solution they advocate, to disregard the rules of grammar and orthography and accept the original spelling however faulty, is not the final answer either. Granting there is a real problem, it would seem that more thought and different yet novel solutions are required. Can we propose a good answer, then, in the frame of a new _BioCode_?

Tackling the old problems of spelling and grammar by providing new, fully retroactive rules on the form of names is among the perhaps over-ambitious purposes of the draft _BioCode_. It is what its last five Articles foreshadow, although in no way exhaustively since in crucial matters they refer to Annexes that do not yet exist, not even in an embryonic state.

Envisaging retroactivity for such rules immediately raises the question of divergent traditions that may have developed under the different _Codes_. There are some discrepancies indeed, albeit not many — and to no one's surprise they kept the drafting Committee busily discussing for at least a couple of hours, resulting in the single case of a paragraph (Art. 37.3) with alternative versions (which, incidentally, differ only in minor details). What is not obvious from the published text of the draft, however, is that each of the Annexes foreseen in Art. 37.8-9 and 39.3-4 will provide opportunities to confirm divergent traditions when they exist and thus to prevent spurious changes and disruption.

In this contribution I deal with five major topics related to formal aspects of names of organisms: (1) the basic form of the names, (2) terminations and stems at the suprageneric ranks, (3) the gender of generic names, (4) orthography and spelling, in particular of epithets, and (5) author citations.

**The Basic Form of Names**

Even under the present _Codes_, the rules governing the general form of names for all organisms are quite similar; otherwise it would not have been possible to envisage common rules for them all. To begin with, all scientific names of organisms are treated as Latin regardless of derivation. Suprageneric names are plural nouns (or adjectives used as nouns), generic names are singular nouns, specific names are binomina, and infraspecific names, trinomina. The epithets in binomina and trinomina are traditionally of the same kind throughout biology. Names of sections and lower supraspecific ranks are not governed by the zoological and bacteriological _Codes_; in botany, such names are binomina with capitalized epithet and intercalated rank indicator.

The single major difference concerns the rank of subgenus, where the names have the same form as generic names in zoology and bacteriology, but resemble sectional names in botany. The present draft covers this in Art. 28.2, which tries to combine both approaches but has a clear botanical bias. This must not be the last word on the matter. I intend to ask the _BioCode_ Committee to reconsider the question and rather opt for the zoological and bacteriological...
gical solution. Subgeneric names published under the present botanical Code would then fall into either of two categories: those which are neither homonymous with established generic names nor have plural adjectiv-es as epithets would retain their status of established subgeneric names but would be reduced to their present epithet; and the others would remain established in their present form but be downgraded to an indefinite, infra-subgeneric rank.

Terminations and Stems at the Suprageneric Ranks

At those suprageneric ranks that are governed by the present Codes, names either are or may be formed from the genitive singular stem of a name of an included genus by adding a termination denoting their rank. The terminations differ between zoology on one side, and botany and bacteriology on the other; at some of the higher (supraordinal) ranks, they also differ between major botanical groups. The BioCode Committee felt that it would neither be acceptable, nor was it really necessary, to achieve uniformity across the kingdoms in this respect. Thus, the zoological family termination -idae can happily coexist with the botanical and bacteriological -aceae.

One question one may legitimately ask is whether it is not troublesome when the same termination denotes different ranks in botany/bacteriology and zoology. This is the case of two such terminations: -idae, denoting families in zoology but subclasses in botany; and -inae used for zoological subfamilies but botanical subtribes. If this is to be avoided, then the botanical termination should in both cases be the one to be replaced, since it designates the less used rank. The identity is not complete for the terminations -oideae (botanical/bacteriological subfamilies) and -oidea (zoological superfamilies), but it is nevertheless disturbing because these terminations are pronounced similarly, and tend to become identical when translated into modern languages such as German, French, Italian, or Spanish. Since use of the termination -oidea is only a recommendation under the zoological Code, it might perhaps be acceptable for zoologists to have it altered.

Under all Codes alike, it has proved notoriously difficult to establish the proper stem to which the terminations are added. The problem is a grammatical one, since the stem is formed from the genitive singular of the corresponding generic name, of which the listed standard form is in the nominative case. While zoologists will find at the end of their Code a 24-page tabular list of Latin and Greek word elements, indicating stem formation, botanists and bacteriologists can dispose of no other help than their own skills in classical languages and those of their colleagues and forerunners. With the present decline, among biologists, of proficiency in Latin, let alone Greek, the difficulties are likely to increase manifoldly in the future.

The Gender of Generic Names

The situation is similar with respect to the gender of generic names (important for finding the correct inflexion of subordinate adjectival epithets). The aforementioned Appendix is again helpful for zoologists. For botanists, a first step
in the same direction has been made through the recent standard inventory of
generic names in current use (Greuter et al., 1993), where the supposedly
correct grammatical gender is given for about 16% of the listed names (in-
cluding a majority of those for which gender assessment is notoriously prob-
lematic). On the special case of names ending in -ma Nicolson (1994) has
published an informative and erudite article. It appears that with the help of
backward alphabetization of lists of generic names in electronic format, the
problem can now be much more conveniently and exhaustively addressed
than in earlier times. Lists of the kind that Nicolson provided for the -ma
terminations are easily produced, practical for use, and fairly economic of
space. The Committee had in mind this kind of lists when referring to a new
Annex under Art. 39.3.

Orthography and Spelling, in Particular of Epithets

Poor scholarship in past generations, and dwindling knowledge of classical
languages in modern times, often result(ed) in names being published that
defy the rules of Latin spelling and grammar. Traditionally, blatant errors
were corrected by subsequent authors, but there was and is no clear borderline
between what is correctable and what must stand, and in a general way
discussions on orthography tend to be rather nightmarish. There is a modern
tendency to accept original spellings as they are, however faulty; but this is
neither generally agreed nor is it devoid of problems.

From a practical point of view, scholarship and grammatical correctness is not
the main reason why spelling variants of names and epithets are often seen as
a nuisance. Some kind of uniformity in epithet formation, in particular, is
essential if names are to be easily memorized in their appropriate form. Unless
standardization rules exist, authors will be forced to check the spelling of
every individual name they use, either in the original place of publication or at
least in an authoritative list.

Botanists have, in a few exceptional cases (substantive epithets in the genitive
commemorating persons; some connecting vowels in compound epithets), de-
cided to enforce standard spellings and to declare deviating spellings correct-
able if originally used. Zoologists have considered, but as it seems discarded,
the idea of admitting dual spellings in the former case. For future names,
registration would provide an ideal filter by which to correct non-standard
spellings at the source, provided of course that unambiguous rules of stan-
dardization could be found (see Art. 37.2, last sentence). Correctability of
non-standard epithet spellings could be declared to be retroactive, as fore-
shadowed in Art. 37.9, pending the publication of adopted lists of protected
names under Art. 21 in which individual spellings would be finally settled.

At present, many epithets are widely used in two or more variant spellings
that are about equally correct, or anyway not correctable. Familiar examples
include sylvaticus and silvaticus; coeruleus, caeruleus and ceruleus; caespi-
tosus and cespitosus; spatulatus and spatulatus; and compounds with calyx
or calix, to name just a few. Unless you learn by heart which given binomial
is written with which of these variant epithets, you are bound to look up the correct spelling again and again whenever you use such a name. In all these cases it would be easy to define that one of the variants is to be preferred (on the basis of preponderance of usage) and to declare the others correctable.

Author Citation

Author citations after scientific names, while strictly speaking not part of the names themselves, are in widespread use and are provided for by each Code. There are slightly different traditions in this respect between zoology and botany, but the basic pattern is the same for all scientific names of organisms. So there is not much scope for a BioCode to innovate.

Nevertheless, the BioCode Committee has felt it useful to point out the relatively minor importance of author citations for other than strictly nomenclatural or purely taxonomic purposes. While author citations remain essential in such special contexts, they can normally be dispensed with elsewhere. Nevertheless, there is a widespread tendency in contemporary literature to enforce the use of author citations. Sure, they are useful on herbarium labels, in floras, monographs and indexes — although recently a flora of Austria (Fischer, 1994) has been published that consciously omits them, causing uproar in taxonomic circles. In popular texts, phytosociological lists, on garden labels, and in many other situations where names are taken from a standard source, citing nomenclatural authorities each time, or the first time a name is mentioned, is a mere waste of space and energy. Art. 40.1 of the draft BioCode therefore stipulates that the use of author citations be optional, and desirable only in taxonomic and nomenclatural contexts.

Botanical and zoological traditions differ in the prominence given to authors of new combinations in author citations. In botany, where mentioning them is prescribed standard procedure, this has arguably led to the proliferation of new combinations being published mainly if not exclusively for the purpose of glorifying their author's name. Art. 41 of the draft BioCode would declare the present botanical practice as optional, in the implicit hope that it may gradually disappear.

Conclusions

The present Codes have their roots in a time when scholarly knowledge of Latin and even Greek was a matter of course. Future rules, such as the proposed BioCode, will operate in a radically changed context. The early Codes had no reason to tell their users how to spell, inflect and compound Latin words; the current editions, especially of the zoological Code, have a bulky grammatical and orthographical corollary to carry along. The current International Code of Zoological Nomenclature devotes almost fifty printed pages to the subject, in three appendices. Yet, zoologists too face problems when aiming at a linguistically correct, or at least tolerably correct nomenclature.
Scientists in general, and taxonomists in particular, are perfectionists in their soul and abhor showing signs of ignorance to their readers and colleagues. It is my firm belief that, if we enable them to coin and use correctly formed names without unreasonable effort, they will gratefully accept. If, on the other hand, we should condone, authorize or even enforce barbarism, e.g. by abolishing gender for names that naturally do have grammatical gender, many would wince and some would doubtless rebel, especially those with a Romance mother tongue.

To my mind, the biological nomenclature of the future will require extensive and detailed tools for assessing the correct form of scientific names and coinig new ones correctly. Such tools will have to be both unambiguous and convenient. They will not be mere sets of rules, but exhaustive lists of concrete cases, compiled on the basis of extant, correctly formed names and epithets. All currently used word elements, including prefixes and suffixes, each with its appropriate spelling and, when substantival, gender and compound form (genitive stem), will have to be so listed. The task is not a trivial one, but at least in the botanical field it is feasible. If we manage to cope with it, we will have rendered a major service, not only to purity but more importantly to the expediency and informative value of organismic nomenclature.

References

Abstract

The proposal to establish an overriding Code of biological nomenclature which would have supremacy over existing Codes of nomenclature for bacteriology, botany and zoology, is one that must be carefully evaluated by biologists. The positioning of such a Code in an organization whose meetings are typically attended only by members appointed by national academies or by invitation only is troublesome. Nonetheless, the problems addressed by the draft BioCode must be solved: stability of names, homonymy, creation and publication of names in a uniform manner, commonality of terms and definitions, develop and adoption of standardized lists, and the ignoring of presently unknown names and places of publication. Other items, such as registration of names, is still not feasible throughout much of the under-developed world and ought to be phased in gradually as technology becomes more widespread.

Solutions to these problems can be found within established Codes if, but only if, individuals throughout systematic biology are willing to both make the effort, cover the costs, and take the time to develop lists in accord with provisions in the existing Codes. The use of standardized lists, conservation and rejection of names, and the suppression of publications can be accomplished in the timely fashion if biologists are willing to cooperate. After all, historically, nomenclature has undergone significant changes in the past and there is nothing to prevent it from happening again.

Biological Nomenclature is a Problem

This observation is hardly new. Names of the Earth's organisms have been a cause of aggravation to biologists and non-biologists alike probably since early humans from different tribes attempted to communicate. Whether scientific or not, names have been and will continue to be a subject of debate.

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1 Reprinted with permission and minor corrections from the Proceedings of a Mini-Symposium on Biological Nomenclature in the 21 Century held at the University of Maryland on 4 November 1996 available on http://www.life.umd.edu/bees/1996sym.html
For the biological community, a frustration with the multitudes of names for the same entity has a long history. Solutions varied. Caspar Bauhin (1623) attempted to resolve the nomenclatural morass for plants by basically establishing a list of standardized names. With the never-ending flow of new species and varieties, William Sherard with the assistance of John Jacob Dillenius, confronted the problem again a century later. Their manuscript revision of Bauhin's *Pinax* was never published because the taxonomy of so many names could not be resolved. The basic reason was that neither Sherard nor Dillenius could see original material.

Initially, Linnaeus thought he could provide a solution first by establishing a set of guidelines for naming plants, and second by carefully doing a thorough taxonomic survey of the living world. Proposing rules, as he did first in his *Fundamenta botanica* (Linnaeus, 1735), proved to be the easy part. Revision and expansion of his ideas on nomenclature evolved through a series of publications (e.g. *Critica botanica*; Linnaeus, 1737) until his working concepts were firmly established in *Philosophia botanica* (Linnaeus, 1751).

The hard part was the names themselves. Initially Linnaeus felt he could account for essentially all of them much as he (Linnaeus, 1738) had done in *Hortus clifortianus* wherein he included complete synonymy. To what extent Linnaeus might have been encouraged or discouraged in this by Dillenius when the two men met in 1736 we may never know. Yet it is clear what Linnaeus intended to judging by a late 1740s draft of what eventually would be *Species plantarum* (Linnaeus, 1753).

Stafleu (1971) has provided a detailed review of the Linnaean method as well as Linnaeus' views on names and nomenclature. Elsewhere (Reveal, 1996), I have attempted to put much of this into an historical perspective. What requires emphasis here is that when Linnaeus returned to drafting *Species plantarum* in 1750, he abandoned any hope of dealing with all of the old names and imposed a new binomial system of nomenclature. In short, he ignored the past and started anew.

There was grumbling. Some (e.g. Gronovius, 1762) did not adopt binomials. Many did not follow Linnaeus' principles. But what eventually everyone did do was to ignore the majority of the older names. A new list of "names in current use" was born.

A history of botanical *Codes* was presented by Nicolson (1991). The sense one gathers from his paper is the gradual separation of nomenclature from taxonomy so that one resolves the taxonomy first and then evaluates the nomenclature. As any practicing taxonomist will clearly proclaim, the first is fun, the latter is a chore. It is only human nature that fun things are done with greater enthusiasm than those that are chores.

During the two and a half centuries since Linnaean nomenclature had its origin, numerous innovations have occurred. As Nicolson (1996) noted, Linnaeus' classification scheme for plants based on sexual characters has been
totally abandoned as, to a large degree, have his nomenclatural principles as originally stated. Despite the continued use of binomials, modern systems of classification are based on discontinuities of all characters guided by evolutionary principles. Nomenclatural Codes which have been developed over the past 150 years, have become formal and internationally accepted (although mandated), and now govern all aspects for naming organisms. To what extent phylogeny and Linnaean nomenclature mingle and forms a compatible bond is the problem articulated by de Queiroz (1996) who in a way points out that our modern form of polynomials (e.g. Plantae Magnoliophyta Liliopsida Commelinidae Commelininae Poales Poinae Poaceae Festuceae Festucinae Festuca thurberi) are not always informative and could be more simply stated.

Where any alternative to the Linnaean-based system of nomenclature might take us in the future is unknown. What we need to appreciate is that nomenclature was changed by Linnaeus in 1753, and there is nothing to prevent nomenclature from fundamentally changing again. There will be grumbling as in the past, and some may adopt the Gronovian model, but ultimately a change is inevitable. Its form and substance insofar as phylogeny and nomenclature are concerned remain to be seen. In my opinion, de Queiroz’s (1996) approach is a logical and reasonable point to begin the discussion.

The argument made by de Queiroz (1996) that present-day nomenclature is phylogenetically uninformative is questionable only insofar as the names themselves are concerned. What can not be denied is that a single name, such as Rosidae, is clearly not informative. Use of this name, for example, implies only the inclusion of Rosanae, Rosales, Rosaceae, Rosoideae and Rosa. It does not indicate the inclusion or exclusion, say, of all or part of the Hamamelidae (incorrectly spelled "Hamamelidae" by many authors), and this lack of information is significant.

A key point to remember from de Queiroz’s (1996) remarks is that he is addressing suprageneric ranks only. He is not proposing to alter the current use of Linnaean binomials. Stability of names at these higher ranks could be achieved, he maintains, by adopting names that reflect known relationships. Accepting this premise, then one might use "Rosidae" for an inclusive taxon encompassing Rosa and Hamamelis and their phylogenetic relatives, and "Rosanae" for Rosa and its relatives but not Hamamelis and its relatives. Neither the termination nor the rank would be significant.

Ranks might be added to such names if one wished, but it is the names themselves that remain constant.

For those familiar with the history of the type concept, of course, this notion will be troublesome. "Rosidae" as a name would not be defined by a type but rather by a circumscription. The last vestiges of the circumscription method of typification were just recently removed from the International Code of Botanical Nomenclature (Greuter et al., 1994). I am not certain many will want to revisit this question.
Solution to Biological Nomenclature

Also, the problems associated with descriptive names, which are still permitted by the botanical Code (Greuter et al., 1994), continue to be troublesome from both a nomenclatural and an application basis. The name *Centrospermae* is now generally applied to what most modern authors call *Caryophyllales*, yet the name was also applied to the plant family *Lemnaceae*. Homonymy may well prove to be particularly troublesome here. Kevin de Queiroz is aware of this flaw and seems willing to use suprageneric names based on generic names but with the taxon defined additionally by a circumscription. Those who would apply a name subsequently would do so only because that name has a circumscription that includes a particular series of subordinate taxa.

Suprageneric names, at least in the botanical *Code*, are not given the kinds of considerations reserved for names at the rank of genus and below. Use of family, order, superorder and subclass names is becoming more common, but we are at a point in time when we could make a fundamental change in our use and definition of suprageneric names without much notice to the majority of the scientific world.

What de Queiroz (1996) is promoting should be considered. The solution I would like to put forward is for him, along with others, to propose modifications to the draft *BioCode* to reflect his views. By framing his thoughts into concrete proposals, then they can more fully be discussed and debated.

The focus of the discussion here, as reflected by the commentaries (Delprete, 1996; Frodin, 1996; Zijlstra, 1996) is the draft *BioCode* as presented by McNeill (1996b) and challenged by Brummitt (1996). The problem Linnaeus faced in 1753 (but without the need for anyone to agree with him) was the names themselves. In moving from polynomials to binomials was a logical step in the era of encyclopedists where reductionism was the goal. This nomenclatural devise in no way prevented him from having whatever taxonomy he wished to express.

The question today revolves around not around the form of the name but which name and the information that name connotes. Just as Bauhin and Linnaeus we are faced with the decision of what to do with all of those old names and which name from the multitude ought we adopt. Unlike the past, however, this can not be accomplished today by the sheer force that Bauhin and Linnaeus were able to exercise. It is not because there are not powerful individuals or agencies who could accomplish this, but because the consequences of any action is so significant to government and business interests. Botanists may well recall the heated discussions regarding the scientific name of the tomato, and the cost of altering a host of governmental regulations and treaties to reflect the “winning” side of that debate.

And, as de Queiroz (1996) asserted, names in a phylogenetic sense, can carry a great deal of meaning if we can only rid ourselves of some of the established ways of expressing them.
Two items stand out. First, there is no need to ask whether or not there is a demand or need for a stable nomenclature. The proceedings of a 1991 symposium on "Improving the Stability of Names" (Hawksworth, 1991) clearly showed that there is. The initial attempt to largely impose "names in current use" (NCU) was not successful in the botanical community, in my opinion, largely because many individuals felt that the necessary work ought to go into the drafting of such lists first, asserting that the "correct" name under the current Code ought to be adopted whether or not it was the "name in current use".

Having worked on suprageneric names (Reveal, 1995-onward) for the last few years, and having discovered numerous earlier valid places for publication for family names as defined by recent editions of the botanical Code, I can verify that there is likely a significant number of earlier names available if people were willing to give up the fun of doing their systematic research in favour of the drudgery of doing nomenclature. However, few seem willing, or even fewer wish to do the work.

My view on Lists of names is this: All Lists should be prepared following provisions in the current Codes. If there are problems of competing names for the same taxon, and the older one is not in current use then I see nothing wrong with placing the NCU name on a List to be considered by the systematic community in the vetting process. Naturally the earlier name would be mentioned so that all would know the full extent of the problem when considering the competing names.

Let such names become the focus of discussion and the decision making processes associated with any vetting procedure.

More troublesome for some is the realization that a name might have been published earlier than previously thought. Hawksworth (1992) drew attention to my work (Reveal, 1991) on the bane of English botany John Hill who validly published numerous generic names in 1753 which were commonly attributed to the English botanical hero Philip Miller who proposed the same names a few months later in 1754. Suppression of the Hill names was smoothly handled by simply excluding certain of his publications from nomenclatural consideration. Certainly this could be done for other works if necessary.

Few taxonomists realize that conservation preserves only the name and not the bibliographic reference. The case of earlier authorships for plant family names has yet to be resolved (note the temporary solution in the botanical Code, e.g. footnote to Art. 14.4). One of the beauties of the names in current use proposals defeated at the last botanical congress is that NCU would protect authorships. The problem with over a hundred of the currently conserved family names is that they were validly published earlier than where now listed. The concept of NCU would remove this as a problem if it were so desired. Of course, as a reviewer noted to me, the ICBN could be altered to state specifically that when a name is conserved, so too is its bibliographic information.
As stated above, I would like listings to be developed using present Codes, vetted, and then submitted for formal adoption. Once a name is protected, even if an earlier one or an earlier place of publication for that name is found, it would not matter nomenclaturally.

My proposal, therefore, is to establish provisions in the botanical Code for NCU adoptions. When a group of names has been worked on, faithfully following the Code in effect, then and only then should that List be submitted formally for consideration. In this way nomenclatural stability can be achieved. It will take time and effort, but by making a determined effort to get it right at the start then fewer people will have reasons to be critical of either the concept of NCU or the processes associated with it.

The previous cavalier notions that any name and any place of publication will do was not appreciated, at least by the botanical community, in the past and is likely not to be so in the immediate future.

Second is the array of problems the BioCode attempts to address. Coordination among the Codes and cooperation of the people using the Codes, in my opinion, could render unnecessary a single overriding super Code. Homonymy can be resolved, in time, with the establishment of databases containing names of organisms at the rank of genus and above. We are not there yet, and while homonyms can sometimes be identified, it is impossible to find all of them now. Nevertheless, in the near future we ought to be able to say all biological creatures will have a single, unique generic name, and to have such a statement in each of the Codes.

By cooperation, the language of the Codes can be coordinated. Some terms and concepts in each of the Codes may need to be altered, but this will not be hard to do, and with the passing of a single generation, such changes will be of no consequence. But, as Brummitt (1996) makes clear, the drawback is that such terms will always be part of our taxonomic past, and therefore they will have to be maintained and defined in any future BioCode so workers of subsequent generations can work with and understand past nomenclatural discussions.

Zijlstra (1996) outlines many of the details that require resolution, and frankly, most seem possible within the existing frameworks of the current Codes. Accordingly, I would like to propose that instead of a BioCode which takes supremacy (real or not; and in the hands of only a few, see Younès, 1996) over the existing Codes (Greuter, 1996), that we return to the original idea worked out at the Brighton meeting of the International Congress of Systematic and Evolutionary Biology (ICSEB) in 1985 (Hawksworth, 1995) of coordinating the rules of nomenclature among the Codes.

If botanists want to deal with superfluous names, let them; if zoologists wish to ignore them, so be it. These are not the most important things within the Codes of nomenclature to outside users of scientific names anyway. What is critical to everyone is the stability of nomenclature, a unique generic name for
each kind of organism regardless of which Code the name was established under, and the creation and application of names in a uniform manner that is acceptable to all concerned, especially for those working on ambireginal organisms (Brummitt, 1996; Zijlstra, 1996).

Therefore my proposal is that we take the useful and unifying concepts from the draft BioCode and incorporate these into the current Codes. If the interested parties could gather in late 1997 and arrive at a set of unifying, coordinating provisions which can be considered by bacteriologists, botanists and zoologists prior to the end of the year 2000, I believe we can achieve much of what is needed and desired without significant controversy or too much disruption to biological nomenclature.

And this consideration would include what I hope would be a set of proposals from Kevin de Queiroz addressing a phylogenetic approach to nomenclature.

As Linnaeus and later workers have realized, it is simpler to propose (and even preach) nomenclatural rules than it is to implement them in their own work. Therefore, it is inevitable for the botanical and zoological communities of this generation to learn from Linnaeus' (1753) work: Ignore the past and get on with the future.

The great scourge to biological nomenclature, Constantine Rafinesque-Schmaltz, would love this period in our history. Oh the vindication he would proclaim! He who wanted one and only one correct name for each genus. He too had his own rules which only he followed. So, in one small way he was right. Let us set out to do the necessary ground work, now, starting with generic and family names. Let us do the names at these two ranks across the board, extinct and extant, plant and animal or whatever. Such Lists can be prepared and vetted by 2005 or earlier if the biological community is willing to make the effort.

At that time we can resolve the last of the nasty homonym problems. While reviewing many of the genera between now and 2005 we should be able to resolve some of the species nomenclature so that, with a better sense of how to do the task, we can get species names resolved by 2010. At that stage, I would urge we follow Linnaeus' example and forget the past.

To be sure there will be the John Hills and the Philip Millers of the future who will come along and resurrect names essentially all regard as unneeded. That is fine. The system, fortunately, will never be perfect and no taxonomic opinion is safe from future revision.

Nonetheless, the implication put forth by McNeill (1996b) that those of us who work on nomenclature are not doing scholarly scientific work is distressing. One of the points made by him and by Greuter (1996), following Hawksworth (1992), is that the cost of doing protracted nomenclatural research is too great. How then, given this kind of commentary, do they expect granting agencies to look upon proposals to do nomenclatural reviews
of the type necessary to prepare scholarly Lists of names for evaluation, if they themselves regard the endeavor as non-scientific?

Seemingly the great failing of the botanical Lists of generic names (Greuter et al., 1993) in the minds of many was the lack of a thorough, scholarly review. As noted by Zijlstra (1996), even the basis from which the list was drawn was knowingly flawed; yet little effort was made to correct the errors and almost none to see if earlier, valid places of publication (as defined by the botanical Code) existed. In fact, in some cases when they were pointed out, the information was largely ignored.

The proponents of a Code for biological nomenclature cannot have it both ways. To do Lists requires the support and cooperation of the systematic community. To undermine them by proclaiming work on nomenclatural matters as unscientific does little to promote harmony.

So, the solutions. Get the genera and family names done, revise in a coordinate way the existing Codes of nomenclature, solve in a cooperative way items of contention, and then abandon the past. And do it in a timely fashion. Bauhin did. And so did Linnaeus. Certainly we can as well.

References


9. Statements and Discussions

This section collates the submissions made by participants during the discussions at the ICSEB symposium and which were submitted in writing at that time.

General Remarks

Philippe Bouchet (Museum National d'Histoire Naturelle, Paris): In many branches of zoology and botany, amateurs contribute significantly to the growth of taxonomical knowledge and reference collections. A number of professional taxonomists hardly get any institutional support beside their salary. To all these people, taxonomical work is an area of personal freedom and individual achievement. Acceptance of the Codes of nomenclature is a purely voluntary decision, as they are enforced by peer pressure, not by an administration.

Therefore, I am worried about the psychological consequences of a BioCode being imposed abruptly from above to such segments of the taxonomical community. The reaction of Dr Brummitt demonstrates that such consequences should not be underestimated. Certainly, the Bio-Code should improve the social visibility of systematics, not create schisms among its practitioners and users.

Denis J. Brothers (University of Natal, Pietermaritzburg, South Africa): Although the aims of attempting to harmonize the principles and rules of nomenclature across all organisms are certainly laudable, I feel that the way in which this has been done is unfortunate.

If one is to expect agreement to change in the communities affected, then such change must be seen as having been proposed by the communities themselves rather than being imposed by some perceived external agency. This means that the BioCode starts off at a fundamental disadvantage because of perceptions (and whether they are justified or not is actually irrelevant) that this is something that has been proposed by an external body which has set itself up as a benign (?) dictator.

Apart from the above problem, to my mind there are two fundamental flaws in the proposal. First, the fact (mentioned by others also) that its adoption would mandate the use of two Codes by all taxonomists after whatever effective date is decided. This is not a trivial matter. It is complicated enough now when one has to consider a single Code; having to check on subtle (or major) differences between two Codes may be more than many would be willing to tolerate.

Second, the proposed draft contains numerous provisions specifying different treatments for names in botany, zoology, etc. This indicates to me a fundamental failure in purpose. It only makes sense to have a
single Code if it is truly a single Code with all names treated the same. The fact that the editorial committee was unable to produce such a Code suggests that the attempt was futile. It implies that it is in fact impossible at this stage to treat names the same across the board. A logical consequence of this is that it would seem more sensible to identify those areas in which harmonization could be accomplished without too much disruption, and make proposals to the appropriate Codes that the different Codes each be modified in the appropriate ways. If successful, the result will be separate Codes which are more similar, approaching the degree to which equivalent treatment of names is proposed in the draft BioCode, but which are much more likely to be accepted by their constituencies since they have been involved in the changes in the way they are familiar with. They will thus “own” the outcome. A further advantage is that each “discipline” will still have only one Code to apply.

Rita R. Colwell (University of Maryland Biotechnology Institute): I wish to report that the Judicial Commission of the International Committee on Bacteriology Nomenclature, meeting in Jerusalem last weekend, endorsed the draft BioCode, but wishes to note a few specific questions of the International Committee on Bionomenclature, which will be submitted separately. The principles of a unified BioCode are acceptable to bacteriologists.

R. Makinson (Australian National Herbarium, Canberra): I remain unclear as to the extent of the problem to which the proposed BioCode is supposed to be in response. How often, in fact, do systematists and others find themselves tripping over inter-regnal homonyms? Often? Sometimes? Seldom? Never? Is it easier to modify date indices with an indication of kingdoms or to adopt a new Code. I have not yet seen a real argument advanced as to the scale of the problems, such as would justify the scale of the proposed changes.

David Hawksworth’s Foreword to the draft BioCode nominates some issues. Among them, that of organisms like protists which are treatable under more than one of the present Codes, and also the changing concepts of kingdoms. These at least can be dealt with by simple changes to the existing Codes, assuming a consensus among practitioners of the subdiscipline concerned.

Hawksworth also nominates: “the need for the simplest possible system bearing in mind the scale of the undescribed biota and the scant literature and collection resources in the most species-rich countries”. This is a much more intractable problem, and certainly needs action. But is a BioCode a useful, or even relevant, response to this problem? The proponents of the BioCode are perfectly frank in acknowledging that the existing Codes will continue in force for names made up to the new starting date, and that systematists will continue to need a familiarity with the old Codes. Are we doing the systematics teacher, students, and practitioners of the future any favours by wishing two Codes on them? I have not seen any contributions so far in the debate from practitioners based in those resource-poor, biota-rich countries — what do they think of a new Code as an aid to their endeavours?
Let me make it clear that I am not arguing for no change. I happen to support the notion of registration of names, although I think it has to be on a polycentric basis, not a monolithic one. Nor are the International Botanical Congresses immovable on such issues. The botanical community does have a well-established and not entirely fossilized mechanism for reviewing and amending its own Code, including in the directions of user-friendliness and a common approach with the sister disciplines.

In this connection, over-much is made of purely nomenclatural name changes in plants. The usual estimate is that about 5% of plant name changes result from purely nomenclatural considerations (such as priority of publication) under the rules that have existed until recently. The other 95% of nomenclatural events are a result of some degree of advance in knowledge, or (at worst) competing taxon concepts. Now, those 95% of name changes will still happen under the proposed new Code. The 5% would not. But please note that since the last International Botanical Congress, botanists themselves have adopted new provisions for the conservation and rejection of species names in the interests of nomenclatural stability. These provisions should see the percentage of purely nomenclatural changes dwindle to vanishing point within the next few years, without the sledgehammer of an imposed new Code.

I have to report that there is concern and a certain amount of anger among many botanists that the BioCode initiative was not canvassed up-front at the last IBC, and that the process is assuming the flavour of a fist from above, bypassing the IBC nomenclatural process to which we are accustomed to have access.

We (taxonomists in general) have spent much of our time in the last few years telling each other that we must get better at demonstrating the relevance of what we do — to our colleagues in other disciplines, to the funding agencies, and to the public at large. This is essential, and to achieve it we might indeed expect initiatives from the peak organizations, the IAPT, IUBS, and others. If IUBS were to say: "here are the key service problems of having divergent Codes, and here are a range of measures (within existing Codes and external to them) that will address these problems", then I believe that botanical systematics will respond. We (botanists) want nomenclatural stability too! But while I respect the amount of constitutional jurisprudence that has gone into the draft Bio-Code, I question whether the proposal really addresses the main perceived problems of taxonomy, for which we are most criticized — relevance, and scientific rigour.

Dan H. Nicolson (National Museum of Natural History, Smithsonian Institution, Washington, DC): John McNeill mentioned nomenclature as a recreation. One general point is that we might ask ourselves how to work ourselves out of a job (recreation). Two steps . . . protected lists of names (new starting point), plus stabilizing the search for future names. Do we need nomenclaturalists?
The old method of repeatedly looking up original publications and applying the latest Code has not worked efficiently as I think the Bio-Code will in the longer run. We have more, not less proposals for conservation in botany after 90 years. I hope that we can move forward as quickly as possible.

**Peter H.A. Sneath** (Department of Microbiology, University of Leicester): Bacteriologists had to put a lot of effort into publicity from about 1968 to 1980 to get agreement to the changes we made. The opposition tended to come from workers in certain taxa who had little interaction with workers on other taxa, but users were broadly more welcoming.

**Attila T. Szabó** (Laboratory of Ecological Genetics & Evolution of Crop Plants, Hungary): The problem we face here is perhaps connected with the controversy raised in the USA recently and reflected in *Science* against Linnaean taxonomy. We hope the Linnaean tradition will resist but the heart of the problem is this situation Linnaeus did not face: to connect the basics of nomenclature with genetics and genes and with biological technology.

This is not a problem of scientific communities but a problem of history of biology. So if taxonomists intend to negotiate with consumers and even with officials responsible for fund raising, then old Linnaean concepts whether botanical or zoological, need to be harmonized with scientific trends. In this I do not believe that zoologists, botanists, bacteriologists can act separately.

My concrete proposals are too peripheral (cultivated plants) or too central (to include even more basic principles of genetic nomenclature in the *BioCode*) and I will formulate these later in a considered manner.

The controversies of this matter are good to reflect on many details. But perhaps if taxonomists will not make the steps of the time, the times will make steps over the taxonomists.

### Specific Remarks

The following remarks relate to items raised in particular contributions, or a very specific topic.

**Werner Greuter** (Botanischer Garten und Botanisches Museum, Berlin): In response to Dr Makinson’s statement I wish to make three points:

1. “Interregnal” homonymy is a problem not to be resolved but explored, for botanic names, in a *BioCode* context. Further to establishing lists of generic names actually and currently used for different organisms under different *Codes* (perhaps 2000), it will be necessary to inventory all species names established under them so as to avoid future homonymy at species level between, say, *Pieris* a butterfly and *Pieris* an ericaceous shrub.

2. I agree with Brummitt that the answer to the problem of the nomenclature of “ambiregnal” organisms is to attribute the major groups individually to the jurisdiction of zoological, bacteriological or botanical provisions. This will continue to be necessary under a *BioCode*, but will
then be a workable option while now it is not. As long as there is not a single Code legislating, dissenting minorities will not feel bound by such a decision. There have been no problems of borderlines between fungi, algae, and other plants (although there are no natural phylogenetic boundaries), all being treated under the ICBN. But after the split of bacterial nomenclature, a borderline problem now arises with the cyanobacteria ("blue-green algae").

(3) The need to work with two Codes will be restricted to those who can cope with the task: the specialists of nomenclature, who will need to assess the nomenclatural status of names governed by the present Codes. The normal users, including students, will find everything they need in the BioCode: rules to choose between competing names (irrespective of date), rules to establish new names, and rules governing the form of names.

Dan Janzen (University of Pennsylvania, Philadelphia): When a species with a valid name is found to actually consist of two species, the tradition is to give a new name to one, and continue to apply the old name to the other. This creates a major problem in pooling data about "the species" prior to the change, with data about "the species" after the change, when in fact the earlier "the species" is about "two" species.

Does the BioCode deal with cases like this (which are not treated by any Code), as well as with extant pooling problems. If the reply is yes, this brings to mind the solution of applying two new names instead of one. This means more name changes, but are more name changes preferable to a known false statement that generate nomenclatural stability?

John McNeill (Royal Ontario Museum, Toronto): Dr Ride seems to be restricting the choice of names to list to two extremes, neither of which seem desirable.

On the one hand he talked of the names that reflect a particular taxonomy; I do not think anyone would wish to give special status to such a restricted list. The botanical NCU proposals involved lists that represent the names that would be needed in any conceivable modern classificatory treatment, essentially those of a "splitter's" taxonomy.

His alternative to list all established names ("available" in zoospeak and "validly published" in botspeak) seems equally undesirable. For example, this could include what the ICZN calls "primary junior homonyms" that it declares are "permanently invalid" (ICZN, Art. 52(b)) an equivalent of ICBN's illegitimacy (ICBN Art. 53.1) and homotypic ("objective"/"nomenclatural") synonyms which although established can never be used. There seems no reason to prepare a contemporary list including such names. Indeed, there also seems no need to include those that reflect taxonomic treatments that have been discredited for centuries.

In reply to Dr Janzen's comments (above):

(1) All options for providing the most effective means of communication about organisms should be explored.
(2) This being said to date, the Committee on Bionomenclature has not looked at proposals different from those that are consistently adopted by all three main Codes.

(3) The issue of one species split into two is only a special case of the general one of different taxonomic circumscription. I would refer you to the interesting contribution and communication about different circumscriptions by W. Berendsohn in *Taxon* (44: 207–212, 1995) in an electronic database context.

Attila T. Szabó (Laboratory of Ecological Genetics & Evolution of Crop Plants, Hungary): With respect to the lecture of Dr Ride, the list of registered names in botanical taxonomy (angiosperms) is a matter of accepting or not the realities. There are many situations, for example in *Poaceae* but in any taxa when a well-defined name, with a content specified by the author of the original name will be and/or should be used, independently of its validity. The situation in *Triticeae*, especially for example in *Agropyron* s.l., illustrates well the situation faced by a theoretical or an applied botanist.

Chris P. Thompson (USDA Systematic Entomology Laboratory, Washington): Dr Janzen's question (see above) relates to the problem of how "events" [= specimens and/or observations] which were previously assembled into one named taxon are reassembled into two named taxa. Nomenclature deals with the names of those taxa, not with the circumscription of the "events" into the taxa.

On the issue of having to work with two Codes and in addition to Greuter's comments on Brummitt's paper (see above), the two "Codes" (i.e. the new BioCode and the older Regnal Codes) will become one Code when specialists deal with their old names by developing and accepting lists of names. Then the old Codes will no longer be needed and only the BioCode will be used for new names and how to determine precedence among names.

Regarding Dr Ride's talk, if Exclusive Lists cover all classifications, then Exclusive Lists are inclusive lists!

John McNeill (Royal Ontario Museum, Toronto): I appreciate the advantage of Dr Tubbs having shared with me earlier the suggestion that the draft BioCode was ambiguous with regard to its treatment of the issue of precedence on transfer of a species to a different genus.

This is a good example of one of the more fundamental problems of terminology to which I have already alluded. Art. 19.4 deals with this situation, but the supposed ambiguity rests in Art. 18.1. No botanist would have any difficulty in considering that the definition of a later homonym provided therein (a "name ...... spelled exactly like a name based on a different type that was previously established for a taxon of the same rank") precludes the establishment of an *Abies picea* based on *Pinus picea* L. (1753), because it would be a later nomonym of *Abies picea* Miller (1768). I can only suppose that his perception of ambiguity comes from zoological usage of "specific name" for what botanists term the "specific epithet", the botanists' "specific name" being the zoologists' "binomen".
Professor Greuter has taken the liberty of exploring some “second thoughts” on details of the draft BioCode — and his suggestion on subgeneric names seem reasonable as well as logical — and I would like to do the same. I could not agree more strongly with his comments on the futility of citing authorship of names in general biological publications, but I do question one of the draft BioCode’s proposals on the citation of authorship in those limited, principally nomenclatural, situations in which citation is appropriate.

I refer to the traditional botanical Code practice of double citation which the draft BioCode suggests be discontinued. I have already commented on Dr Tubb’s suggestion of ambiguity in the draft BioCode on the issue of precedence on transfer of a species to a different genus. Retaining the double citation would ensure that the critical precedence date is highlighted.

En passant, I might add that I believe Greuter’s criticism of the anonymous botanist whose paper he reviewed would only have been justified had we been working under the provisions of the zoological Code (and double citation was nevertheless permitted). We must assume that he/she is convinced of the merit of the new taxonomic treatment being proposed. In that case he/she is ensuring some degree of nomenclatural stability by establishing precedence in the new genera for the epithets in current use. If it transpires that no-one adopts his/her taxonomy, his/her name will never reappear (the fame/notoriety of “comb. nov.” attribution will be ephemeral) — and even if the treatment should be accepted, we both agree that the botanist’s name should only be cited in the new specialist taxonomic works that review the group.
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IUBS SECRETARIAT
51, Boulevard de Montmorency, 75016 Paris, France.
Tel: 33 (1) 45.25.00.09 - Telefax: 33 (1) 45.25.20.29
Telex: c/o ICSU 645 554 F, Email: iubs@paris7.jussieu.fr

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