Zootaxa 2426: 1–42 (2010)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Retroactive changes should be introduced in the *Code* only with great care: problems related to the spellings of nomina

ALAIN DUBOIS
Reptiles & Amphibiens, UMR 7205 OSEB, Département de Systématique & Evolution, Muséum national d'Histoire naturelle, CP 30, 25 rue Cuvier, 75005 Paris, France. E-mail: adubois@mnhn.fr

Table of contents

Accepted by A. Minelli: 11 Jan. 2010; published: 14 Apr. 2010

Abstract

Taxonomy is currently facing a major crisis and is likely to have strong difficulties to reduce significantly the taxonomic gap before the biodiversity crisis has wiped out a large proportion of the living species of the earth. In this context, taxonomists should pay great attention to the nomenclatural Rules, and care for them to help them in this urgent task, rather than diverting their time and energy to secondary or useless questions or debates. A major purpose of the *Code* is to promote nomenclatural stability in zoology. This requires stability in the Rules, or at least that a great care be taken, when establishing new Rules, to avoid that they can have unexpected deleterious consequences for stability. In particular, in most cases, it is crucial to deny retroactivity to the new Rules. Several examples of problems created in zoological nomenclature by introduction of changes in Articles dealing with the spellings of nomina are examined in detail. These Articles were modified, with retroactive value, in the 1985 edition (Art. 32, 33, 35 and 39) and in the 1999 edition (Art. 24) of the *Code*. It is shown that these changes, which have no clear "philosophical" or practical justifications and which result in no clear benefits, have in fact had negative impacts on nomenclatural practice. Their implementation requires heavy useless additional work from taxonomists and has negative results in nomenclatural stability that had clearly not been anticipated by the ICZN when promulgating them. In a few sets of nomina tested below, the changes in the 1985 edition resulted in spelling changes for 10.0 to 22.2 % of the nomina, and those in the 1999 edition for 21.7 to 33.3 % of the nomina, roughly a quarter of them on the whole (24.5 %). Among others that are less emblematic, a striking case is that of the fish generic nomen *Tetraodon*, widely used especially since the genome of a species of this genus has been sequenced, and which should be changed to *Tetrodon* because of the unwarranted introduction of the new Art. 24.2.4 into the *Code*. It is suggested that these changes should be cancelled, or at least denied retroactivity from the years of their promulgations. In order to make this discussion easier, a "taxonomy" of the different kinds of spellings of nomina, and a dichotomic key to such situations, are provided. This stresses the fact that detailed discussions on very precise aspects of the functioning of nomenclatural Rules, as well as the computerization of nomenclatural data for online databases, require to use a specialized technical terminology to designate the nomenclatural concepts and tools, not vague "common language" terms like "name" or "type": "*keep the Rules, but change the terms*". The problems outlined here should be kept in mind by the ICZN before implementing drastic changes in the Rules of nomenclatural availability, as recently suggested.

Key words: Nomenclature, *Code*, availability, stability, terminology, nomen, spelling, *nomen novum*, First-Reviser, change in Rules, retroactivity, *Tetraodon*

Introduction

A new paradigm for biology has been created at the end of the last century by the combination of three facts: the taxonomic gap (Dubois 2010), the crisis of taxonomy and the biodiversity crisis (Dubois 2003). It requires a strong acceleration of the work of exploration, study, description and naming of the species of the globe (Wheeler *et al.* 2004; Dubois 2008*a*,*c*,*e*, 2010).

In order to be able to deal with the living organisms of our planet, we need to communicate unambiguously about them, and for this we need a specific and universal language. This is provided by scientific names or *nomina* (Dubois 2000) and nomenclatural Rules regulating the use of these nomina. As a result of a progressive work by the international community of taxonomists over two and a half centuries, a set of international Rules has been established and has been in force for more than one century in zoology (Melville 1995): the *International Code of Zoological Nomenclature* (Anonymous 1999; "the *Code*" hereafter). The International Commission of Zoological Nomenclature (ICZN) cares for the updating the *Code* and solving problems regularly occurring in this field.

As reminded in its *Preamble*, one of the stated purposes of the *Code* is "*to promote stability (…) in the scientific names of animals*". In order to play this role, one of the basic requirements is that the Rules of the *Code* themselves be stable, as frequent changes in these Rules can only be a cause of nomenclatural instability. A major potential cause of problems in this respect is the introduction of *retroactive* changes in long established Rules. Such changes should be introduced only with great care, and taking into consideration their potential unexpected disturbing consequences. In order to avoid these problems, in most cases, changes in the basic Rules of the *Code* should only be implemented with a proactive, but not retroactive, value. Otherwise the risk is strong to result in unnecessary changes in the valid nomina of some taxa, or in their

authorship and date. This matter will be discussed here about changes introduced hastily in the last two editions of the *Code* (Anonymous 1985, 1999) that concern several Rules dealing with the spellings of nomina. Being retroactive, these changes result in unexpected and unnecessary changes in the valid nomina of some taxa and they are therefore doing a disservice to zoological taxonomy and nomenclature.

To prevent any confusion, let us remind first that the object of the *Code* is not to deal with the theory and practice of classification of organisms (taxonomy), but to provide Rules for the automatic and universal establishment of the unique valid nomen of a given taxon in any given taxonomic frame, and that this establishment is a three-step (or "three-floor") process that consists in Rules first for the nomenclatural *availability* of nomina, then for their *allocation* to taxa and finally for their *validity* (Dubois 2005*a*-*d*). Nomina are referred in the *Code* to three "groups of names" or *nominal-series* (Dubois 2000), the *family*-, *genus*- and *species-series*, to which the *class-series* can be added for nomina, unregulated by the *Code*, above the rank superfamily (Dubois 2000).

Keep the Rules, but change the terms

Let us first come back to a point that was made previously (Dubois 2006*a*: 233–235) but which is still controversial. The *Code* is a very specialized, highly technical set of Rules, that cannot be grasped "intuititively" by a quick look at a few lines in a book, or guessed by use of "common sense". Rather, they require proper understanding of the differences between distinct situations that may appear similar or identical at first sight (e.g., "unjustified emendation" *vs.* "*nomen novum*"). This specialized work should not be done by any zoologist without prior making the effort of understanding and learning the Rules in all their detail. This also requires to fully master a precise terminology designating technical nomenclatural concepts. As a matter of fact, the *Code* makes use of very few "technical terms", and where it does so it seems to do it "reluctantly". Some zoologists, including some members of the ICZN, do not think the use of special terms for nomenclatural concepts is necessary (e.g., Rentz 1973; Douglas 2008: 171), or even state (e.g., in reviews of manuscripts submitted for publication) that such terms would be harmful to communication, being "jargon", "too pedant" or "too complex", and likely to discourage some zoologists from getting acquainted with these concepts.

As will be illustrated below in several cases, empirical evidence rather supports the opposite interpretation. The use of simple, "common language" terms, for precise technical concepts of the *Code*, does not appear to make the understanding of these concepts easier. To me, real "jargon" is the use of an imprecise term (like "name" for a spelling, or "type" for an onomatophore) in an imprecise sense, which results in miscommunication. In teaching nomenclature to hundreds of students for more than 15 years, I have often observed that such terms, sometimes arranged in multi-word expressions (e.g., "incorrect subsequent spelling") may be deceiving, as some zoologists, especially when they think they are in a hurry, have sometimes the impression that the concepts they designate are "self-evident" and do not require making the effort of reading, studying carefully and mastering the *Code*. This results in some cases in important nomenclatural mistakes. This problem may be obviated by the use of *precise technical terms*, that no one can believe to be understandable intuitively and that *require to make this effort*.

To take just one example, the continued use in zoological nomenclature, since the 19th century, of the term "type", for reference specimens or "nominal taxa", results in careless outsiders of taxonomy believing that taxonomists are still fixist and have a "typological" approach to biodiversity. This is exemplified, among many others, by these citations from a "*Focus*" of the leading journal *Science*: "*The traditional system groups organisms in part according to their resemblance to a representative 'type' specimen (…). Under the traditional system, a taxonomist (…) selects the most representative species to be the 'type' for each genus, then the most representative genus to be the type of the family, and so forth. (…) as new specimens with similar characteristics are found, they are deemed part of a known species, a new species, or even a new genus based on how closely they resemble the type specimen.*" (Pennisi 2001: 2304). Such a strange statement completely misses the point of the status and role of "name-bearing types", which is not to provide *characters*

but to *bear the nomen* in establishing a *connection* between the real world of organisms and the world of language (Dubois & Ohler 1997).

This point would be made clear by extirpating the term "type" from zoological nomenclature and using a special technical term. The formula "*name-bearing type*" currently used in the *Code* is not only unpalatable, but also still based on this term "type" and then does not fully clarify this question (as would have e.g. a formula like "*name-bearing specimen*"). The proper term to designate this very particular nomenclatural tool, *onomatophore*, is more than half a century old (Simpson 1940). For better clarity of communication, especially with non-taxonomists, it would be useful to implement it in the *Code* to replace "name-bearing type" (Dubois & Ohler 1997; Dubois 2000, 2005*c*, 2007*a*, 2008*d*,*f*). Many zootaxonomists think this is not necessary, because all of us "know well" that a nomenclatural "type" is not a specimen "typical" of a taxon but a sample of the latter, that provides an objective reference for the allocation of a nomen to this taxon. But this attitude completely misses the point outlined above: many *outsiders* of our discipline *do not* understand this and think that the use of the term "type" in the *Code* testifies to a persistence of typological thinking in taxonomy. This misunderstanding certainly does not help taxonomy to solve its current crisis, because most of this crisis comes from a devaluation of this discipline in the eyes of many colleagues from other biological disciplines, who constitute most of the members of the committees and boards that decide research priorities and distribute funds and positions.

I fail to see why zoological nomenclature, which is a highly specialized field, would not have its own language. All scientific and technical specialized domains do indeed have their own terminology, which is not readily transparent to outsiders, and to enter these fields and be active in them, *any outsider must first learn this language*. The deliberate use in the *Code* of special, opaque (*vs.* seemingly "self-speaking") terms would *force* all potential users to study this text and get acquainted with its methods and concepts. Another advantage of the use of precise, technical *single* terms is that it shortens considerably the text, as exemplified in the discussion below, where many terms designating distinct nomenclatural concepts are used in many sentences (see another example in this respect in Dubois 2006*a*: 235). In fact, some of the parts of the technical discussion below on some aspects of the *Code* are admittedly rather complex, and are made possible only thanks to the use of a special terminology, in the absence of which it would be almost impossible because it would require the use of too many explanatory periphrases in many sentences.

Another advantage of using special terms, based on classical roots (from ancient Greek or Latin languages), is that they are international, and can be used almost without modification in all languages of the world. Terms based upon modern languages may look very differently in different modern languages: thus, "*spelling*" in English is "*orthographe*" in French or "*Schreibweise*" or "*Rechtschreibung*" in German. Except if one thinks that all languages other than English should now be banned from scientific publications (an opinion that has its supporters, but also opponents), it appears much better to have a single term in all languages, as even non native readers can easily guess what it is about when meeting it in a text, even if they do not completely master the language.

Additionally, as will be seen below, for some of the concepts used in the present discussion, the *Code* proposes no designation at all, whether under an English term or a multi-word formula: for example, whereas the *Code* proposes two designations for a nomen coined especially to replace another one (new replacement name and *nomen novum*), it has none to designate the replaced one, and we will need such a term in the discussion below.

Finally, an important function of such a precise, non-ambiguous terminology is that it provides an efficient tool for the computerisation of databases on nomina, and more generally of zoological nomenclature and taxonomy. Many such databases already exist on the net, but a quick look is enough to realize that many, if not most, of them, use ambiguous categories of nomina and data that do not allow to find precise and accurate information. Just one example will be enough here: most of these databases include in the same category of "synonyms" very different kinds of nomina and spellings (for more details, see below and Dubois 2000), such as isonyms (protonyms having the same onomatophore), doxisonyms (protonyms having different onomatophores but designating the same taxon in a given taxonomy), aponyms (various spellings, ranks and onymorphs of the previously listed protonyms), orthochresonyms (correct usages of nomina) and

heterochresonyms (incorrect usages of nomina). Using a precise terminology for all these categories would, so to speak, "force" the builders of databases on nomina, nomenclatural and taxonomic data, at least if they are serious, to enquire about the genuine status of the nomina and data before including them in the database. This would greatly enhance the efficiency of these databases for information storage and retrieval in taxonomy and to improve communication of zootaxonomists among themselves and with other members of the scientific community (Dubois 2000: 35, 59).

Although the ICZN does not seem to be prepared to introduce such new terms in the *Code*, their progressive use in publications like this one may be an efficient way to show in practice the advantages of using such precise terms to designate the concepts of the *Code*. For this reason, in the rather complex and fully technical situations discussed below, I am using several such technical terms, after having defined them. Except for two of them (lectautoneonym and lectarchaeonym), these terms do not correspond at all to proposals of "new Rules". They merely provide precise technical designations for some of the nomenclatural concepts of the *Code*. Thus, whereas I think that in many respects the Rules of the *Code* are good and should not be modified, except very carefully, I think the current terminology of the *Code* should greatly be improved: "*keep the Rules, but change the terms*".

Nomina and spellings

A taxonomy of nomina and spellings

Nomina play a crucial role in all publications dealing with organisms, in many fields including biology, medicine, agricultural and veterinary sciences, conservation, trade and legislation. For proper communication among all actors in these fields, a given taxon (species, genus, family), as recognized under a given taxonomic scheme (classification), must be designated by a single nomen in all publications. Not only the nomen has to be the same, but it must be *spelt* exactly in the same way, as even a one-letter difference may lead to misunderstandings or to failure to find the information seeked. This is particularly true in our times when online electronic communication has deeply modified the way of looking for information. When only written documents existed, any reader could "correct" by him/herself the spelling of a misspelt word, e.g., "grog" for "frog" or "Ninnaeus" for "Linnaeus", but today many search engines, which require to enter the exact spelling, will not find "frog" if they look for "grog".

The treatment in the *Code* of nomina and of their various spellings requires the use of several distinct nomenclatural concepts. To avoid confusions in communication, it is useful to have different terms to designate these different concepts. Except where mentioned, all the terms presented below were created by Dubois (2000). Appendix 1 provides formal definitions of these terms and their etymology.

An important distinction must first be made here: that between *nomen* and *spelling*. To make this distinction fully clear, I suggest to use technical terms ending in *–onym* (from the Greek ὄνομα, *onoma*, "name") for the various kinds of nomina distinguished below, and ending in *–graph* (from the Greek γράφω, *grapho*, "I write") for the various kinds of spellings.

A "scientific name" or *nomen* is a Latin term that is used formally under the Rules of the *Code* to designate a taxon or several taxa. It becomes *available* (and therefore usable, and potentially valid) in zoological nomenclature only once it has been *published*, and following certain *criteria*. An available nomen has a nomenclatural *author* (see Dubois 2008*b*) and *date*, and it relies on a (real or potential) *onomatophore*. Among several nomina that potentially designate the same taxon ("synonyms"), or that are identical or "similar" ("homonyms") but designate different taxa, only one can be kept and used in zoology, and is then the *valid* nomen for the taxon.

A nomen designates what the *Code* calls a "nominal taxon", an ill-chosen term, that can be replaced by the term *taxomen*. As a matter of fact, it does not designate a taxon (a taxonomic concept): a taxomen has no *intension* or *extension* (see Dubois 2000, 2005*c*, 2007*a*, 2008*d*,*f*). This nomenclatural concept points to the indissoluble link, established by *ostension*, between an onomatophore and a nomen (or several nomina in cases of neonyms, see below).

An available nomen may be known as a *hoplonym*, whereas a published but non-available nomen is an *anoplonym*. A hoplonym subsequently deprived of its availability (e.g., "totally invalidated" or "suppressed" by the ICZN, but see Dubois 2000 for a criticism of the use of the latter term) becomes an *exoplonym*.

Once created and available, a nomen may be used under different avatars or *paronyms*[1]. These include the original paronym or *protonym*, and the subsequent paronym(s) or *aponym(s)*. These avatars may differ among them in three respects: (1) their spelling; (2) their rank; (3) their onymorph. These allow to recognize subcategories within paronyms:

(1) The *spelling* is the arrangement of letters that compose a word. In zoological nomenclature, any one-letter difference constitutes a different spelling (except in a few very strictly regulated cases, where different arrangements of letters are "deemed to be identical"). The different spellings taken by a nomen in the literature are its *parographs* (see Appendix 1). They include its *protograph* and its *apograph(s)* (see Appendix 1).—**Example.** The family-series nomen created under the protograph *RANAE* Goldfuss, 1820 has many apographs (Dubois 1984: 41), including *RANOIDEA* (superfamily), *RANIDAE* (family), *RANINAE* (subfamily) and *RANINI* (tribe), that have been used as valid nomina in recent classifications.

(2) The *rank* of a nomen is its place in the nomenclatural hierarchy (from subspecies to kingdom). A given nomen (with its author, date and onomatophore) may be used at any available rank *within the nominal-series* in which it was created: a nomen created for a species may be used for a subspecies, one created for tribe may be used for a superfamily, etc. However, a nomen introduced in the literature for an order may be used for a class or a phylum, but not for a superfamily, because order, class and phylum belong in the class-series, and superfamily in the family-series. The different protonyms of a nomen regarding its rank may be known as it *parohypses*, including its *protohypse* and its *apohypse(s)* (see Appendix 1).—**Example.** The parohypses of the nomen *RANAE* mentioned above include, among others (Dubois 1984: 41), the apohypses *RANOIDEA*, first used for a family by Fitzinger (1826: 37), and *RANOIDEA*, first used for a superfamily by Bolkay (1919: 348). Although both these paronyms are the same parograph, they are different parohypses.

(3) The *onymorph* of a nomen (Smith & Pérez-Higareda 1986) designates any association between genus-series substantives and species-series epithets that has been used for a given species-series nomen: the term *combination* as used in the *Code* only designates a subcategory of onymorph, as it only considers the association between a generic substantive and a specific or subspecific epithet, irrespective of potential other words in the binomen or trinomen. Here also, a given nomen may exist as different *paronymorphs*, its *protonymorph* and its *aponymorph*(*s*) (see Appendix 1).—**Example.** The protonymorph *Hydrus rynchops* Schneider, 1799 has had several aponymorphs (Dubois 2000: 76), including some that are the same parograph (e.g., *Cerberus rynchops*) or different parographs (e.g., *Cerberus rhynchops*), and including some that are the same parohypse (e.g., *Cerberus rynchops*) or different parohypses (e.g., *Cerberus rynchops rynchops*).

Parographs, parohypses and paronymorphs are just different aspects of paronyms: any different paronym can be qualified according to these three criteria. In the present paper, mainly dedicated to questions of spellings, most of the discussions will deal with parographs.

In the taxonomic literature, the same nomen may take different spellings either for invalid reasons (incorrect subsequent spelling) or for valid reasons, if used at different nomenclatural ranks (e.g., family *RANIDAE* and tribe *RANINI*) or under different onymorphs (e.g., *Rana esculenta* and *Pelophylax esculentus*). These different parographs are just avatars of a single nomen, which all have the same onomatophore, author and date. It is therefore fully misleading to designate them as "different names", as often found in publications. Nomenclatural *availability*, and ultimately *validity*, only concerns *nomina*, not *spellings*. According to the *Code*, a spelling may only be *correct* (e.g., *Rana esculenta*, family *RANIDAE*) or *incorrect* (e.g., *Rana esculentus*, family *RANIDI*), not *available* or *valid*.

1. Dubois (2000: 42) also used the term *morphonym* for this concept, but in a sense different from that given to this term by Smith & Smith (1993: 5) when they coined it, i.e., as a strict synonym of *onymorph*, defined below. As this is liable to cause confusion, it is better to abandon the term morphonym altogether.

Among the different parographs of a nomen, only one or a few can be used in zoological taxonomy for being *correct*. Usually, a parograph is not correct by itself but according to the rank or the onymorph in which the nomen is used: a correct paronym may then be known as a *eunym*, whereas an incorrect paronym is a *nothonym*. If only spelling is concerned, the terms *eugraph* and *nothograph* are appropriate (see Appendix 1). Similarly, in some cases it may be useful to distinguish *euhypse* from *nothohypse*, or *eunymorph* and *nothonymorph* (see Appendix 1), but this won't be explored here.

The *Code* provides precise and complex Rules for the establishment of the *unique* eunym of a given nomen, at a given rank and if relevant as a given onymorph, within a given taxonomy. As presented in the current version of the *Code*, these Rules appear in different articles and even chapters, and a newcomer may have difficulties finding the proper information in this "jungle". It is therefore useful to dispose of a "taxonomy" of all cases and situations regarding the categories of nomina and spellings that are distinguished in the *Code*. Several of the Rules dealing with these cases have changed, sometimes repeatedly, during the history of zoological nomenclature, which is problematic, as will be shown below.

In the standard situation, a new nomen is published as a single original paronym (spelling, rank and onymorph if appropriate), its protonym, with a single spelling, its protograph. Any subsequent paronym, whether intentional or not, correct or not, is an aponym. The protonym and all its aponyms are not different nomina, they have the same author, date and onomatophore. In what follows, we will concentrate our attention on the spellings of these paronyms, i.e., on the protograph and its apographs.

In most cases, the protograph will have to remain the eugraph ("correct spelling") of the nomen (Art. 32.2 of the *Code*). Exceptions are the few very particular situations where evidence exists, in the original publication itself, of an "*inadvertent error, such as a lapsus calami or a copyist's or printer's error*" (Art. 32.5.1). This evidence requires to "correct" the spelling of the nomen. Such situations, listed in Art. 32.5, are much less numerous than believed by many (see e.g. Dubois 2007*b*), as for example an "*incorrect transliteration or latinization, or use of an inappropriate connecting vowel, are not to be considered inadvertent errors*" (Art. 32.5.1). When correction of the spelling for this reason is required, the eugraph of the nomen is called by the *Code* (Art. 32.2.2) a "justified emendation". Another case where the spelling of a nomen must be emended is that of subsequent changes in rank or combination which require to modify its ending. Such a changed spelling is called by the *Code* (Art. 34) a "mandatory change". It is also a eugraph.

Apographs (subsequent spellings) of a nomen may be *intentional* or not from the part of the authors of the publications where they first appeared in the literature (Dubois 1987*c*). A spelling changed unintentionally by an author, or *ameletograph*[2], is an "incorrect subsequent spelling" which has no independent nomenclatural status, i.e., no author, date and onomatophore. A spelling changed intentionally may be either justified, in the cases just mentioned (justified emendations and mandatory changes), or unjustified. In the first case, it is just a particular case of apograph of the nomen, a *meletograph*[3]. In the second case, it is an "unjustified emendation", which, according to the *Code*, is a new nomen being a junior objective synonym of the original nomen, with a partly independent nomenclatural status: it is part of the same taxomen, has a different author and date, but the same onomatophore. An unjustified emendation is thus just but one particular case of a more general situation, that of a "new replacement name" or "*nomen novum*" provided for an already available nomen. The similarity between the two situations can be stressed by using the same general term *neonym* for both, and the terms *autoneonym* for a neonym directly derived from a nomen through unjustified emendation, and *alloneonym* for a neonym not so derived: whereas *Micrhyla* Duméril & Bibron, 1841 is an autoneonym of *Microhyla* Tschudi, 1838, *Dendromanes* Gistel, 1848 is an alloneonym of the latter nomen (see Dubois 1987*b*-*c*). The original nomen replaced by a neonym, for which the *Code* provides no term, can be known as its *archaeonym* (Dubois 2005*b*, 2006*a*).

A basic (although not stated as such) principle of the *Code* is the *nomenclatural founder effect* (Dubois 2005*d*), i.e., the fact that the status of a nomen is established once and for all in the original publication where it first appears. This is the case, as we have seen, for most protonyms. However, in a few rather rare cases, an

2. Term here emended from *ameletonym* in Dubois (2000: 54).
3. Term here emended from *meletonym* in Dubois (2000: 54).

ambiguity remains in the original publication. This ambiguity can be solved only by a "First-Reviser"[4] action, defined in Article 24.2 of the *Code* as the action of the author of the first publication containing a clear choice between alternative possibilities. One such case concerns the correct spelling of nomina.

As a matter of fact, a rather rare situation exists where a new nomen appears under several alternative spellings in the original work. This is usually due to inadvertence from the author, or from a change in his mind during the preparation of the manuscript, with incomplete replacement in the latter of the first spelling he/she had coined by another one. These spellings are "multiple original spellings" (Art. 19.3) of the same nomen, which can be called *symprotographs* (see Appendix 1). This is only one possible case of *symprotonyms*, with *symprotohypses* and *symprotonymorphs*, not considered here.

To put the same ideas more briefly, any variant way of writing a nomen can be either an apograph (modified spelling of an extant nomen) or an autoneonym (new, nomenclaturally independent, nomen, derived from an extant nomen).

Finally, another useful term is that of *chresonym* (Smith & Smith 1973, Dubois 2000) which designates neither a nomen nor a spelling, but any subsequent *citation* or use of an already existing nomen, under any of its paronyms. This citation may use correctly either a nomen that indeed applies to this taxon (*orthochresonym*), or incorrectly a nomen that in fact applies to another taxon (*heterochresonym*). Most "synonymies" found in the taxonomic literature are in fact mainly *chresonymies* (lists of chresonyms that were applied in the past to a taxon). Strictly speaking the term *synonymy* should only designate a list of hoplonyms referring to the same taxon, either for nomenclatural ("objective synonyms" or *isonyms*) or taxonomic ("subjective synonyms" or *doxisonyms*) reasons.

Ambiguities in communication

The use of precise terms to designate the various categories of nomina and spellings recognized by the *Code* clarifies many situations, and failure to use these terms may cause ambiguities in communication. Thus, the use of the unclear and vague term "name" may result in designating undiscriminately as "different names" both different homonyms (which are indeed different nomina, with different authors, dates and onomatophores) or the different parographs that were used, either originally (symprotographs) or subsequently (apographs) for what is in fact the same nomen (with the same author, date and onomatophore).

The precise terminology for nomina, spellings and citations, presented above and used below, allows to avoid misleading statements as are often found in zootaxonomic publications and even in the *Code*, because of the indifferentiated use of the imprecise and catch-all term "name" for these different concepts and tools, or of other terminological confusions. Examples of such mistakes will document this statement and make it clearer.

Thus, the *Code* writes in its Art. 24.2.3: "*If a name is spelled in more than one way in the original work, the first author to have cited them together and to have selected one spelling as correct is the First Reviser. The selected spelling (if not incorrect under Articles 32.4 and 32.5) is thereby fixed as the correct original spelling; any other spelling is incorrect (and therefore unavailable [Art. 32.4]).*" This writing suggests that spellings can be "available", which is not true: as we have seen above, nomenclatural availability is a concept which applies to nomina, not to parographs (spellings). A more proper writing for the last part of this article would be: "*any other spelling is incorrect and cannot be used as a substitute nomen, not being an independent nomen (Art. 32.4)*".

The same confusion appears in Art. 32.4: "*An incorrect original spelling has no separate availability and cannot enter into homonymy or be used as a substitute name*". A more proper writing for this sentence would

4. Although the *Code* writes "First Reviser", I am using here the writing "First-Reviser" with a dash, for the reason explained by Dubois (2000: 39): "*the technical expressions which are used in the* Code *or derived from expressions used therein, will always be written below with dashes, in order to show that they are well defined formulae with a precise technical meaning*".

be: "*Not being a different nomen but only an incorrect spelling of an available nomen, an incorrect original spelling cannot enter into homonymy or be used as a substitute nomen*".

Similarly, Art. 33.3 writes: "*Any subsequent spelling of a name different from the correct original spelling, other than a mandatory change or an emendation, is an 'incorrect subsequent spelling'; it is not an available name and, like an incorrect original spelling [Art. 32.4], it does not enter into homonymy and cannot be used as a substitute name (…)*". This writing also suggests that a parograph (spelling) is a nomen (name). The second sentence above should rather start by: "*not being a different nomen but only an incorrect spelling of an available nomen, it cannot enter into homonymy or be used as a substitute nomen, just like an incorrect original spelling (Art. 32.4) (…)*".

The same confusion between nomen and parograph is clearly present in the recent paper by David *et al.* (2009) discussed below: "*Spellings not selected by the FR(s), if reused in our text, appear in quotation marks to signal that they are not separately available (Arts. 19.3, 32.4). Because these names then become unavailable we do not include them in our appendices.*" (p. 3); "*Peters (1951: 54) cited both spellings and used* 'pucherani*', but his spelling is no longer available (Art. 19.3) on account of Lafrenaye's* [*sic*] *selection*" (p. 7); "(…) randoni *Loche 1860, no longer available (Art. 19.3) on account of Loche's selection*" (p. 7); "*(…) used* 'swainsonii*' without comment, but on account of Baird's selection this is no longer available (Art. 19.3)*" (p. 8); "*(…) mistaken usage of an unavailable spelling*" (p. 9). Once again, when *spellings* are concerned, they cannot be *available* or *unavailable* but only *correct* or *incorrect*, and a spelling is not a "*name* [that could] *become unavailable*". On the other hand, spellings, once they have been published, do exist in the literature and cannot be erased or "suppressed". They should not be ignored in an index or list of nomina and spellings, because any author who meets one of these spellings in a publication may look at such indexes or lists of nomina to know what its current status is, and if does not appear there the index will be only partly useful.

Many other examples of use of incorrect terms to designate nomenclatural concepts could be mentioned but this would only occupy space. In amphibians, some were already discussed at some length, such as the use of the formula "*unjustified emendation*" (which designates a autoneonym, i.e., an available nomen) by Hillis (2007: 336) for what were in fact unavailable nomina (see Dubois 2007*c*: 396), or the use by Duellman & Wiens (1993: 40) of the strange formula "*junior objective homonym*" for what was in fact just a subsequent citation or use of an already existing nomen, i.e., a chresonym of the latter (see Dubois & Ohler 1997: 307).

About "nomenclatural stability"

As we have seen, one of the main functions of the *Code* is to "*promote stability and universality in the scientific names of animals*". The ICZN, which is in charge of updating the *Code* and of dealing with problematic cases, often claims to care for "*nomenclatural stability*" and for this reason, in the recent years, has given more weight than in the past to "usage" against the Principle of Priority, which poses various problems that need not be discussed here (see Dubois 2005*b*, 2008*d*, 2010). However, in some recent cases, this Commission has indeed taken decisions that go in the exactly reverse direction, for reasons that are difficult to understand. Thus, in the same period when this Commission "suppressed" a family-series nomen to "protect" a completely obscure tribe nomen that had been used only 16 times in zoological nomenclature since 1758 before the application for its conservation (Dubois 1994; Anonymous 1997), the ICZN suddenly decided (Anonymous 2005) to deny nomenclatural availability to all the amphibian and reptilian nomina created in the very famous books by de la Cepède (1788*a*-*b*), quoted thousands of times since their publication (for more details, see Dubois & Raffaëlli 2009). We will see below a similar contradiction in the discussions of the Rules of the *Code* that deal with the spellings of nomina. Whereas some Rules recently implemented tend to protect "usage", others result in completely challenging some long established spellings. The benefits of both kinds of changes are difficult to appreciate, and one cannot help thinking that, for the sake of "nomenclatural stability", the best solution would probably have been to keep the 1964 Rules unchanged.

The Rules concerning family-series nomina based on "unjustified emendations" of generic nomina

Some changes, introduced in the "third" edition of the *Code* (Anonymous 1985), had consequences which still seem to have escaped the attention of many zootaxonomists, despite several publications dealing with them (Dubois 1984, 1985, 1987*a*,*c*).

Changes were brought in the Art. 32, 35 and 39 of the 1985 edition of the *Code*, concerning family-series nomina based on "unjustified emendations" (autoneonyms) of generic nomina. In the second edition of the *Code* (Anonymous 1964), no article was dealing expressly with the case of such nomina. Article 33(a)(ii), which has now become Art. 33.2.3, was just stating that such an unjustified emendation was, in nomenclatural terms, a new nomen, and wrote: "*the name thus emended has status in nomenclature with its own date and author, and is a junior objective synonym of the name in its original form*". In such conditions, a family-series nomen based on an autoneonym of a generic nomen had of course also its own nomenclatural status, with its own date and author, and was distinct from the family-series nomen based on the original generic nomen. Whenever the family-series nomen based on the archaeonym had been published first, no nomenclatural disturbance occurred: this family-series nomen remained the valid one. However, a nomenclatural problem was raised whenever the first published family-series nomen for this group was based on the autoneonym of the generic nomen: should this family-series nomen be conserved, or replaced by the family-series nomen based on the archaeonym? This depended on the date at which reversal to the use of the original generic nomen had occurred in zoological taxonomy.

Considering the fact that an autoneonym of a generic nomen was not only a new generic nomen but also a junior isonym of the latter, this problem could be solved in many cases through use of the Art. 40 of the *Code* (still present in the 1999 edition), which stated that, if a family-series nomen had been replaced before 1961 on account of the fact that the generic nomen on which it was based was rejected as an invalid junior synonym, and if this replacement had "*won general acceptance*", this family-series nomen was to be maintained in the interests of stability, and given the date of the rejected nomen. Let us take an example: the family-series nomen *RANIRIDIA* Rafinesque-Schmaltz, 1814 was based on the generic nomen *Ranaria* Rafinesque-Schmaltz, 1814, an unjustified emendation of *Rana* Linnaeus, 1758*a*; although it was the first nomen ever coined for this family, it was soon (and long before 1961) replaced in amphibian taxonomy by the family-series nomen *RANIDAE*, a mandatory change for its protonym *RANAE* Goldfuss, 1820. Consequently, and as established by Dubois (1983, 1984, 2000), the valid nomen of this family was *RANIDAE* Goldfuss, 1820 (1814). As most unjustified emendations of generic nomina were published in the early years of zootaxonomy, recourse to this solution allowed solving most problematic cases of this kind. Only in the case of unjustified emendations of generic nomina rejected after 1960 was it impossible to restore the spelling of the family-series nomen based on the original generic nomen. If stability was really threatened, it was then possible to ask for conservation of the long-used nomen through use of the Plenary-Powers[5] of ICZN.

This simple situation was drastically modified by the changes in Art. 32 and 35 implemented in the 1985 edition of the *Code*. Art. 35(d)(ii) of this edition (slightly modified as Art. 35.4.1 in the 1999 edition) stated: "*A family-group name based upon an unjustified emendation of a generic name is an unjustified original spelling and must be corrected (…)*". This new Rule was confirmed in Art. 32(c)(iii) of the 1985 edition (Art. 32.5.3.3 in the 1999 edition), which specified: "*An original spelling is an 'incorrect original spelling' if (…) in the case of a family-group name, it (…) is based (…) on an unjustified emendation of a generic name*". This change entails a confusion between spelling and nomen, as it "downgrades" some unjustified emendations (new nomina) to the status of incorrect spellings (apographs of existing nomina).

Under the 1964 edition of the *Code*, the same nomenclatural treatment was afforded to all family-series nomina based on generic nomina that are junior objective synonyms of other generic nomina: in all cases, what allowed to establish the valid family-series nomen for a taxon was (1) whether rejection of the junior generic nomen took place before 1961 or after 1960, and (2) for the nomina rejected prior to 1961, the fact that the new family-series nomen had "*won general acceptance*" or not.

5. See note 4 above for the use of a dash in this formula.

With the 1985 edition (followed in the 1999 edition), a basic distinction was introduced according to whether the junior synonymous generic nomen is, or not, an autoneonym. If it is not so, Art. 40 still applies as previously: this is the case when the junior synonym is either an alloneonym, or an objective synonym created independently (i.e., not as a neonym), or a subjective synonym. In contrast, if the junior synonym is an autoneonym, Art. 40 does not apply any more, and Art. 35(d)(ii) (now Art. 35.4.1) applies. This change poses a problem of internal coherence of the *Code*. It is inconsistent with the fact that an autoneonym is still considered by the *Code*, in Art. 33(b)(iii) of the 1985 edition and Art. 33.2.3 of the 1999 edition, as a nomen having its independent status in nomenclature, with "*its own author and date*". Furthermore and perhaps more importantly, it raises another difficuly: to be able to deal with each particular case, it becomes imperative to distinguish between nomina that are autoneonyms from those that are alloneonyms. Despite what one could think *a priori*, such a distinction is not always easy to make, especially when one deals with ancient texts. Several examples of disputed cases in amphibian nomenclature were discussed in detail by Dubois (1981, 1982, 1984, 1985, 1987*c*), including: *Astrodactylus vs. Asterodactylus*; *Batrachus vs. Bufo*; *Bombinator* and *Bombitator vs. Bombina*; *Calamites vs. Calamita*; *Callula vs. Kaloula*; *Cassina vs. Kassina*; *Cecilia vs. Caecilia*; *Cyclorhamphus vs. Cycloramphus*; *Hylaplesia vs. Hysaplesia*; *Hylaria vs. Hyla*; *Hyperodon vs. Uperodon*; *Lophiohyla vs. Lophyohyla*; *Megalofrys*, *Megalophrys*, *Megalophys* and *Megaphrys vs. Megophrys*; *Myiobatrachus vs. Myobatrachus*; *Occidogyna*, *Ooeidozyga* and *Oxydozyga vs. Occidozyga*; *Ranaria vs. Rana*; *Triturus vs. Triton*; and *Megophrys monticola vs. Megophrys montana*. Despite their apparent similarity, all these cases are not identical, and each one requires a careful analysis to ascertain the status of the junior nomen. Some are indeed autoneonyms (e.g., *Megalophrys* and *Megalofrys* for *Megophrys*), others alloneonyms (e.g., *Batrachus* for *Bufo*), others ameletographs (e.g., *Megalophys* and *Megaphrys* for *Megophrys*) and still others (e.g., *Bombinator vs. Bombina*) brand new nomina with different onomatophores, i.e., subjective, not objective, junior synonyms. Finally, some, like *monticola*, *Ranaria*, *Hylaria* or *Triturus*, can well be argued to belong in either category autoneonym or alloneonym. Let us just consider one of them. Dubois (1982: 263–264) considered the specific epithets *montana* and *monticola* that appear in Kuhl & Van Hasselt (1822) as "multiple original spellings". However, Brongersma (in Dubois 1982: 264, footnote) considered that this is not true, as they have different etymologies (*montana* derives from the Latin noun *mons*, and *monticola* from the Latin noun *mons* combined with the Latin verb *colo*) and must therefore be considered as two distinct nomina (allelonyms as defined here, see below). Well, this depends on the definition one gives of "different etymologies". Where is the Rule in the *Code* that would allow to settle objectively this case?

This difficulty to distinguish between autoneonyms and alloneonyms also has a bearing on another modification in the 1985 *Code*. In the 1964 *Code*, Art. 39 was very short: "*The name of a taxon of the family-group is invalid if the name of its nominal type-genus is a junior homonym*". In the 1985 edition, this article was much longer, and a paragraph 39(a) was added: "*If an unjustified emendation of the name of the type genus becomes itself the replacement name, the family-group name is then to be based upon it by correcting the name to the spelling required by the stem of the name of the replacement type genus; the author and date of the family-group name remain unchanged*". Let us first note that the beginning of this paragraph contained a confusion. It stated that an unjustified emendation can "*become a replacement name*", but this is not the problem here: an unjustified emendation *is* already a replacement name, but of a particular kind, as it simply results from a change in the spelling of the original nomen. The term "replacement name" merely designates the way a nomen is made *available* (first step of the nomenclatural process), it has nothing to do with its *validity* (third step). What this paragraph meant is in fact "*becomes itself the valid name*" of the taxon. More importantly, in this case also, like in Art. 32 and 35, this new Rule requires to credit an author with a nomen that he/she had not coined or used, and application of the Rule requires to distinguish between autoneonyms and alloneonyms, a difficult, if not impossible, distinction in some cases.

In the 1999 edition of the *Code*, Art. 39(a) was displaced and became 35.4.2, and the writing of its first part was corrected ("*replacement name*" was changed to "*substitute name*"), but the Rule remains.

In order to make this fully clear, let us consider in detail the case of the family-series nomina *TRITONIA* and *TRITURINAE* (Dubois 1985: 67–69), which shows the kind of problems that were created *ex nihilo* by this

Article introduced in 1985. Linnaeus (1758*a*) created a nomen *Triton* for a genus of **MOLLUSCA**. Laurenti (1768) created a junior homonym *Triton* for a genus of **AMPHIBIA**. Rafinesque (1815) created the family nomen *TRITONIA* (later emended to *TRITONIDAE* by Boie 1828), based on the latter generic nomen, but in the same work he proposed to replace the latter by the nomen *Triturus*. The latter nomen is still nowadays the valid one of this salamander genus (Dubois & Raffaëlli 2009), which is now referred to the family *SALAMANDRIDAE* Goldfuss, 1820. In an unpublished work, Brame (1957) created, within this family, a subfamily *TRITURINAE*, nomen based on *Triturus* Rafinesque, 1815. Kuhn (1965) was the first to publish the nomen *TRITURINAE*, associated with a diagnosis, and thus made it nomenclaturally available. What are the status of the family-series nomina at stake?

Under the first and second edition of the *Code*, the situation was straightforward. The nomen *TRITONIA* Rafinesque, 1815, based on an invalid junior generic homonym, was an exoplonym, i.e. a nomen definitively invalidated by virtue of Art. 39, whereas the nomen *TRITURINAE* Kuhn, 1965 was available as from 1965. However, if a subfamily was to be recognized, within the family *SALAMANDRIDAE*, for *Triturus* and related genera, its valid nomen was *MOLGINAE* Gray, 1850, based on *Molge* Merrem, 1820, another neonym for *Triton* Laurenti, 1768 (Dubois 1984, 1985). Today, under the taxonomy of Dubois & Raffaëlli (2009), this nomen is the valid one of a tribe *MOLGINI* Gray, 1850 that includes the genus *Triturus*.

Under the third and fourth editions of the *Code*, the situation is different. The status of the nomen *TRITONIA* Rafinesque, 1815 will depend on whether *Triturus* Rafinesque, 1815 is considered an autoneonym or an alloneonym of *Triton* Laurenti, 1768.

As discussed by Dubois (1985: 68), the nomen *Triturus* was only one among many "changes in original spelling" published by Rafinesque (1815), so it would appear justified to consider that, like the other ones, *Triturus* is an autoneonym ("unjustified emendation") of *Triton*. Art. 39(a) of the 1985 and 35.4.2 of 1999 would then require to correct *TRITONIA* into *TRITURINAE*, but with the authorship and date "Rafinesque, 1815". Therefore, this nomen should become the valid one, not only of the subfamily or tribe including the genus *Triturus*, but also of the family *SALAMANDRIDAE* Goldfuss, 1820![6]

Another interpretation of this situation is however possible, if we turn to the etymologies of these nomina. Both in Linnaeus (1758*a*) and Laurenti (1768), the nomen *Triton* was clearly derived from the Greek name Τρίτων, the name of a God of the sea. However, as noted by Dubois & Raffaëlli (2009: 56), the etymology of *Triturus* is unclear, as this nomen could be construed as based on Τρίτων alone, or on Τρίτων and ούρά (*oura*, "tail"). Are these the same or different etymologies? This case is similar to the case of *monticola* and *montana* discussed above. The etymology of *Triturus* being unclear, this nomen can be formally considered either as an autoneonym ("unjutified emendation") or as an alloneonym ("*nomen novum*" s. str., i.e., excluding autoneonyms) of *Triton*: in the second case, Art. 39(a) in 1985 or 35.4.2 would not apply any more and we would turn back to the situation in the first two editions of the *Code*. Be it as it may, this example shows how a case that was clear before the 1985 edition of the *Code* became highly complex after this edition, and in fact impossible to solve objectively and automatically, as the distinction between autoneonym and alloneonym is often unclear and must sometimes be decided upon quite arbitrarily.

Although this was apparently unnoticed by many zootaxonomists, including some of the then members of the ICZN (see the debate between Savage 1986 and Dubois 1987*c*), these modifications in the 1985 *Code* resulted in changes in spelling, author and/or date for many family-series nomina. Case studies in the family-series nomenclature of recent anuran amphibians (Dubois 1984, 1985, 1987*a*,*c*) and chelonians (Bour & Dubois, 1985, 1986) have documented this instability. In these two groups, changes were entailed for several, mostly well-known, family-series nomina and even more of parographs of these nomina (e.g., a family and its "nominotypical" subfamily): these changes concerned 6 nomina[7] over 60 (i.e., 10.0 %) and 14 parographs over 79 (i.e., 17.7 %) in anuran amphibians, and 4 nomina[8] over 18 (i.e., 22.2 %) in chelonians. Furthermore,

6. Nowadays, precedence of *SALAMANDRIDAE* over *TRITURIDAE* can be easily obtained through Art. 23.9 on "reversal of precedence", as the former has been used thousands of times in all kinds of publications, whereas the latter is seldom used and virtually unknown of zoologists, but in 1985 conservation of *SALAMANDRIDAE* would have required a vote of the ICZN using its Plenary-Powers.

7. *CYCLORAMPHINI*, *HYLIDAE*, *MEGOPHRYINAE*, *MICROHYLIDAE*, *PIPIDAE* and *RANIDAE*.

in some cases, these changes in the *Code* created quite insoluble problems, at least if objective criteria are seeked for, as exemplified by the case of the nomen *TRITONIA* just discussed. The problem here is caused by the absence in the *Code* of *objective* criteria to distinguish autoneonyms from alloneonyms in some cases.

The family-series nomenclatures of very few zoological groups have apparently been revised carefully after 1985 to take into account the changes in the Articles 32, 35 and 39 introduced in the 1985 *Code* and maintained in the 1999 edition. It is easy to predict that, when this is done, problems of nomenclatural stability will also be disclosed in various other groups.

These problems were created *ex nihilo* by changes of the *Code* and could have been solved by suppressing these changes, or at least deciding that they apply only after 1985. Dubois (1987*c*: 39) wrote in this respect: "*if these modifications were to be maintained, then the ICZN* must *devise and publish precise criteria and rules to allow taxonomists to objectively decide if a given name is to be considered as an unjustified emendation or as a new replacement name. I predict that this would not be an easy task*." Despite this warning, the ICZN has never discussed this question since 1985 and no such criteria are provided in the *Code*, so that ambiguities like that of *TRITONIA vs. SALAMANDRIDAE* still exist in the current *Code*, and can be solved only by arbitrary (and therefore questionable and potentially labile) decisions of individual taxonomists. Is it a good way "*to promote stability (…) in the scientific names of animals*"?

"Prevailing usage" regarding spellings of nomina

Art. 35(c) of the 1985 edition of the *Code* reads as follows: "*Any subsequent spelling of a name different from the correct original spelling, other than a mandatory change or an emendation, is an 'incorrect subsequent spelling'; it is not an available name and therefore does not enter into homonymy and cannot be used as a replacement name*". This article was quite straightforward and allowed a clear distinction between the concepts of available nomen (hoplonym) and of spelling (parograph) highlighted above. However, the 1999 edition, beside keeping this article, introduced a new Art. 33.3.1, which reads: "*when an incorrect subsequent spelling is in prevailing usage and is attributed to the publication of the original spelling, the subsequent spelling and attribution are to be preserved and the spelling is deemed to be a correct original spelling*". This new article completely blurs out the distinction between nomen and spelling and therefore creates a considerable confusion. Whereas the first part of Art. 33.3 still states that a spelling is not a nomen, the second part states that, in certain conditions, a spelling can become a nomen. Furthermore, these conditions are unclear and certainly illogical and inconsistent. What does the zoological community have to gain in the introduction of such a confusing "Rule"? This question needs to be considered more closely.

Let us first start with the internal inconsistency of this article. The introduction of this new Art. 33.3.1 in the *Code* was apparently motivated by the concept of "nomenclatural stability", which by itself is highly open to criticism, at least as used in the current *Code* (Dubois 2005*b*, 2008*d*, 2010). The spirit of this article is clearly that a long-used spelling, even if "incorrect", must be "protected", i.e., validated. But then, if this is the purpose of the introduction of this basic change in the *Code*, why does this new article only mention "subsequent" incorrect spellings? Original incorrect spellings also occur in zoological nomenclature, either as a single protonym or as several symprotonyms (see below), and some of them are used for a long time in the literature before being corrected (see e.g. Koerber 2009). Simple consistency would require to suppress the word "subsequent" from this article. But then, as we will see below, this would be fully contradictory in frequent cases with both Art. 24.2.3 and 24.2.4, because this article does not apply in the case of multiple original spellings, as acknowledged by David *et al.* (2009: 2, 8).

Most strangely, this article requires to credit a spelling to a publication where it did not appear, and under the responsibility of an author who did not use it, but it refuses the same treatment to a spelling that was indeed used by this author in this publication! This is completely illogical.

More importantly, the appropriateness of this Art. 33.3.1 itself is questionable. It relies on the concept of "prevailing usage" which is unclear and confusing, and has several important drawbacks analysed in detail

8. *CHELIDAE*, *DERMATOCHELYIDAE*, *EMYDIDAE* and *KINOSTERNIDAE*.

elsewhere (Dubois 2005*b*, 2008*d*, 2010). Particularly relevant in this case is the fact that it entails a shift from nomenclatural Rules based on entirely *automatic* procedures to procedures that rely on opinions, majority, poll, and in fact on an "argument of authority". As a matter of fact, no clue is given in this article or in the *Code*'s *Glossary* regarding the quantitative criteria to be used to establish that the usage of a spelling is "prevailing". The *Glossary* provides a definition for usage *of a name*, but not of a spelling, which is different, as discussed above: "*that usage of the name which is adopted by at least a substantial majority of the most recent authors concerned with the relevant taxon, irrespective of how long ago their work was published*". Article 23.9 of the *Code* provides some *criteria* for establishing "prevailing usage" *of nomina*, but they are not part of the *definition* of the concept itself and they only partly correspond with this definition: in particular, they do not clarify the concept of "*substantial majority of the most recent authors concerned with the relevant taxon*".

Why do we need a *Code*? To have stringent Rules for an automatic and indisputable identification of the valid nomen of any taxon, with its correct spelling. Introducing a concept like "usage", moreover with a vague definition and no criteria of implementation, results in opening *discussions* among colleagues, about questions that should not require it. In our time of taxonomic gap (Dubois 2010) and of biodiversity crisis, taxonomists need automatic Rules to facilitate their work, not "debates" or "polemics" to decide what is the correct spelling of a nomen. Furthermore, these practices amount to validate the work of careless authors, against those who were careful enough to discover a spelling problem: doing so, the *Code* promotes a very strange "image" of our discipline, one which is not going to help for its better appreciation by other scientific disciplines and "experts" who distribute funds and positions.

The Rules concerning multiple original spellings of nomina

The new Article 24.2.4 of the Code

We have seen above that a new nomen may be introduced in zoological nomenclature under two or more alternative spellings or *symprotographs*. Of course, this situation is not acceptable in zoological nomenclature, as a given taxon, in a given classification, must have a single nomen, with a single spelling. So Rules had to be devised in order to know how to fix the correct spelling of such a nomen. Nowadays, with the implementation of the online database *Zoobank*, a new need exists, that of providing this database with lists of such correct spellings (David *et al.* 2009). But, recently, changes have been introduced in the *Code* regarding these Rules, and they must be critically evaluated.

In some cases of symprotographs, both (or more) spellings show equal or similar occurrences in the publication (often only once each!), whereas in other cases one is used in most of the work and the other one(s) appear(s) only once or twice, which suggests a possible inadvertence. Not being acquainted with the *Code*, one could imagine various possible Rules to fix the eugraph, e.g.: quantitative criterion (number of usages of each spelling); "page" or "line" priority; "correct transliteration or latinization"; "appropriateness" of the term for the taxon it designates; "euphony"; etc. A Rule of "page" or "line" precedence once existed, from 1948 (Anonymous 1950) to 1953, in the *Règles Internationales de la Nomenclature Zoologique* (Blanchard 1905) that were in force before the *Code*, but it was suppressed by the *Copenhagen Decisions on Zoological Nomenclature* (Hemming 1953: 66–67). Although it has not existed in the *Code* since then, some taxonomists still use it (see Nemésio 2007). As for incorrect formation of the nomen suggesting that one of the competing spellings "*resulted from an inadvertent error*", it was once considered as a possible reason for rejecting one of the two symprotographs as incorrect (Follett 1955: 21), but this was never implemented in the *Code*.

In fact, the Rules of the *Code* are more straightforward. They simply state that, in such cases, the "correct original spelling" among the two symprotographs is not established in the original publication, but that chosen by the First-Reviser (FR), i.e., "*the first author to have cited them together and to have selected one spelling as correct*" (Art. 24.2.3). This First-Reviser action (FRA) is definitive, and not liable to be modified by

subsequent authors. Following this action, the chosen spelling is the "correct" one for the nomen, whereas the rejected spelling is "incorrect". As such, it does not have an independent status in nomenclature. Therefore, it does not preoccupy this spelling against potential junior homonyms. Its status is exactly similar to that of an "incorrect subsequent spelling": it is just a particular case of ameletograph, an *original ameletograph* (*vs.* a *subsequent ameletograph*). For simpler communication, let us call *lectoprotograph* (see Appendix 1) the correct original spelling as chosen by the FR among multiple original spellings, and *leipoprotograph* (see Appendix 1) any original incorrect original spelling as rejected by the FR among multiple original spellings. The FRA results in the choice of the lectoprotograph and, by way of consequence, the rejection of all other symprotograph(s) as original ameletograph(s).

Although with very slight differences in its writing, this Article of the *Code* has remained virtually unchanged in the first three editions of the *Code*.

In the first (Anonymous 1961) and second (Anonymous 1964) editions, the exactly same text appeared in Art. 24, simply stating that, whenever identical spellings are published simultaneously, "*their relative priority is determined by the action of the first reviser*". It further added an important precision, stating that "*The expression 'first reviser' is to be rigidly construed*", i.e. that the FR must have expressly *cited* the two or more competing spellings and must have expressly *chosen* one as valid. This precise definition of the FRA as "*rigidly construed*", i.e., requiring to mention the alternative spellings before choosing between them, can be traced back to the *Copenhagen Decisions on Zoological Nomenclature* (Hemming 1953: 67), i.e., from the middle of the 20th century.

Although more lengthy and detailed, the text of Art. 24 in the third edition of the *Code* (Anonymous 1985) maintained this Rule unchanged, requiring that both or more competing spellings be "*cited together*" and one chosen as the "*correct original spelling*".

However, a drastic change in this Article was introduced in the fourth edition (Anonymous 1999), currently in force. Art. 24.2.3 repeats the same statement as in the previous editions: "***Selection of correct original spellings.*** *If a name is spelled in more than one way in the original work, the first author to have cited them together and to have selected one spelling as correct is the First Reviser. The selected spelling (if not incorrect under Articles 32.4 or 32.5) is thereby fixed as the correct original spelling; any other spelling is incorrect (and therefore unavailable [Art. 32.4]).*" (See above for a suggestion of different wording for the end of this article).

But then a new Art. 24.2.4 was added in this edition: "***Original authors may be deemed to be First Revisers of spellings.*** *When the author, or one of the joint authors, of two different original spellings of the same name subsequently uses one of them as valid in a work (including the author's or publisher's corrigenda), and neither had previously been selected as the correct spelling by a First Reviser, the author is deemed to be the First Reviser, whether or not the author cites both spellings together (that used as valid becomes the correct original spelling).*"

In the discussion below, for shorter designation of these two kinds of First-Reviser actions, I will use the formula "*external First-Reviser action*" or EFRA for a FRA taken by an author or authors not being the original one(s), under Art. 24.2.3, and "*internal First-Reviser action*" or IFRA for a FRA taken by the original author(s) under Art. 24.2.4. Whereas internal First-Reviser actions may be either explicit or implicit (EIFRA or IIFRA), external First-Reviser actions are valid only if clearly explicit (mention of both original spellings and unambiguous choice between them).

Why such a change?

This modification of Rule introduced a basic change in the philosophy underlying First-Reviser actions. As will be shown below, it has detrimental consequences on nomenclatural stability. Why was it then introduced in the *Code*? One can think of two possible justifications for this change, a "philosophical" and a practical one.

This change may appear "philosophically" justified at first sight, because it would seem that the author of a nomen is the best person to know what his/her "intention" was when coining it. But experience shows that

this interpretation is not always born out by the facts, far from that. This may seem strange, but many taxonomists, during the whole history of the discipline, have proved to be careless about questions of spellings, if not about other nomenclatural problems with farther reaching consequences. For example, all herpetologists well acquainted with the literature know that John Edward Gray (1800–1875) was extremely careless about spelling and introduced many ameletographs, including for the nomina he had coined himself! In all the cases, which are not rare, when an author had not noticed the presence of different symprotographs for a new nomen he/she had published earlier, or had no interest or care about these questions of spelling, the new Rule of Art. 24.2.4 has no justification, and the "First-Reviser" action credited to this author by this new Rule can be fully inadvertent and remain unnoticed by its own "author". This author may not have realized the existence of two different spellings in the original work, and used one of them subsequently by pure chance, without any conscious "choice" between them. This is confirmed in many cases, when the same author in a still subsequent publication uses the other original spelling, if not a third one. In fact, any author who publishes a new nomen under two symprotographs, and does not immediately publish a correction (as an addendum or corrigendum in the original work, or published shortly after, or in another paper published in the very subsequent months or years) shows without doubt an absence of interest and care for the problems of spelling of zoological nomina. It then appears a strange idea to "reward" him/her by giving him/her the priority of FRA, through simple mention of one of the symprotographs, over a more serious subsequent author who was careful enough to mention both of them and to explicitly choose one of them as valid!

Another, practical, reason for supporting this change in the Rules, may be that it would make easier the tracing of the valid FRA having fixed the lectoprotograph, as it would appear quicker to survey all the works of a given author than all works by various authors where a FRA could possibly have been taken. David *et al.* (2009) mentioned "*the potential shorter search for a First Reviser in a case previously unconsidered*" (p. 14) and stated that such nomenclatural acts by the original authors will always be the valid ones, as "*of course they have priority*" (p. 3). This is simply not true, as Art. 24.2.4 does not state that an IFRA by the original author has priority over a "traditional" EFRA through Art. 24.2.3, if published subsequently to the latter. If such an EFRA by another author citing all symprotographs and choosing one as valid has taken place before the original author had again mentioned one of them in a publication, then this "traditional" EFRA is the valid one. This is quite possible, especially when the first subsequent mention of one of the symprotographs by the original author was much delayed after the original publication. Thus, in their review of FR actions in ornithology, David *et al.* (2009) mentioned 45 cases of IFRA. These took place at various dates after the original publication, from the same year to up to 20 (*Haematortyx*) or 23 years later (*Nectarinia pygmaea*). In such cases, the delay was fully sufficient to allow for a "traditional" EFRA to have occurred in the meanwhile, and shorter periods may do as well. One such case is examined in detail below, that of the nomen *Tetraogallus himalayensis saurensis*, where an EFRA by another author actually took place four years earlier than the IFRA by the original author. Thus, the new Rule does not necessarily result in a facilitation of the search of the valid FRA.

Therefore, no clear benefit results from this change of Rule. In contrast, as we will now see, it entails several drawbacks and inconsistencies that lead to question the opportunity of this change suddenly introduced in the *Code* in 1999.

Basic problems with this change

Beside a change in the "philosophy" of FRA (from a careful, conscious nomenclatural act to a possibly inadvertent act), this change of Rule has another, more severe, consequence. In a significant proportion of cases, the spelling so "chosen" by the author of the original nomen turns out to be different from that chosen by the first subsequent author who mentioned the existence of both (or more) symprotographs and chosen one among them as lectoprotograph, a choice which had to be considered as the only valid FRA until 1999. If this choice has been followed by all authors for a long period, the retroactive implementation of Art. 24.2.4 results in a nomenclatural instability, which can be remedied only through a vote of the ICZN suspending the Rules.

In some cases, the disturbance can be even stronger, whenever the generic nomen whose spelling has to be modified is also the basis of a family-series nomen. Examples of such problems are given below.

Additionally, this Rule is illogical and inconsistent, as it concerns only one kind of First-Reviser actions that can be taken by an author in zoological nomenclature. Such actions are of various kinds, described as follows using the terms of Dubois (2000, 2005*c*): choice of a lectophoront (lectotype) among several symphoronts (syntypes) (Art. 74.1); choice of a nucleospecies (type species) among the prenucleospecies (originally included species) of a genus-series nominal taxon (Art. 69.1); choice of precedence between two synonyms, homonyms or nomenclatural acts published simultaneously by the same or by different authors (Art. 24.2); etc. In all these cases however, the original author is not deemed to have made a surreptitious FRA if he/she only mentioned some information: the FRA is valid only when clearly stated in full words, or can be clearly deduced from mention of two competing nomina or acts and choice of a valid one.

In particular, the new Art. 24.2.4 only mentions First-Reviser actions between alternative original *spellings* of a single nomen (symprotographs), but not between alternative original *nomina* proposed simultaneously for the same taxon in the same publication. Such alternative nomina or *allelonyms* (Dubois 2006*a*: 183) were not rare in the early taxonomic literature, especially in higher-rank nomenclature (see e.g. Dubois 2004, 2006*a*, 2009*b*) but also exist in lower-rank nomenclature (e.g., Dickinson *et al*. 2009). The nomenclatural precedence among allenonyms is fixed by the choice of the First-Reviser, who can be stated to have chosen a *lectonym* (see Appendix 1) against one or several *leiponyms* (see Appendix 1). According to the current *Code*, in such cases, the new Art. 24.2.4 does not apply, even when the original author had used only one of the allelonyms in subsequent works, thus clearly rejecting the other one(s): this is the case of the nomen **AMPHYBIENS** de Blainville, 1816 as analysed by Dubois (2009*b*). This is fully inconsistent, because in such cases there can be hardly a doubt on the intentionality of this author's choice between two completely different nomina, contrary to "trivial" differences of one or a few letter(s) between two spellings.

Three more "philosophical" and practical questions regarding this change of Rule are raised by three particular situations: (S1) that of a nomen published originally by an author who subsequently changed his/her name; (S2) that of a nomen originally published by several joint authors; (S3) that of a nomen published originally under more than two alternative spellings.

Regarding (S1), from a nomenclatural point of view, an author is not a person, but a signature (Dubois 2008*b*) and it may be difficult in some cases to establish that two different signatures correspond to the same person. If a nomen was first published with two different symprotographs by an author X, and that later an author Y used only one of these symprotographs as valid but without mentioning the other one, this is not a valid FRA under Art. 24.2.3. But if later it can be established that the nomenclatural author Y was the same person as X (see several examples of this situation in Dubois 2008*b*), then this becomes a valid IIFRA. If in the meanwhile another, subsequent, EFRA has been published and accepted as valid by the scientific community, this will result in nomenclatural instability.

Concerning (S2), when a nomen was originally published by several joint authors, they are collectively responsible for the new nomen, and in the original order of the initial authorship. If the "philosophy" behind the new Art. 24.2.4 is that the original author can be guessed to know what he/she is doing when using only one of the two symprotographs in a subsequent work, then this should require that the same authors, in the same order, are authors of this subsequent work. But what occurs in the situation where a nomen was first published with two different symprotographs A and B by the authors X, Y & Z, then later the author Z alone used only the symprotograph A as valid, and still later the author X alone, or X & Y, or even X, Y & Z, used the symprotograph B a valid? As Art. 24.2.4 only requires that "*one of the joint authors*" mentioned one of the two symprotographs to publish a valid IFRA, the third author Z may have inadvertently used one spelling, whereas the first author, or the three authors altogether, may have made a conscious choice. This situation does not necessarily raise problems of nomenclatural instability, but it shows that the new article may well be unjustified in some cases if it is based on the idea that the original author "knows what he/she is doing" when using a spelling. In fact, this is similar to the cases where a single author, who had created a nomen under two different spellings, later used alternatively both of them in different publications, or even a third one. Priority should of course be given to the first subsequent publication settling the case, but this has a poor

"philosophical" justification, as this author was in fact fully careless about the spelling of this nomen and cannot be stated to have made a real "First-Reviser action".

Finally, the situation (S3) is a very trivial problem, but it clearly points to a hasty writing of this change (and others as well) introduced in the last edition of the *Code*: the new article only mentions the case where only *two* different spellings were used in the original publication, not "several". Very rigidly interpreted, this means that the new Rule 24.2.4 cannot be applied when three or more symprotographs were created together. This rigid interpretation was adopted by David *et al.* (2009: 2), who wrote: "*this Article does not extend to cases where there were three or more spellings*". This interpretation may be considered unnecessarily rigid, as when a nomen was created under three spellings A, B and C, the subsequent use by its original author of the sole spelling B may well be construed as meaning two distinct dichotomous choices, one of B over A and one of B over C.

Although these three latter cases are certainly rare, they cannot be ignored in a *Code* which is supposed to provide a universal covering of all possible situations.

Finally, it is doubtless that implementation of the new Art. 24.2.4 may in some cases confront taxonomists with an internal contradiction of the *Code*. This is the case with the discovery today that an IFRA under this article had unconsciously been taken by an author long ago (up to 250 years), leading to resurrection of a spelling that had remained unused since the original publication, or very seldom used, and to rejection as "incorrect" of a spelling long considered correct. This incorrect spelling may even have been the basis for a family-series nomen. In such cases at least, this is in contradiction with the spirit of Art. 33.3.1 of the *Code*, as discussed above, although not with its current writing, because of the restriction of the use of "prevailing usage" in this article to "subsequent" spellings.

The status of spellings once chosen by First-Reviser actions now considered invalid

As well illustrated by the work of David *et al.* (2009) in ornithology, or by the nomina in Linnaeus (1758*a*) analysed below, the consequences of the new Art. 24.2.4 in zoological nomenclature cannot be considered trivial, as this new Rule results in changes in the eugraphs in 21.7 to 33.3 % of cases. Such a disturbance may be expected to be important especially in the zoological groups which have been the matter of thorough nomenclatural works in the last century, with proper search for First-Reviser actions and establishment of the lectoprotograph under Art. 24.2.3. What course should be followed when one discovers now that, following the new Rule, some First-Reviser actions are invalid and should be replaced by others which result in some change in the eugraphs? The solution proposed by David *et al.* (2009) is simply to ignore the problem, to replace the eugraph and to reject completely the spelling that was once considered valid outside nomenclature as an original ameletograph ("incorrect original spelling") without nomenclatural status, just as if these spellings "had never existed" and did not appear in earlier publications. This is highlighted by their refusal to even include these spellings in the indexes of their work (p. 23–24). As will be shown below, this is problematic not only for future taxonomists who will meet these spellings in the literature and may have difficulties in finding their status, but also for establishing the status of the various spellings of family-series nomina derived from these variant spellings of generic nomina.

Whenever a nomen was created under different symprotographs, subsequent authors may have been aware of this, or not. If no one has noticed the existence of symprotographs (e.g., because one appeared only once in the original publication, and the other one several times), even if only one spelling has been used in all the subsequent literature this cannot be taken as a FRA. If then an IFRA is recognized today, it is logical to consider this as the first nomenclatural act regarding this situation, and to consider the leipoprotograph as an original ameletograph devoid of nomenclatural status. In any such case concerning a generic nomen, it is logical, although sometimes strange, to consider that any variant spelling of a family-series nomen based on this spelling is also an ameletograph without independent nomenclatural status, i.e., having the same onomatophore, author and date as the spelling based on the lectoprotograph.

But the situation is different if a conscious choice has been made by an author between symprotographs and has resulted in the valid publication of an EFRA, sometimes long before implementation of Art. 24.2.4.

Such a choice cannot be considered involuntary or inconscious, and cannot be ignored, even if today this choice is not supported by the 1999 *Code*. It is in fact exactly similar to the case where an author introduced, for some reason, a modified spelling for an existing nomen, even if nowadays this spelling change is considered invalid: as this was an intentional act, this is now considered nomenclaturally as the creation of a new nomen, objective junior synonym of the replaced nomen, with its own author and date, i.e., an autoneonym. Simple consistency requires to give the same status to spellings chosen before 1999 as valid through First-Reviser actions following Art. 24.2.3 of the 1999 *Code*. Such nomina can be known as *lectautoneonyms* (see Appendix 1). A lectautoneonym should be considered a new nomen, with its own author and date (those of the EFRA), but the same onomatophore as its *lectarchaeonym* (the spelling rejected by this EFRA but re-established as valid after 1999 by the IFRA; see Appendix 1). The strong advantage of this solution is that it allows to recognize a nomenclatural status to a spelling that has been much used in the literature and that may have been, in the case of a generic nomen, the basis for a family-series nomen. On the other hand, and contrary to Art. 33.3.1 discussed above, this status is given to this spelling not by a vague concept of "usage", but an intentional nomenclatural act, a First-Reviser action.

As we will see below, my conclusion of this long discussion will be that Art. 24.2.4 should be either completely suppressed from the *Code*, or at least made only proactive after 1st January 2000, not retroactive before that date. However, in case the ICZN would not follow this suggestion, then at least this article should be followed by a new one giving First-Reviser actions under Art. 24.2.3 before 2000 the status of nomenclatural acts creating new available nomina (lectautoneonyms), just like in the case of autoneonyms ("unjustified emendations").

Examples of symprotographs

The problems raised *ex nihilo* by the new Art. 24.2.4 and its retroactivity can now be illustrated with a few examples. These will be taken from two sources: David *et al.*'s (2009) list of First-Reviser actions in ornithology; and Dubois's (2007*e*) list of supraspecific nomina in Linnaeus (1758*a*).

David *et al.* (2009) identified 76 cases of symprotographs in birds' nomenclature (32 in the genus-series, 44 in the species-series). In 45 of these cases (i.e., 59.2 % of the total, including 22, i.e., 68.8 %, in the genus-series, and 23, i.e. 52.3 %, in the species-series), they found that the new Article 24.2.4 of the *Code* results in identifying an IFRA, which is a new nomenclatural act as compared to the situation under the third edition of the *Code*. We will now explore the question: does this entail changes in the spellings traditionally used for these nomina? Another aspect of this question, that David *et al.* (2009) did not explore, is the impact of these changes on family-series nomina. They wrote: "*We have deliberately not examined family group names but we are aware that retroactive application might lead to a corrected spelling for the family of birds of paradise*". We will also consider this point.

This question can be further explored here with the case of all the symprotographs created by Linnaeus (1758*a*) in the tenth edition of the *Systema Naturae* which was arbitrarily fixed as the starting landmark for zoological nomenclature. Among the 312 generic nomina used by Linnaeus in this book, seven[9] (i.e., 2.2 %) had symprotographs, including 2 already studied by David *et al.* (2009) in birds; as will be shown below,

9. Dubois (2007*e*: 91) also mentioned the existence of two symprotographs for the genus *Trichechus* Linnaeus, 1758*a*: *Trichecus* (p. 18) and *Trichechus* (p. 34). This was a mistake, due the fact that I had used, for the preparation of this work, the 1894 reprint by Engelmann of the 1758 edition of the *Systema Naturae*. This reprint is apparently identical to the original edition, *except for* this mistake in page 18: whereas in the original 1758*a* edition this nomen appears there as *Trichechus*, in the 1894 edition it appears as *Trichecus*. Therefore this nomen was created in 1758 with a single original spelling, *Trichechus*, and *Trichecus* is a subsequent ameletonym of the latter (already used before 1894, e.g., by Oken 1816 or Cuvier 1829). Another special case is that of the genus created by Linnaeus (1758*a*) under the two symprotographs *Columbus* (p. 84) and *Colymbus* (p. 135). As this nomen was later invalidated by the ICZN (Hemming 1956*a*-*b*), it is not further discussed here.

Linnaeus (1758*a*) himself provided an EIFRA for 4 of them; so we are left with only 1 additional nomen. Among the 45 class-series nomina used in this book, 3 (i.e., 6.7 %) had symprotographs.

So altogether the analysis below deals with 49 nomina, including 3 of the class-series, 23 of the genus-series and 23 of the species-series. Although this sample is limited, it will allow a rough evaluation of the importance of nomenclatural changes in spelling entailed by the new Art 24.2.4.

Let us consider successively the cases belonging in the class-series of nomina, then in the species-series and finally in the genus-series (with consequences in the family-series).

Symprotographs in the class-series of nomina

Linnaeus (1758*a*) introduced symprotographs for three of the 34 nomina of orders he used for suprageneric taxa: [C1] **BELLUAE** (p. 16, 19) and **BELLUA** (p. 73–74); [C2] **REPTILES** (p. 194, 196–197) and **REPTILIA** (p. 197–213); [C3] **HŒMIPTERA** (p. 341) and **HEMIPTERA** (p. 343, 434–457).

Nomina of orders are not currently submitted formally to the Rules of the *Code* and the only available guidelines in this respect are the proposed Rule R22 of Dubois (2006*a*), which introduced the recourse to a First-Reviser action in such a case. Let us examine the consequences that would result from implementation of Art. 24.2.4 to class-series nomina in the *Code*, in the perspective that, unavoidably, one day or another, the ICZN will be bound to incorporate class-series nomina into the *Code* (Dubois 2005*b–d*, 2006*a–b*, 2009*b*).

In a well-known book, Linnaeus (1761) used only one spelling for each of these three nomina: [C1] **BELLUAE** (p. xxiii, 15), [C2] **REPTILIA** (p. [xxvi], 101–103) and [C3] **HEMIPTERA** (p. xxxiii, 239–267). These spellings happen to be those adopted by most subsequent authors and therefore would appear to be the lectoprotographs following Linnaeus' (1761) First-Reviser action. However, this action was preceded by two earlier ones, in two books of Linnaeus that have been much less often quoted.

The tenth edition of the *Systema Naturae* of Linnaeus (1758*a*) has been arbitrarily chosen as the starting point of scientific zoological nomenclature, and the *Code* states that this book is "*deemed to have been published on 1 January 1758*" and that "*names in any other work published in 1758 are deemed to have been published after the 10th Edition of* Systema Naturae" (Art. 3). As a matter of fact, another book of Linnaeus was published in 1758, the *Opera Varia*. As it does not use binominal nomenclature, class-series nomina published in this book, although not generic and specific nomina, are nomenclaturally available[10]. In this work, Linnaeus (1758*b*: 289) did not use the nomen [C1] **BELLUAE**, as he placed the genera *Equus* and

10. This book (Linnaeus 1758*b*) is a reprint with slight alterations of several earlier books of Linnaeus, including the French fourth edition of the *Systema Naturae* (Linnaeus 1744), but without the French vernacular names that it contained, thus constituting a new text. This version of the *Systema Naturae*, originally much anterior to the tenth edition of 1758, includes many less taxa and does not use binominal nomenclature for species. Its nomenclatural availability is open to question but this book has never been invalidated for zoological nomina by the ICZN for not being binominal. The nomenclatural status of nomina in this book was discussed by botanists, although not by zoologists to the best of my knowledge. Barneby (1965: 163) wrote: "*The adoption by means of a pirated edition of an opinion which Linnaeus had roundly and repeatedly rejected in his mature judgment cannot be tolerated; or if tolerated it cannot be attributed to Linnaeus*". However, Dandy (1967: 15) rightly commented: "*Despite sympathy with this view, the work is here treated as admissible as a source of generic names, there being nothing in the* International Code *[*of Botanical Nomenclature*] to exclude it; and as for the authorship of the names, it was in fact Linnaeus who in the original work recognized the genera even though he had ceased to uphold them by 1758, so that there is no real error in attributing them to him*". The same position is taken here regarding the class-series zoological nomina in this book, which are treated here as available. Actually, the *Code* only deals with availability of nomina according to the date of their *publication*, not of their *conception*. The situation is not rare in which the order of publication of two works, e.g., two papers, by the same author or by different authors, has been reversed with respect to their date of writing or submission. This sometimes raises nomenclatural problems, as exemplified by the funny case of *Rana wageri* Wager, 1961 discussed by Poynton (1964). In the present case, the *Opera Varia* can be considered a source for nomina of classes and orders in zoology, but not of genera and species. Article 11.4 of the *Code* allows to reject the latter as non-available in this book, but not its class-series nomina, as it states expressly: "*this Article does not apply to the availability of names of taxa at ranks above the family group*".

Hippopotamus (its conucleogenera in Linnaeus 1758*a*; see Dubois 2006*a*), as well as three other genera, in an order **JUMENTA**. For the two other nomina here concerned however, he was the author of the valid First-Reviser action, as he used only the spellings [C2] **REPTILIA** (Linnaeus 1758*b*: 312) and [C3] **HEMIPTERA** (Linnaeus 1758*b*: 343). Fortunately, these choices correspond to the traditional spellings used for these nomina.

Another rarely quoted book, also anterior to the 1761 edition of the *Fauna Suecica*, is the *Animalium Specierum* of Linnaeus (1759). It is in the same situation as the previous one: not using consistently a binominal nomenclature for species, it is not available for genus-series and species-series nomina, but it is available for class-series nomina. In this book, Linnaeus (1759) mentioned the three class-series here at stake. For the first one [C1], he used only the spelling **BELLUA** (Linnaeus 1759: 9–10, 25): this choice being anterior to that of **BELLUAE** in Linnaeus (1761), it is the valid IIFRA. For the second nomen [C2], he still used both spellings **REPTILES** (Linnaeus 1759: 69–70) and **REPTILIA** (Linnaeus 1759: 71–75), but, as we have seen, in this case the valid IIFRA rests with Linnaeus (1758*b*). For the third nomen [C3], he used only the spelling **HEMIPTERA** (Linnaeus 1759: 109–110, 140–148), but, here also, the valid IIFRA was by Linnaeus (1758*b*).

Finally, in the twelth edition of the *Systema Naturae*, Linnaeus (1766, 1767) used the spellings [C1] **BELLUAE** (1766: 24–25, 27, 100–104), [C2] **REPTILES** (1766: 347, 349–350) and **REPTILIA** (1766: 350–371) and [C3] **HEMIPTERA** (1767: 536, 538, 687–743), but these two books, being posterior the valid First-Reviser actions above, have no bearing on the lectoprotographs of these nomina.

In conclusion, the lectoprotographs of these three class-series nomina are as follows: [C1] **BELLUA**, by IFRA of Linnaeus (1759: 9); [C2] **REPTILIA**, by IFRA of Linnaeus (1758*b*: 312); and [C3] **HEMIPTERA**, by IFRA of Linnaeus (1758*b*: 343). The spelling retained for the first of these three nomina is different from that which was used for a while for this taxon, before being abandoned.

This detailed analysis clearly shows that the search for an IFRA under Art. 24.2.4 is not necessarily quicker and more straightforward than under Art. 24.2.3—much to the contrary in some cases.

In the class-series, First-Reviser actions among symprotographs do not have binding consequences on the stability of spellings, as the nomenclature of these nomina is currently not regulated by the *Code*: authors are free to use the most common spelling or even the one that they "prefer". In the set of Rules proposed by Dubois (2006*a*) however, Rule R22 is more constraining. Here is a slight rewording of this Rule using the terms introduced in this paper and mentioning the case of symprotographs: "*The correct spelling (eugraph) of a class-series nomen is the spelling used* universally *by all taxonomists after 31 December 1899. If several spellings have been used by taxonomists after that date, the following order of precedence must be used for fixation of the eugraph: first, the protograph or the lectoprotograph, if it was one of the spellings used after that date; then, the senior apograph, if used after that date; then, if several apographs were created together and used after that date, that chosen by the First-Reviser.*"

Symprotographs in the species-series of nomina

Compared to the checklist of bird species of Dickinson (2003), the 23 cases of IFRA identified by David *et al.* (2009) result in spelling changes for 6 specific nomina: [S1] *Megapodius forsteni* instead of *forstenii*; [S2] *Ortalis mccalli* instead of *mccallii*; [S3] *Xiphorhynchus pucheranii* instead of *pucherani*; [S4] *Galerida randonii* instead of *randoni*; [S5] *Tetraogallus himalayensis sauricus* instead of *saurensis*; and [S6] *Vireo swainsoni* instead of *swainsonii*.

These 6 changes however are not due to a shift from a previous EFRA to an IFRA. Interestingly, according to the data of David *et al.* (2009), among the 23 cases of IFRA that they identified, only 5 had been the matter of a previous EFRA. This figure might be slightly underevaluated, because the list of FR actions of David *et al.* (2009) is probably incomplete, as they deliberately excluded from their survey the FR actions in publications like the *Zoological Record* or Neave's *Nomenclator Zoologicus* (see Dubois 2009*a*). Be it as it may, in the 18 other cases, all previous authors had apparently not realized that the nomen had been created with two symprotographs, and the traditional use of one of them was only a matter of "usage", not having ever been validated by an EFRA as required by the *Code*.

Of the six nomina listed above, only two had been the matter of an EFRA before Dickinson et al. (2009): [S3] and [S5]. Let us consider first these two nomina. In both cases, it happens that the IFRA made a different choice, which results in two changes in traditional spelling. If the suggestions made above concerning First-Reviser actions under Art. 24.2.3 published before 2000 are implemented here, this therefore results in the recognition of two lectautoneonyms.

[S3] *Xiphorhynchus pucheranii* Lafresnaye *in* Des Murs, 1849.—David *et al.* (2009: 7) discovered that, under Art. 24.2.4, Lafresnaye (1850: 379) had acted as FR and chosen the spelling *pucheranii* as correct. However, Peters (1951: 54) later cited both symprotographs and chose the spelling *pucherani* as valid. He thus created a lectautoneonym *Xiphorhynchus pucherani* Peters, 1951 which is an invalid junior objective synonym of the now valid nomen.

[S5] *Tetraogallus himalayensis saurensis* Potapov, 1993.—This case is a strange but enlightening one. Potapov (1993) used two symprotographs for this subspecies: *sauricus* (p. 3) and *saurensis* (p. 4–5). Dickinson (2003: 48) mentioned both spellings. In the text, he listed the subspecies as "*T. h. saurensis* Potapov, 1993". After the subspecific nomen, he added a footnote which reads: "*In the text of the paper, but not in the description, called* sauricus". In the *Index of scientific names* at the end of his book (Dickinson 2003: 993), the spelling *saurensis* only appears, and *sauricus* is not mentioned. Thus, Dickinson (2003) clearly selected one of the two spellings, *saurensis*, as the correct one for the taxon. This fully applies to the definition of an explicit First-Reviser action as defined in Art. 24.2.3 of the *Code*: "*If a name is spelled in more than one way in the original work, the first author to have cited them together and to have selected one spelling as correct is the First Reviser*". Potapov (2007: 654) subsequently explicitly stated he was acting as FR and selected *sauricus*, but, and despite the fact that he was the original author of the nomen, his action is invalid for being subsequent to that of Dickinson (2003). David *et al.* (2009: 8) stated that Potapov's action was valid and wrote, about Dickinson's action: "*E. D. Dickinson here confirms that his use of* 'saurensis' *should not be construed as an intentional FR act and that it was he who suggested to R. L. Potapov to take formal action as FR. Potapov's action under 24.2.4 should be recognised as the valid action by an FR.*" This interpretation cannot be supported. In order to function as a universal and automatic system of references (Dubois 2005*c*), the nomenclatural Rules must rely on facts, not on interpretations, and the facts of nomenclature are the statements that appear in the original publications, not in subsequent ones. If an author has made a mistake when creating a nomen, he/she cannot repair it later on, the nomen remains available as it was published. *A posteriori* statements about the *intentions* one author had when he/she published a work are of no relevance in zoological nomenclature. How could we ask the authors of the past what were their "intentions"? We have to rely on texts as they were published, not on what the authors had in mind, or can be supposed to have had in mind, when they wrote them. Dickinson's (2003) action may not have being "intentional", it is fully *explicit* and fully qualifies as an EFRA, it does not have to be "construed" as such. Thus, in this case, the correct nomen of this subspecies is *saurensis*, resulting from the choice of Dickinson (2003). As for *sauricus*, for the reasons explained above, it is a distinct available nomen, a lectautoneonym of *saurensis*. Its author is Potapov (2007) and it is an invalid junior objective synonym of *saurensis* Potapov, 1993. In conclusion, in this case, there is no change in the "traditional" spelling of the nomen, although this "tradition" only dates from Dickinson (2003).

Let us now turn to the four other nomina for which the IFRA resulted in a spelling different from the traditional one, as recorded in Dickinson (2003): [S1] *Megapodius forsteni* instead of *forstenii*; [S2] *Ortalis mccalli* instead of *mccallii*; [S4] *Galerida randonii* instead of *randoni*; and [S6] *Vireo swainsoni* instead of *swainsonii*. Strictly speaking, these cases do not result from substituting an IFRA to an EFRA that had made another choice, so one could consider that no nomenclatural disturbance occurs. However, should a work similar to that of David *et al.* (2009) have been carried before implementation of Art. 24.2.4, what would the authors have done? When discovering that a nomen had initially been created under two symprotographs, they would have been bound to publish a FRA to select the correct one. It is likely that, in many cases, they would have cared for introducing the least possible disturbance in the traditional usage: so it is likely that these authors would have selected, through an EFRA, the spelling most used in the past for the taxon. This is no more possible nowadays for these four nomina, because of the unexpected existence of internal First-Reviser actions.

To sum up, over 23 cases of IFRA in birds' species nomenclature, 5 (i.e., 21.7 %) result in a change in the traditional spelling of the nomen, in one case after an EFRA, and in four cases without any EFRA having ever been taken.

Let us note that in none of these six cases, David *et al.* (2009) discussed the potential relevance of Art. 33.3.1 of the current *Code* (at least in its spirit), or the possibility to submit some cases to the ICZN for the "conservation" of some well-known spellings under the Plenary-Powers. They simply considered all the newly discovered lectoprotographs as the eugraphs of the nomina. Perhaps however some of these cases might deserve an action, if a real nomenclatural disturbance was at stake. This matter should be left in the hands of authors well acquainted with the taxonomic ornithological literature, which is not my case.

Symprotographs in the genus-series of nomina, and implications for family-series nomina

Compared to the checklist of Dickinson (2003), the 22 cases of IFRA identified by David *et al.* (2009) result in spelling changes for 4 generic nomina: [G1] *Chelidorhynx* instead of *Chelidorynx*; [G2] *Guaruba* instead of *Guarouba*; [G3] *Paradisea* instead of *Paradisaea*; [G4] *Telespiza* instead of *Telespyza*. These four cases will be discussed below.

Dubois (2009*a*) identified five additional explicit First-Reviser actions among these 22 nomina, which were not recognized as such by David *et al.* (2009). Three of them deal with nomina not listed above: [G5] *Haematortyx* and *Hematortyx*; [G6] *Thryothorus* and *Thirothorus*; [G7] *Xiphorhamphus* and *Xiphoramphus*. These nomina will also be discussed below.

Finally, among the 22 nomina at stake, eight have been used as the basis of family-series nomina according to Bock (1994). Six of these are not listed above. As the spelling of genus-series nomina has an impact on that of family-series nomina, these 6 nomina will also be briefly examined below: [G8] *Asturina* and *Asturia*; [G9] *Dromiceius* and *Dromaius*; [G10] *Endyptes* and *Eudyptes*; [G11] *Pyrenestes* and *Pirenestes*; [G12] *Rhyncops* and *Rynchops*; [G13] *Thamnophilus* and *Tamnophilus.*

Let us come now to the work of Linnaeus (1758*a*). This book introduced symprotographs for seven (2.2 %) of the 312 class-series nomina used for suprageneric taxa[11]. Two of these, which apply to birds, were already listed above as [G3] *Paradisea* and [G12] *Rynchops*. The other five are: [G14] *Tetrodon* (p. 243) and *Tetraodon* (p. 332–334); [G15] *Coecilia* (p. 196) and *Caecilia* (p. 229); [G16] *Libella* (p. 343) and *Libellula* (p. 543–546); [G17] *Mutella* (p. 343) and *Mutilla* (p. 582–583); [G18] *Myes* (p. 645, 671) and *Mya* (p. 670). For these 5 nomina, the question is now to trace the First-Reviser action that is valid under the current *Code*, which in some cases may prove different from that resulting from the preceding editions of the *Code.*

Linnaeus (1758*a*: 824) himself published four First-Reviser actions regarding these situations in the *Emendanda* at the end of his volume, and he chose the following lectoprotographs, which have since been used as eugraphs for the corresponding nomina: [G15] *Caecilia*; [G16] *Libellula*; [G17] *Mutilla*; [G18] *Mya*. We are left with a single additional nomen, [G14], that will also be studied in detail below.

Before starting the analysis of these 14 nomina, let us remind some general questions regarding family-series nomenclature. Family-series nomina are built by adding an ending indicating nominative plural to the stem of available generic nomina. Whenever a generic nomen exists in the literature under several spellings, some of which have different stems, this may result in the coining of different family-series nomina. If the two distinct spellings of the genus nomen are in fact distinct nomina, with different authors and dates (e.g., an archaeonym and its autoneonym), the family-series nomina based on them are also distinct nomina, with different authors, dates and onomatophores ("type genera" or *nucleogenera*; see Dubois 2005*d*, 2006*a*). But if the different spellings of the generic nomen are only "avatars" of a same nomen (e.g., a protograph and its apographs), the different spellings of the family-series nomen are also to be considered as different "avatars" of the same nomen. Whenever two distinct spellings have been used over a long period (decades or centuries) for the generic nomen, and also for the family-series nomen, such a distinction is very awkward to use, especially in view of the difficulties, analysed above, in distinguishing sometimes between different kinds of

11. See footnote 9 (p. 19) for the case of the nomen *Columbus*/*Colymbus.*

"subsequent spellings" of nomina. In all similar cases, it is much clearer and easier in use to consider the two generic spellings, created in different publications, as two distinct nomina, the most recent one being treated as an autoneonym of the oldest one, which results also in recognizing two distinct family-series nomina. This was the solution I adopted in the family-series nomenclature of the anuran amphibians (Dubois 1984, 1987*c*).

In the case of generic symprotographs, however, strictly following the *Code* it is impossible to consider the leipoprotograph as an autoneonym of the lectoprotograph. As long as no choice has been published among two or more symprotographs, they remain available together, but as soon as a lectoprotograph has been validly published, this action removes independent nomenclatural existence to the leipoprotograph(s). Art. 24.2.3 of the *Code* states incorrectly that they are "unavailable", but availability applies to nomina, not to spellings or parographs. A correct statement would be to write that they have no independent nomenclatural status, i.e., no distinct author and date, and that they cannot be the correct spellings of the nomen—except in the rare case where the lectoprotograph is shown to be an incorrect original spelling, being based on an "*inadvertent error, such as a lapsus calami or a copyist's or printer's error*" (Art. 32.5.1). In fact, their status is similar to that of "incorrect subsequent spellings" of "normal" generic nomina. The lectoprotograph being the correct original spelling of the nomen, according to Art. 35 (discussed at length above) it must be used as the stem of any family-series nomen based on this generic nomen. If the first such nomen coined was based on (one of) its leipoprotographs, it must be corrected.

Then, what happens in the case where implementation of the new Art. 24.2.4 results in a change of the lectoprotograph? According to Art. 35, this immediately implies a change in the correct family-series nomen's spelling as well. But this has another consequence: that of creating an incorrect family-series nomen based on the leipoprotograph of the generic nomen. This new Rule may then entail a change in the generic and family-series nomina of long known taxa. In fact, the situation is different according to whether the leipoprotograph resulting from the IFRA has, or not, obtained subsequently a nomenclatural status through an EFRA that made the opposite choice. In such a case, as argued above, it is justified to consider that the spelling of the leipoprotograph has become the basis for a lectautoneonym of the lectarchaeonym, both nomina having then an independent nomenclatural status. Then, two distinct family-series nomina exist, with different authors and dates, although they are objective synonyms.

These general statements will be made clearer by the study of the examples mentioned above. As we will see below, all these distinctions are not useless "trifling", because they have consequences in genus-series and family-series nomenclature.

Let us now consider successively the 14 generic nomina listed above.

[G1] *Chelidorhynx* Blyth, 1843.—This case is straightforward. No previous EFRA was identified by David *et al.* (2009) for this nomen, but Dickinson (2003: 493) used the spelling *Chelidorynx*. So this case is similar to those discussed above in the genus series as [S1], [S2], [S4] and [S6], except that here, this generic nomen not being in use nowadays, and not being the basis for a family-series nomen, the nomenclatural disturbance is virtually non-existent.

[G2] *Guaruba* Lesson, 1830.—David *et al.* (2009: 4) stated that, under Art. 24.2.4, Lesson (1831: 654) acted as FR and chose the spelling *Guaruba*. However, Neave (1939: 523) had clearly chosen *Guarouba* against *Guaruba* as correct, as he wrote: "*Guarouba* Lesson 1830, Traité Ornith., (3) 210 (as *Guaruba* p. 211).—Aves", and "*Guaruba* see *Guarouba*". Whether this writing amounts to a valid EFRA is controversial (David *et al.* 2009: 2; Dubois 2009*a*), but if this is accepted, then *Guarouba* Neave, 1939 is a lectautoneonym of *Guaruba* Lesson, 1830 and its invalid junior objective synonym. Dickinson (2003: 196, footnote 4) had explicitly made the same choice as Neave (1939). So, if the action of the latter is refused the status of EFRA, Dickinson (2003) is the author of the lectautoneonym. Neither *Guarouba* nor *Guaruba* were ever used as stems for family-series nomina (Bock 1994).

[G3] *Paradisea* Linnaeus 1758*a*.—Sherborn (1902: 717), followed by Neave (1940*a*: 565), incorrectly credited the *creation* of the spelling *Paradisea* to Linnaeus (1766: 166), but, as stated by David *et al.* (2009: 4), both spellings appeared in Linnaeus (1758*a*). Although he considered that "*it is a moot question which may be correct*" (Iredale 1950: 13), Iredale (1948), as he had mentioned expressly both spellings and used consistently *Paradisea* as correct, had made a valid EFRA under the 1985 *Code*. But, strangely, this FRA was

ignored by all subsequent authors. The spelling *Paradisaea* was "*used consistently by ornithologists for many decades*" (Bock 1994: 221), from Linnaean times (e.g., Batsch, 1788: 316) until nowadays (e.g., Mayr 1962; Bock 1963, 1994; Gilliard 1969; Forshaw & Cooper 1977; Sibley & Ahlquist 1990; Frith & Beehler 1998) and still by Dickinson (2003) several years after publication of the 1999 *Code*. However, no EFRA choosing the spelling *Paradisaea* as "correct" is known to have been published prior to Iredale (1948), so this spelling remains an ameletograph of *Paradisea*, devoid of nomenclatural status. Following the 1999 *Code*, David *et al.* (2009: 4) pointed to the IFRA by Linnaeus (1766: 117, 166–167), who made the same choice as Iredale (1948), *Paradisea*. So in this case the IFRA simply replaces the EFRA, but there is no spelling change.

Although they briefly mentioned it (see citation above), David *et al.* (2009) did not address the problem of the eugraph of the family-series nomen based on this generic nomen. As we have seen, the spelling *Paradisaea* has no independent nomenclatural status and, strictly following the *Code*, should be considered a simple ameletograph of *Paradisea*. It was the basis for the first family-series nomen based on this generic nomen, created as *PARADISEI* by Vieillot (1816: 35)[12], and which appeared in the 19th century literature under various paronyms: *PARADISEI* (e.g., Vieillot & Oudart 1825), *PARADISEANA* (e.g., Vigors 1825*b*), *PARADISEAE* (e.g., Sundevall 1836)[13], *PARADISEIDAE* (e.g., Cabanis 1847; Gray 1849; Elliot 1873) and *PARADISEINAE* (e.g., Cabanis 1847; Gray 1849; Elliot 1873). However, in all recent publications this nomen was considered valid at familial level as *PARADISAEIDAE* (e.g., Dickinson 2003: 515), sometimes also at subfamilial level, as *PARADISAEINAE* (e.g., Bock 1963, 1994; Forshaw & Cooper 1977; Frith & Beehler 1998), or at tribal level, as *PARADISAEINI* (e.g., Sibley & Ahlquist 1990: 262). The spelling *Paradisaea* being just an ameletograph, as discussed above, these spellings are just to be considered as ameletographs of the spellings based on *Paradisea*. According to this, the family should now be known as of *PARADISEIDAE* Vieillot, 1816.

An interesting aspect of this case is that the required change in the genus and family nomina, although discovered on the occasion of a survey of First-Reviser actions in bird nomina prompted by the implementation of Art. 24.2.4, was not caused by this article, as a valid EFRA had already made the same choice, but had been ignored. This results in "resurrecting", both at generic and at family-series level, spellings that have not been used as valid since the middle of the 20th century. This is in strong contrast with the "spirit", at least, of Art. 33.3.1, as discussed in detail above. It seems that in this case concern for "nomenclatural stability" might require to apply to the ICZN for the conservation of the spellings *Paradisaea* and *PARADISAEIDAE*, although the possibility of this course was not mentioned by David *et al.* (2009).

[G4] *Telespiza* Wilson, 1890.—This case is rather similar to that of *Chelidorhynx*. No previous EFRA was identified by David *et al.* (2009) for this nomen, but Dickinson (2003: 493), without mentioning *Telespiza*, used the spelling *Telespyza*. However, Neave (1940*b*: 415) had clearly chosen *Telespyza* against *Telespiza* as correct, as he wrote: "*Telespiza see Telespyza*", and "*Telespyza* Wilson 1890, Ibis, (6), 2, 341 (as *Telespiza* pl. 9).—Aves". Whether this writing amounts to a valid EFRA is controversial (David *et al.* 2009: 2; Dubois 2009*a*), but if this is accepted, then *Telespyza* Neave, 1940*b* is a lectautoneonym of *Telespiza* Wilson, 1890 and its invalid junior objective synonym. Neither *Telespiza* nor *Telespyza* were ever used as stems for family-series nomina (Bock 1994).

[G5] *Haematortyx* Sharpe, 1879.—Dubois (2009*a*) pointed to an EFRA by Neave (1939: 545, 600), who had chosen *Hematortyx*. This EFRA was not recognized as such by David *et al.* (2009). The discovery by the latter of an IFRA choosing *Haematortyx* results in no change in the tradition however, as Dickinson (2003: 56) also used this spelling. This nomen was never used as stem for a family-series nomen (Bock 1994).

12. Bock (1994: 263) stated that "*Family names used in this work are not based on the name of a type genus.*" This is incorrect. Above the rank genus, Vieillot's (1816) classification used the ranks "ordre" (order), "tribu" (tribe) and "famille" (family). The nomina he provided for orders and tribes were not based on generic nomina, but for families he used a heterogeneous system, some nomina being based on generic nomina, whereas others were not. There is nothing in the *Code* which prevents nomenclatural availability of the former. The second ones, termed *arhizonyms* by Dubois (2006*a*), are unavailable family-series nomina. The nomen *PARADISEI* was coined for a family including, among others, the genus *Paradisea* ("Samalie" in French) and is clearly an available family nomen.

13. Vigors' (1825*a*) use of the spelling *Paradiseae* does not qualify as a paronym of this nomen, as it is clearly a generic nomen in the plural (just like *Pari*, as plural of *Parus*), not a family-series nomen. Shortly later however, Vigors (1825*b*) formally recognized the *PARADISEANA* as a subfamily of the *CORVIDAE*.

[G6] *Thryothorus* Vieillot, 1816.—David *et al.* (2009: 5) stated that this nomen had been published by Vieillot (1816) under two symprotographs, *Thriothorus* (p. 45) and *Thryothorus* (p. 70). In fact, the spelling that appears in p. 45 is *Thirothorus*, which was apparently ignored by all authors until now, including Neave (1940*b*). It was clearly a misprint, as the French equivalent "Thriothore" was mentioned, but this is the real symprotograph. As remarked by Dubois (2009*a*), Neave (1940*b*: 480, 482) mentioned both spelling *Thriothorus* and *Thryothorus*, and clearly chose the former as the correct one, but this cannot be an EFRA as this spelling was not part of the original symprotographs. David *et al.* (2009) pointed to an IFRA choosing *Thryothorus*, which is valid as it is indeed one of the two symprotographs. It results in no change in the tradition (Dickinson 2003: 636). Bock (1994: 152) listed the nomen *THRYOTHORIDAE* des Murs, 1860 in the synonymy of *TROGLODYTIDAE* Swainson *in* Swainson & Richardson, 1832. However, as noted by Bock (1994: 207), this nomen had been created by des Murs (1860) under the spelling *TRYOTHORINAE*, based on *Tryothorus*, an ameletograph (incorrect subsequent spelling) of *Thryothorus*. An ameletograph having no independent nomenclatural status, the nomen must be treated as based on the lectoprotograph *Thryothorus*. The actual first-user of the spelling *THRYOTHORINAE* was Jerdon (1862: 486).

[G7] *Xiphorhamphus* Blyth, 1843.—Dubois (2009*a*) pointed to an EFRA by Neave (1940*b*: 677), who had chosen *Xiphoramphus*. This EFRA was not recognized as such by David *et al.* (2009). The discovery by the latter of an IFRA choosing *Xiphorhamphus* has no nomenclatural consequence however, as this nomen is an invalid neonym of *Xiphirhynchus* Blyth, 1842 (David *et al.* 2009: 5) that was never used as stem for a family-series nomen (Bock 1994).

[G8] *Asturina* Vieillot, 1816.—No EFRA between this lectoprotograph and its leipoprotograph *Asturia* is known to have been published before David *et al.*'s (2009) discovery of the IFRA. The lectoprotograph of this nomen under Art. 24.2.4 corresponds to the traditional use (Dickinson 2003: 110). Interestingly, this nomen had long ago been placed on the *Official List of Generic Names in Zoology* by the ICZN under the spelling *Asturina*, without any mention of the spelling *Asturia* (Anonymous 1916). According to Bock (1994: 132), this nomen was used as stem for the family-series nomen *ASTURININAE* Bonaparte, 1854*b*, now an invalid junior synonym of *ACCIPITRINAE* Vigors, 1824.

[G9] *Dromaius* Vieillot, 1816.—The IFRA between this lectoprotograph and its leipoprotograph *Dromiceius* discovered by David *et al.* (2009) results in the same choice as the subsequent EFRA by Gray (1840: 63). This is also the spelling in traditional use (Dickinson 2003: 35). According to Bock (1994: 130), *Dromaius* was used as stem for the family nomen *DROMAIIDAE* Huxley, 1868, and *Dromiceius* as stem for *DROMICEIIDAE* Richmond, 1908. The latter being based on a leipoprotograph is devoid of independent nomenclatural status and must be treated as an apograph of *DROMAIIDAE*. The family is traditionally recognized under this nomen (Dickinson 2003: 35).

[G10] *Eudyptes* Vieillot, 1816.—The IFRA between this lectoprotograph and its leipoprotograph *Endyptes* discovered by David *et al.* (2009) results in no change compared to the tradition (Dickinson 2003: 71). According to Bock (1994: 130), the lectoprotograph of this nomen under Art. 24.2.4 was used as stem for the family-series nomen *EUDYPTIDAE* des Murs, 1860, now an invalid junior synonym of *SPHENISCIDAE* Bonaparte, 1831.

[G11] *Pyrenestes* Swainson, 1837.—The IFRA between this lectoprotograph and its leipoprotograph *Pirenestes* discovered by David *et al.* (2009) results in no change compared to the tradition (Dickinson 2003: 728). According to Bock (1994: 156), *Pyrenestes* was used as stem for the family-series nomen *PYRENESTINAE* Bonaparte, 1854*a*, now an invalid junior synonym of *ESTRILDINAE* Bonaparte, 1850.

[G12] *Rynchops* Linnaeus 1758*a*.—In the past, both symprotographs *Rynchops* and *Rhyncops* have been considered as the correct spelling for the nomen: *Rynchops* as from Linnaeus (1767: [iv] after 1327), and *Rhyncops* as from Scopoli (1777: 473). However, in the recent decades *Rynchops* alone seems to have been used (Bock 1994: 138; Dickinson 2003: 153). Neave (1940*b*: 68) had clearly chosen *Rynchops* as correct, as he had written: "*Rhyncops* Linnaeus 1758, Syst. Nat., ed. 10, 84.—Aves. (Cf. *Rynchops* L. 1758)" and "*Rynchops* Linnaeus 1758, Syst. Nat., ed. 10, 138; 1766, ed. 12, 228.—Aves". Such a writing qualifies as a valid EFRA according to Dubois (2009*a*) but not to David *et al.* (2009: 2). Even if this is accepted, this EFRA is nullified under the 1999 *Code* by the IFRA of Linnaeus (1767), who had made the same choice of *Rynchops* (David *et al.* 2009: 5). So this IFRA does not entail change in the spelling recently used for this generic

nomen, and it is devoid of consequence in family-series nomenclature: this genus is usually referred either to a subfamily *RYNCHOPINAE* (Dickinson 2003: 153) or a tribe *RYNCHOPINI* (Bock 1994), a nomen which according to Bock (1994: 138) must be credited to Bonaparte (1838) and which remains the valid one for the taxon. Let us note finally that Linnaeus himself (1759: 256) created a new apograph for the generic nomen, *Rhynchops* (p. 256), the first use of which was erroneously credited by David *et al.* (2009: 5) to Latham (1790: 802) although it had also appeared in Batsch (1788: 366)[14].

[G13] *Thamnophilus* Vieillot, 1816.—The IFRA between this lectoprotograph and its leipoprotograph *Tamnophilus* discovered by David *et al.* (2009) results in no change compared to the tradition (Dickinson 2003: 380). In fact, this nomen had long ago been placed on the *Official List of Generic Names in Zoology* by the ICZN under the spelling *Thamnophilus*, without any mention of the spelling *Tamnophilus* (Anonymous 1916). According to Bock (1994: 130), the lectoprotograph of this nomen under Art. 24.2.4 was used as stem for the family-series nomen *THAMNOPHILIDAE* Swainson, 1824, now considered the valid nomen of a family (Dickinson 2003: 379).

[G14] *Tetrodon* Linnaeus 1758*a*.—In the past, both symprotographs *Tetrodon* and *Tetraodon* have been used in parallel in the literature. The spelling *Tetrodon* is to be found regularly in dozens of publications, at least from Bloch (1785, 1786, 1787), Batsch (1788) or Shaw (1804) to Berg (1940), Willem (1947) or McAllister (1960). The spelling *Tetraodon* appeared also regularly from Forskål (1775), Bonnaterre (1788) or Gmelin (1789) to our days, being the spelling universally adopted as valid by all fish specialists nowadays (e.g., Le Danois 1961; Dekkers 1975; Tyler 1980; Arai 1983; Roberts 1986, 1998; Kottelat 1989, 2001; Lévêque *et al*., 1989; Allen 1991; Randall & Lim 2000; Sepkoski 2002; Hoese *et al.* 2006; Nelson 2006). Which spelling is the correct one for this nomen according to the *Code*?

Many authors shifted from *Tetrodon* to *Tetraodon* as a result of Briggs's (1961) statement that Linnaeus (1758*a*) had created the nomen under the sole spelling *Tetraodon* and that "*an alternative spelling (*Tetrodon*) was introduced at an early date by Linnaeus himself in the twelfth edition of his famous work (1766: 410)*" (Briggs 1961: 164). This is wrong, because the spelling *Tetrodon* also appeared in Linnaeus (1758*a*: 243). This faulty interpretation had already been given earlier (Agassiz 1846: 64; Sherborn 1902: 971; Neave 1940*b*: 440, 444; Fraser-Brunner 1943: 14) and was repeated later (Dekkers 1975: 92; Roberts 1986: 434), and the existence of two symprotographs seems to have escaped the attention of all authors until Dubois (2007*e*). Therefore, no EFRA between them seems to have ever been published. Under the 1985 *Code*, the recent discovery today of the two symprotographs would have caused no problem: a simple EFRA would have allowed to validate *Tetraodon* as the lectoprotograph of this nomen, thus maintaining the general usage since 1961.

Unfortunately, following the new Art. 24.2.4, an IFRA is available. Linnaeus (1766: 349, 410–412) used only the spelling *Tetrodon* and is therefore the author of the valid IFRA. This choice is at variance with the spelling *Tetraodon* used in all the recent literature, which according to the new edition of the *Code* should now be abandoned. In the absence of an EFRA, the latter spelling must be considered an ameletograph, without nomenclatural status. This raises problems not only at generic level, but also at higher nomenclatural levels.

A family nomen *TETRODONTIDAE*, based on *Tetrodon*, has been in use in the literature until the middle of the last century (e.g., Jordan 1885; Berg 1940; Le Danois 1959; McAllister 1960). In parallel, several parographs based on *Tetraodon* have also been in use: *TETRAODONTIDAE* (e.g., Jordan 1907; Fraser-Brunner 1943; Breder & Clark 1947; Le Danois 1961; Duarte-Bello & Buesa 1973; Tyler 1980; Fritzsche & Fuiman 1982; Arai 1983; Roberts 1986; Kottelat 1989, 2001; Lévêque *et al.* 1989; Allen 1991; Randall & Lim 2000; Hoese *et al.* 2006; Nelson 2006), *TETRAODONTINAE* (e.g., Fraser-Brunner 1943; Tyler 1980; Arai 1983; Nelson 2006), *TETRAODONTOIDEA* (Tyler 1980) and *TETRAODONTINI* (Arai 1983). These parographs are currently considered the correct ones for the nomen by all authors.

14. As we have seen, the book of Linnaeus (1759) is not available for the creation of new generic nomina or for nomenclatural acts affecting them, but this book exists and cannot be ignored as the first reference for new apographs of already existing nomina. Such apographs have no independent nomenclatural status, therefore no authors and dates in the sense of the *Code*, only "first-users" (Dubois 2000), and mention of first-users of nomina only have a bibliographical and historical function, not a nomenclatural one.

The two spellings used for this generic nomen have also been used as stems for class-series nomina. *Tetrodon* was the basis for **TETRODONTIFORMES** (Berg 1940; Duarte-Bello & Buesa 1973; Hoese 2006*a*) and **TETRODONTOIDEI** (Berg 1940). *Tetraodon* was the basis for **TETRAODONTIFORMES** (Fraser-Brunner 1943; Dekkers 1975; Tyler 1980; Fritzsche & Fuiman 1982; Arai 1983; Roberts 1986; Randall & Lim 2000; Nelson 2006), **TETRAODONTOIDEA** (Fraser-Brunner 1943; Hoese 2006*b*), **TETRAODONTINES** (Fraser-Brunner 1943), **TETRAODONTOIDEI** (Duarte-Bello & Buesa 1973; Tyler 1980; Fritzsche & Fuiman 1982; Hoese 2006*b*; Nelson 2006), **TETRAODONTOIDEO** (Tyler 1980) and **TETRADONTIFORMES** [*sic*] (Sepkoski 2002). Here also, the spellings based on *Tetraodon* have been much more mentioned, and are the ones in current usage.

A particular situation was created by the recent genome analysis of the species *Tetraodon nigroviridis* Procé, 1822, which documented that whole-genome duplication occurred in the teleost fish lineage, subsequent to its divergence from mammals, and which allowed to infer the basic structure of the ancestral vertebrate genome (Jaillon *et al.* 2004). These spectacular findings resulted in a burst of mentions of this fish in publications in fields quite far from systematics (e.g., Van de Peer 2004; Esnault *et al.* 2005; Christoffels *et al.* 2006; Crollius 2006), and this is undoubtedly only a start. This fish is going to become a classic organism appearing in textbooks, just like *Caenorhabditis elegans*, *Drosophila melanogaster* or *Mus musculus*. Nothing could be more detrimental for the image of zoological nomenclature if suddenly, for a reason completely obscure to everybody (including taxonomists and nomenclature specialists), the nomen of this species and of its genus, family and other higher taxa had to change. To tell the truth, this would really be a stupid consequence of thoughtless and useless changes in the nomenclatural Rules. Of course, it is possible to repair this mistake by asking the ICZN to use its Plenary-Powers to validate the spelling *Tetraodon* and invalidate *Tetrodon*, but how many other similar cases are waiting for us in the unfold pages of the complete catalogue of all zoological nomina? This case was found by chance on the occasion of a very limited survey of 49 nomina, i.e., virtually nothing. It sounds as a bell to warn us that this change in the 1999 *Code* should be fully reconsidered.

Conclusions

To sum up, among the 49 cases of IFRA studied above, in twelve cases (24.5 %), the IFRA under Art. 24.2.4 resulted in a change in the spelling traditionally used for the taxon. The proportion is 21.7 % in the species-series (5 cases over 23), 26.1 % in the genus-series (6 over 23) and 33.3 % in the class-series (1 over 3). Also, as a result of changes in the eugraphs of generic nomina, the spellings of 25.0 % of the family-series nomina studied (2 over 8) have to change.

Thus, very roughly and preliminarily, from this very limited sample of nomina, one gets the impression that introduction of Art. 24.4.4 entails a spelling change for about one quarter of zoological nomina created as two or more symprotographs. Of course, there is no evidence that the same proportion would be found over the numerous other cases of IFRA that still await scrutiny, but this possibility exists.

In three of the twelve cases discussed above, an EFRA, following Art. 24.2.3, had been taken after the IFRA, and results in the creation of lectautoneonyms, which should be considered as nomina having a status in nomenclature, as junior objective synonyms.

Although David *et al.* (2009) did not discuss the potential relevance of Art. 33.3.1 of the current *Code* (at least in its spirit), or the possibility to submit some cases to the ICZN for the "conservation" of some well-known spellings under the Plenary-Powers, to avoid some of these nomenclatural disturbances, probably this should be done in some cases of birds' nomina. At any rate, it is doubtless that this should be done for the fish generic leipoprotograph *Tetraodon*, which should be protected against its lectoprotograph *Tetrodon*.

A dichotomic key to the different kinds of nomina and spellings in zoological nomenclature

Whenever a zootaxonomist uses a nomen in a publication, he/she may use a new nomen or an existing nomen, without changing it or with some modifications, i.e., under one of its spellings. For the sake of clarity, the different kinds of nomina and spellings may be presented in the form of a dichotomic key:

1. The writer uses a new nomen for a taxon that he/she considers new: the nomen, the taxomen and the taxon are new, and must all be credited to the author of the publication. Nowadays, the new nomen is usually presented with an indication ("gen. nov.", "n. sp.", etc.) which makes it clear that a new nomen and taxomen are created, and, according to Art. 16.1 of the last edition of the *Code*, this statement is now compulsory for nomenclatural availability after 1999. In older texts however, indications like "*mihi*" or "*nobis*" were sometimes used, but in many other cases the fact that the nomen and taxomen were created as new in the paper must be inferred from other direct or indirect sources of evidence. Regarding the spelling of the new nomen, two possibilities exist:

1.1. The new nomen appears in the original publication under a single spelling, its *protograph*. Two cases must be distinguished:

1.1.1. The protograph is correctly formed and must therefore keep its original spelling, its "correct original spelling" according to Art. 32.2 of the *Code*, which is therefore the *eugraph* of the nomen.

1.1.2. There exists, in the original publication itself, evidence of an "*inadvertent error, such as a lapsus calami or a copyist's or printer's error*" (Art. 32.5.1) in the spelling of the protograph, which is therefore an "incorrect original spelling" or *nothograph*. In such a case, it is necessary to "correct" the spelling of the nomen. The new spelling, called "justified emendation" in the *Code*, is just an *apograph*, which has no independent nomenclatural status: it is the same nomen, has the same onomatophore, author and date as the protograph and is part of the same taxomen. In this case the eugraph is not the protograph, but one of its apographs.

1.2. The new nomen appears in the original publication under two or more spellings, its "multiple original spellings" or *symprotographs*. The "correct original spelling" or *lectoprotograph* must then be fixed by a First-Reviser action under either Art. 24.2.3 or 24.2.4. The rejected spelling(s) become(s) *leipoprotograph(s)*, i.e., incorrect original spelling(s) of the same nomen without independent nomenclatural status. A special situation exists whenever a First-Reviser action was published before 2000 under Art. 24.2.3, but was nullified after 1999 by an internal First-Reviser action under Art. 24.2.4 which made a different choice: then the first EFRA published before 2000 has created a *lectautoneonym*, which is an available but invalid nomen, being a junior isonym of the lectarcheonym under the 1999 *Code*.

2. The writer deals with a nomen which he/she credits to a previous author, even if he/she modifies in part the intension or extension of the taxon, e.g. by retiring specimens or taxa from it or by adding others. This reference to an already existing nomen is usually explicit, but in some cases must be inferred from the context: for example, in many ancient publications, nomina like *Rana*, *Bufo* or *Hyla* were used without any mention of their authors, but it was however clear that they were not new, homonymous nomina. This is particularly frequent regarding family-series nomina, as the tradition in zootaxonomy is not to mention the authors of these nomina. Therefore, whenever an author mentions a family-series paronym like *RANIDAE*, *RANINI* or *RANINA*, he/she must be considered to have mentioned an aponym of *RANAE* Goldfuss, 1820, and not to have created a new nomen, except when explicit evidence for the contrary is provided (e.g., by a mention like "fam. nov." or "new tribe"). Regarding the spelling of this nomen, two possibilities exist:

2.1. The writer uses exactly the same parograph as the author who had first recognized the taxon and named it. This is just a subsequent citation or use of an already existing nomen, i.e., a *chresonym* of the latter (Smith & Smith 1973, Dubois 2000). In such situations, neither the nomen nor the taxomen are new, even if the taxon or its rank have been emended (e.g., a subgeneric nomen raised to the generic rank).

2.2. The writer uses a spelling slightly or totally different from that of the original nomen. Two possibilities again appear here:

2.2.1. The new spelling differs slightly (e.g., by one letter or a few letters) from the protograph, and this difference in spelling is not intentional from the part of the writer: it may be due to a misspelling on his part (e.g., a mistake in copying the original text) or on the part of the printer (misprint). Such a spelling is an "incorrect subsequent spelling" or *ameletograph*, which has no independent nomenclatural status.

2.2.2. The writer uses intentionally a different spelling or emendation (*meletograph*), or even a brand new different nomen, because he/she thinks, for some reason, that the protonym is incorrect or invalid and must be modified or replaced. Two main categories exist here:

2.2.2.1. The spelling of the protonym was “incorrect” and had to be changed to become *Code*-compliant. Two cases must then be distinguished:

2.2.2.1.1. The spelling of the protonym resulted from an “inadvertent error” (see 1.1.2 above): the new spelling is a “justified emendation” of the same nomen, which has no independent nomenclatural status.

2.2.2.1.2. The spelling of the protonym was “correct” at the original rank and/or combination in which it was originally published, but has to be modified in its ending because of a change in rank and/or combination: the new spelling is a “mandatory change” of the same nomen, which has no independent nomenclatural status.

2.2.2.2. The spelling of the protonym was “correct” under the Rules of the *Code*, and a change in its spelling was not warranted. In this case it is clear that the *taxomen* is not new but that the *nomen* is. This new nomen or *neonym* is called by the *Code* “new replacement name” or “*nomen novum*”. It has an independent nomenclatural status, with its own author and date, but keeps the same onomatophore as the replaced nomen or *archaeonym*, and remains part of the same taxomen. Nowadays, this new nomen is usually first published with the indication “nom. nov.”. In older times however, although it was sometimes presented as a new nomen in an explicit sentence, in many other cases the fact that it was such a nomen must be inferred from other direct or indirect sources of evidence, analysed in detail by Dubois (1987*c*: 35–38). This latter category may again be subdivided into two categories, although, a discussed above, no objective or reliable criteria currently exist to distinguish between them in all cases:

2.2.2.2.1. The new nomen was coined as an intentional *emendation* of the protonym of the original nomen, from which it was “clearly” derived. It is then an “unjustified emendation” or *autoneonym* for the original nomen.

2.2.2.2.2. The new nomen is a “new replacement name” in the narrow sense of the term, i.e., excluding “unjustified emendations”. It was not “clearly”, or not at all, derived from the original nomen. It is then an *alloneonym* for the original nomen, i.e., a completely new nomen. In practice however, as discussed with some examples above and in Dubois (1985, 1987*c*), it is not always easy to establish whether a neonym was derived from the replaced nomen, or not, i.e., whether it is an autoneonym or an alloneonym.

Conclusion: changes should be introduced in the *Code* only with great care

The examples studied in detail above show that the changes introduced in the 1985 edition of the *Code* regarding its Articles 32, 33, 35 and 39, and in the 1999 edition regarding its Article 24, created new nomenclatural problems. First of all, their implementation requires additional work from the part of taxonomists, including additional bibliographical search and detailed analysis of complex cases, which was not required by the previous editions of the *Code*. Zoological nomenclature in the century of extinctions should be a help to taxonomy, not a brake to it. The best way for nomenclature to help taxonomy is to be the most automatic possible, with as few exceptions and “particular cases” as possible, so that any taxonomist in the world can use them without having to make complex surveys like those illustrated in this paper.

Secondly, and more importantly, these changes in the *Code* have a negative impact regarding nomenclatural stability. This might be warranted, if in return these changes had improved the functioning of the *Code* and had resulted in better nomenclatural clarity or stability, but such benefits have yet to be documented.

In fact, it seems that many zootaxonomists have not yet realized that these changes have been brought to the *Code*, so that the real consequences of their potential implementation in the whole of zoological nomenclature have yet to be evaluated. The changes mentioned above in the 1985 *Code* were implemented in some general lists and catalogues dealing with large taxa (e.g., Dubois 1985, 1987*a*,*c*; Bour & Dubois 1986; Bock 1994; Bouchet & Rocroi 2005; Ng *et al.* 2008), but many other important groups still remain to be properly surveyed in this respect. In the groups that have been examined, the only quantitative evaluation of the importance of changes in valid nomina that I am aware of are those provided above for anuran amphibians (10.0 %) and chelonians (22.2 %). Potential similar consequences in other zoological groups are unknown. As for the quantitative evaluation of the nomenclatural consequences of Art. 24.2.4, they do not seem to have

been evaluated elsewhere than in the present paper, where it was shown that, over 49 nomina concerned by this Article, change in the valid nomen was required in 24.5 % of the cases. Are such changes really promoting stability in zoological nomina, as announced in the *Preamble* of the *Code*? Should we continue to implement these Rules over the whole of zoology, or should we stop, or even go back to the preceding situation, that of the 1964 *Code*? Three possibilities seem to be offered: (1) maintain the new Rules as they are; (2) maintain the new Rules but only starting from the date of their publication, without retroactivity; (3) suppress the new Rules and come back to the anterior situation. Although my personal preference would clearly go to the third solution, it is clear that any decision in this respect should rely first on a thorough discussion, not only among the members of the ICZN, but mostly among practising zootaxonomists in various zoological groups.

These examples show that any modification brought to the *Code*, however small in appearance and dealing with only a small detail, may have far-reaching consequences that were clearly not anticipated by the authors of these changes. This is because the *Code* is not a set of isolated and independent Rules that could be added up, a kind of "beanbag nomenclature". The *Code* is a very complex construction, all parts of which are in permanent interaction. Changing but one single "small" Rule may entail a chain of consequences in other Rules and may result in the contrary of what a simplistic thought may have predicted. In fact, in many cases, purely theoretical reflection may be unable to predict these consequences, and only a practical approach of concrete cases, as exemplified above, allows to disclose some unexpected problems. This has always been so. The *Code* was not the result of a purely theoretical approach, but of a "*trial and error process*" in which mistakes or inconveniences of the past were regularly corrected (Dubois 2005*c*: 396). However, it is better to try and anticipate these errors in order to minimize the need of such corrections as well as back and forth changes.

A good way to evaluate the consequences of changes in the *Code* is, so to say, to "experiment" these changes first as simple Recommendations, not Rules. As a matter of fact, many Recommendations of the early editions of the *Code* have subsequently been incorporated into the Rules, when experience had shown that they were beneficial. But of course this is impossible to do for Rules that concern e.g. availability or validity of nomina: a nomen must be available or not, valid or not, it cannot be half-way between two status. Then, the best way to "experiment" the new Rules is to implement them only with a proactive, not retroactive value.

In the future, care should be taken, much more closely than in the past, to carry out a thorough evaluation of the consequences of proposed changes in the *Code*, not only by members of the ICZN, but also by the whole community of zootaxonomists, and in most cases these changes should not be given retroactive value. The best way to do so would be to associate more closely the international community of zootaxonomists to the work of reflection on the Rules and of proposal of possible changes in the *Code*.

This question raises another one, regarding the way changes are implemented in the *Code*. Experience has shown that, in the past, the ICZN has done a number of mistakes, both in changes brought to the *Code*, and in decisions taken regarding some problematic cases of zoological nomenclature. There is nothing surprising or shocking in this: no human individual or group is perfect, everybody can make mistakes, and even a collective body is liable to take wrong decisions. The ICZN has sometimes been able to correct these mistakes, but not always. The problem is not here. It is rather in the fact that nomenclatural Rules have (unavoidably) become so complex that, as stated above, any change in one part of the *Code* may have consequences in another one. In many cases, only a practical experience of the proposed new Rules will allow to test them and to disclose their possibly unexpected consequences. It would be better to carry out such experiences before really implementing the new Rules. Thus for example, if a survey like that of David *et al.* (2009) and an analysis like that provided above had been carried out before implementing the new Art. 24.2.4, probably the ICZN, or some of its members, might have been more reluctant to do so.

In order to limit the number and importance of these problems, the solution might be to associate more closely the community of zootaxonomists to the elaboration of changes in the *Code* and to the final decisions regarding their change. There would be several possibilities allowing to do that, as shown by several examples of other biological nomenclatures which are not directed by a closed self-recruited Commission but democratically by the whole community of taxonomists (this is the case in botany) or by all members of a

society (this is the case for the project of *Phylocode*). This matter will be explored elsewhere, but let us insist here on the fact that important changes in the *Code*, which may have far-reaching consequences, should not be implemented without thorough examination by a high number of practising taxonomists, who should be *involved by vote* in the final decision.

An important problem of this kind is currently in front of the community of zootaxonomists: that of the proposed implementation of a drastic change in the *Code* regarding nomenclatural availability of nomina (Anonymous 2008). Some basic criticisms have already been published concerning these proposals (Dubois 2007*d*, 2008*d*; Michel *et al.* 2009*a-b*; Carlos & Voisin 2009) and others have not yet been so. Comments on this question will be published elsewhere, but for the time being, in light of the long discussion above, it seems "*urgent to wait*" (Dubois 2007*d*) before implementing hastily this basic change, which might have detrimentous consequences on the future of zoological nomenclature.

References

Anonymous [International Commission on Zoological Nomenclature] (1916) Opinions rendered by the International Commission on Zoological Nomenclature. Opinion 67. One hundred and two bird names placed in the *Official List of Generic Names*. *Smithsonian Institution Publications*, Washington, 2409, 177–182.

Anonymous [International Commission on Zoological Nomenclature] (1950) Article 28: relative merits of the "first reviser" and "page precedence" principles. Report by the Secretary. *Bulletin of zoological nomenclature*, 4, 328–331.

Anonymous [International Commission on Zoological Nomenclature] (1961) *International code of zoological nomenclature*. First edition. International Trust for zoological Nomenclature, London, i–xviii + 1–176.

Anonymous [International Commission on Zoological Nomenclature] (1964) *International code of zoological nomenclature*. Second edition. International Trust for zoological Nomenclature, London, i–xx + 1–176.

Anonymous [International Commission on Zoological Nomenclature] (1985) *International code of zoological nomenclature*. Third edition. International Trust for zoological Nomenclature, London, i–xx + 1–338.

Anonymous [International Commission on Zoological Nomenclature] (1997) Opinion 1873. Hemidactyliini Hallowell, 1856 (Amphibia, Caudata): conserved. *Bulletin of zoological Nomenclature*, 54, 140–141.

Anonymous [International Commission on Zoological Nomenclature] (1999) *International code of zoological nomenclature*. Fourth edition. International Trust for zoological Nomenclature, London, i–xxix + 1–306.

Anonymous [International Commission on Zoological Nomenclature] (2005) Opinion 2104 (Case 3226). Lacepède, B. G. E. de la V., 1788, *Histoire naturelle des Quadrupèdes Ovipares*: rejected as a non-binominal work. *Bulletin of zoological Nomenclature*, 62 (1), 55.

Anonymous [International Commission on Zoological Nomenclature] (2008) Proposed amendment of the *International code of zoological nomenclature* to expand and refine methods of publication. *Zootaxa*, 1908, 57–67.

Agassiz, L. (1846) *Nomina systematica generum piscium.* Soloduri, Jent & Gassmann, i–vi + 1–69 + 1–8.

Allen, G.R. (1991) *Field guide to the freshwater fishes of New Guinea*. Madang, Papua New Guinea, Christensen Research Institute, 1–268.

Arai, R. (1983) Karyological and osteological approach to phylogenetic systematics of tetraodontiform fishes. *Bulletin of the national Science Museum*, Tokyo, Series A (Zoology), 9 (4), 175–210.

Baird, S. (1866) Review of North American Birds, in the museum of the Smithsonian Institution. Part I. *Smithsonian miscellaneous Collections*, Smithsonian Institution, Washington, 181, [Signature 21, May 1866], 321–336.

Barneby, R.C. (1965) Conservation and typification of *Dalea*. *Taxon*, 14, 160–164.

Batsch, A.J.G.C. (1788) *Bersuch einer Anleitung, zur Kennniss und Geschichte der Thiere und Mineralien.* Erster Theil. Jena, Akademischen Buchhandlung, i–viii + 1–528, pl. 1–5.

Beesley, P.L. & Wells, A. (Eds.) (2006) *Zoological catalogue of Australia*. Vol. 35.3. *Fishes*. Canberra, Australian Government Publishing Service, i–xxi + 1473–2178.

Berg, L.S. (1940) Classification of fishes both recent and fossil. *Travaux de l'Institut zoologique de l'Académie des Sciences de l'URSS*, 5 (2), 87–517. Reprint 1965: Bangkok, Document Reproduction Unit, Thai national Documentation Centre, Applied Scientific Research Corporation of Thailand, 346–517.

Blanchard, R. (Ed.) (1905) *Règles internationales de la nomenclature zoologique adoptées par les Congrès Internationaux de Zoologie.* Rudeval, Paris, 1–64.

Bloch, M.E. (1785) *Naturgeschichte der ausländischen Fische, mit sechs und dreissig ausgemalten Kupfern nach Originales*. Erster Theil. Berlin, [i-viii] + 1–136.

Bloch, M.E. (1786) *Naturgeschichte der ausländischen Fische, mit sechs und dreissig ausgemalten Kupfern nach*

Originales. Zweiter Theil. Berlin, [i-viii] + 1–160.
Bloch, M.E. (1787) *Naturgeschichte der ausländischen Fische, mit sechs und dreissig ausgemalten Kupfern nach Originales*. Dritter Theil. Berlin, i–xii + 1–147.
Blyth, E. (1842) Report from the Curator. *Journal of the Asiatic Society of Bengal*, 11 (128), 788–809.
Blyth, E. (1843) Mr. Blyth's monthly Report for December Meeting 1842, with addenda subsequently appended. *Journal of the Asiatic Society of Bengal*, 12 (143), 925–1011.
Bock, W.J. (1963) Relationships between the birds of paradise and the bower birds. *The Condor*, 65 (2), 91–125.
Bock, W.J. (1994) History and nomenclature of avian family-group names. *Bulletin of the American Museum of natural History*, 222, 1–281.
Boie, H. (1828) Bemerkungen über die Abtheilungen im natürlichen Systeme und deren Characteristik. *Isis von Oken*, 21 (4), 351–364.
Bolkay, S.J. (1919) Osnove uporedne osteologije anurskih batrahija. *Glasnik zemaljskog Muzeja u Bosni i Hercegovini*, 31, 275–357.
Bonaparte, C.L. (1831) Saggio di una distribuzione metodica degli animali vertebrati. *Giornale Arcadico di Scienze, Lettere ed Arti*, 52, 1–78 + 129–209.
Bonaparte, C.L. (1838) *Geographical and comparative list of the birds of Europe and North America.* London, John van Voorst, 1–67. [Not seen].
Bonaparte, C.L. (1850) *Conspectus generum avium*. Leiden, E.J. Brill, Vol. 1, 1–543.
Bonaparte, C.L. (1854*a*) Conspectus systematis ornithologiae. *Annales des Sciences naturelles, Zoologie*, (4), 1, 105–152.
Bonaparte, C.L. (1854*b*) Tableau des oiseaux de proie. *Revue et Magasin de Zoologie*, (2), 6, 248–257. [Not seen].
Bonnaterre, Abbé (1788) *Tableau encyclopédique et méthodique des trois règnes de la nature. Ichthyologie.* Paris, Panckoucke, i–lvi + 1–215, pl. A + 1–100.
Bouchet, P. & Rocroi, J.-P. (2005) Classification and nomenclator of gastropod families. *Malacologia*, 47 (1–2), 1–397.
Bour, R. & Dubois, A. (1985) Nomenclature ordinale et familiale des tortues (Reptilia). *Studia geologica salmanticensia*, vol. especial 1, *Studia palaeocheloniologica*, I, Salamanca, Ediciones Universidad, 77–86.
Bour, R. & Dubois, A. (1986) Nomenclature ordinale et familiale des Tortues (Reptilia). Note complémentaire. *Bulletin mensuel de la Société linnéenne de Lyon*, 55, 87–90.
Brame, A.H., Jr. (1957) *A list of the world's recent Caudata*. Los Angeles, University of Southern California, a–b + 1–21.
Breder, C.M., Jr. & Clark, E. (1947) A contribution to the visceral anatomy, development, and relationships of the Plectognathi. *Bulletin of the American Museum of natural History*, 88 (5), 287–319, pl. 11–14.
Briggs, J.C. (1961) Emendated generic names in Berg's classification of fishes. *Copeia*, 1961 (2), 161–166.
Cabanis, J. (1847) Ornithologische Notizen. *Archiv für Naturgeschichte*, 1847 (1), 308–352.
Carlos, C.J. & Voisin, J.-F. (2009) A few remarks on the proposed amendment of the *International Code of Zoological Nomenclature* to expand and refine methods of publication. *Zootaxa*, 2198, 67–68.
Christoffels, A., Brenner, S. & Venkatesh, B. (2006) *Tetraodon* genome analysis provides further evidence for whole-genome duplication in the ray-finned fish lineage. *Comparative Biochemistry & Physiology*, (D), *Genomics & Proteomics*, 1 (1), 13–19.
Crollius, H.R. (2006) The *Tetraodon* genome. *In*: J.-N. Volff (Ed.), *Vertebrate genomes*, Vol. 2, Basel, Karger, 154–164.
Cuvier, G. (1829) *Le règne animal distribué d'après son organisation.* Tome 2. Paris, Deterville, i–xv + 1–406.
Dandy, J.E. (1967) Index of generic names of vascular plants 1753–1774. *Regnum Vegetabile*, Utrecht, 51, 1–130.
David, N., Dickinson, E.C. & Gregory, S.M.S. (2009) Contributions to a list of First Reviser actions: ornithology. *Zootaxa*, 2085, 1–24.
De Blainville, H. (1816) Prodrome d'une nouvelle distribution systématique du règne animal. *Bulletin des Sciences de la Société philomatique de Paris*, juillet 1816, "105–112" [in fact 113–120] + 121–124.
De la Cepède, [B.G.E.] (1788*a*) *Histoire naturelle des quadrupèdes ovipares et des serpens.* Tome premier. 16 cm. Paris, Hôtel de Thou, 1–60 + 1–359, pl. 1–12.
De la Cepède, [B.G.E.] (1788*b*) *Histoire naturelle des quadrupèdes ovipares et des serpens.* Tome second. 16 cm. Paris, Hôtel de Thou, [i–iv] + 1–464, pl. 1–15.
Dekkers, W.J. (1975) Review of the Asiatic freshwater puffers of the genus *Tetraodon* Linnaeus, 1758 (Pisces, Tetraodontiformes, Tetraodontidae). *Bijdragen tot de Dierkunde*, 45 (1), 87–142.
Des Murs, O.M.A.P. (1849) *Iconographie ornithologique. Nouveau recueil général des planches peintes d'oiseaux pour servir de suite et de complément aux planches enluminées de Buffon, 1770 et aux planches coloriées de MM Temminck et Laugier de Chartrouse, mêmes formats, accompagné d'un texte raisonné. critique et descriptif.* Paris, Klincksoek. [Not seen].
Des Murs, O. (1860) *Traité général d'oologie ornithologique au point de vue de la classification.* Paris, Klincksieck, i–xix + 1–640. [Not seen].
Dickinson, E.C. (Ed.) (2003) *The Howard and Moore complete checklist of the birds of the world.* Revised and enlarged 3rd edition. London, Christopher Helm, 1–1039.

Dickinson, E.C., David, N. & Gregory, S.M.S. (2009) A potentially contentious case of correction under Article 32.5.1.1 of the *International Code of Zoological Nomenclature*. *Zootaxa*, 2217, 67–68.
Douglas, G. (2008) Updating the Linnaean heritage: names as tools for thinking about animals and plants. *Bulletin of zoological Nomenclature*, 65 (3), 169–172.
Duarte-Bello, P.P. & Buesa, R.J. (1973) Catalogo de peces cubanos (primera revisión). I. Indice taxonómico. *Ciencias*, Serie 8, *Investigaciones marinas*, La Habana, Universidad de la Habana, 3, i +1–256.
Dubois, A. (1981) Liste des genres et sous-genres nominaux de Ranoidea (Amphibiens, Anoures) du monde, avec identification de leurs espèces-types: conséquences nomenclaturales. *Monitore zoologico italiano*, (n.s.), 15, suppl., 225–284.
Dubois, A. (1982) Le statut nomenclatural des noms génériques d'Amphibiens créés par Kuhl & Van Hasselt (1822): *Megophrys*, *Occidozyga* et *Rhacophorus*. *Bulletin du Muséum national d'Histoire naturelle*, (4), 4 (A), 261–280.
Dubois, A. (1983) Classification et nomenclature supragénérique des Amphibiens Anoures. *Bulletin mensuel de la Société linnéenne de Lyon*, 52, 270–276.
Dubois, A. (1984) La nomenclature supragénérique des Amphibiens Anoures. *Mémoires du Muséum national d'Histoire naturelle*, (A), 131, 1–64.
Dubois, A. (1985) Miscellanea nomenclatorica batrachologica (VII). *Alytes*, 4 (2), 61–78.
Dubois, A. (1987*a*) Living amphibians of the world: a first step towards a comprehensive checklist. *Alytes*, 5 (3), 99–149.
Dubois, A. (1987*b*) Miscellanea taxinomica batrachologica (II). *Alytes*, 6 (1-2), 1–9.
Dubois, A. (1987*c*) Again on the nomenclature of frogs. *Alytes*, 6 (1-2), 27–55.
Dubois, A. (1994) Comment on the proposed conservation of Hemidactyliini Hallowell, 1856 (Amphibia, Caudata). *Bulletin of zoological Nomenclature*, 51, 264–265.
Dubois, A. (2000) Synonymies and related lists in zoology: general proposals, with examples in herpetology. *Dumerilia*, 4, 33–98.
Dubois, A. (2003) The relationships between taxonomy and conservation biology in the century of extinctions. *Comptes rendus Biologies*, 326 (suppl. 1), S9–S21.
Dubois, A. (2004) The higher nomenclature of recent amphibians. *Alytes*, 22 (1-2), 1–14.
Dubois, A. (2005*a*) Les règles de la nomenclature familiale en zoologie. *In*: A. Dubois, O. Poncy, V. Malécot & N. Léger (Eds.), *Comment nommer les taxons de rang supérieur en zoologie et en botanique?*, *Biosystema*, 23, 17–40.
Dubois, A. (2005*b*) Propositions pour l'incorporation des nomina de taxons de rang supérieur dans le *Code international de nomenclature zoologique*. *In*: A. Dubois, O. Poncy, V. Malécot & N. Léger (Eds.), *Comment nommer les taxons de rang supérieur en zoologie et en botanique?*, *Biosystema*, 23, 73–96.
Dubois, A. (2005*c*) Proposed Rules for the incorporation of nomina of higher-ranked zoological taxa in the *International Code of Zoological Nomenclature*. 1. Some general questions, concepts and terms of biological nomenclature. *Zoosystema*, 27, 365–426.
Dubois, A. (2005*d*) Proposals for the incorporation of nomina of higher-ranked taxa into the Code. *Bulletin of zoological Nomenclature*, 62 (4), 200–209.
Dubois, A. (2006*a*) Proposed Rules for the incorporation of nomina of higher-ranked zoological taxa in the *International Code of Zoological Nomenclature*. 2. The proposed Rules and their rationale. *Zoosystema*, 28, 165–258.
Dubois, A. (2006*b*) Incorporation of nomina of higher-ranked taxa into the *International Code of Zoological Nomenclature*: some basic questions. *Zootaxa*, 1337, 1–37.
Dubois, A. (2007*a*) Phylogeny, taxonomy and nomenclature: the problem of taxonomic categories and of nomenclatural ranks. *Zootaxa*, 1519, 27–68.
Dubois, A. (2007*b*) Genitives of species and subspecies nomina derived from personal names should not be emended. *Zootaxa*, 1550, 49–68.
Dubois, A. (2007*c*) Naming taxa from cladograms: some confusions, misleading statements, and necessary clarifications. *Cladistics*, 23, 390–402.
Dubois, A. (2007*d*) For or against the mandatory registration of new names of organisms? The case of Zoobank in Zoology. *Third Linnean Society Debate on Issues in Systematic Biology*, London, The Linnean Society of London, 29 November 2007. [Unpublished powerpoint presentation. Abstract available at: http://www.linnean.org/index.php?id=243&tx_ttnews[tt_news]=133&tx_ttnews[backPid]=139&cHash=797e44d62c. Powerpoint available at: http://www2.mnhn.fr/oseb/spip].
Dubois, A. (2007*e*) Nomina zoologica linnaeana. *In*: Z.-Q. Zhang & W. A. Shear (Eds.), *Linnaeus tercentenary: progress in invertebrate taxonomy*, *Zootaxa*, 1668, 81–106.
Dubois, A. (2008*a*) Identifying some major problems and their possible solutions. *In*: *Future trends in taxonomy, EDIT Symposium, Carvoeiro (Portugal), 21-23 January 2008*, 38–42.
Dubois, A. (2008*b*) Authors of zoological publications and nomina are signatures, not persons. *Zootaxa*, 1771, 63–68.
Dubois, A. (2008*c*) Handicap taxinomique et crise de la biodiversité: un nouveau paradigme pour la biologie au 21e siècle. *In*: D. Prat, A. Raynal-Roques & A. Roguenant (Eds.), *Peut-on classer le vivant? Linné et la systématique*

aujourd'hui, Paris, Belin, 141–160.
Dubois, A. (2008*d*) Le *Code international de nomenclature zoologique*: présentation, philosophie, règles majeures, problèmes actuels. *In*: D. Prat, A. Raynal-Roques & A. Roguenant (Eds.), *Peut-on classer le vivant? Linné et la systématique aujourd'hui*, Paris, Belin, 355–402.
Dubois, A. (2008*e*) Un nouveau paradigme pour la biologie au XXI[e] siècle. *In*: M. Veuille, J.-M. Drouin, R. Deleporte & J.-F. Silvain (Eds.), *Linnaeus – Systématique et biodiversité, Biosystema*, 25, 127–142.
Dubois, A. (2008*f*) Phylogenetic hypotheses, taxa and nomina in zoology. *In*: A. Minelli, L. Bonato & G. Fusco (Eds.), *Updating the Linnaean heritage: names as tools for thinking about animals and plants*, *Zootaxa*, 1950, 51–86.
Dubois, A. (2009*a*) First Reviser actions in ornithology: an editorial note. *Zootaxa*, 2085, 25–26.
Dubois, A. (2009*b*) Incorporation of nomina of higher-ranked taxa into the *International Code of Zoological Nomenclature*: the nomenclatural status of class-series zoological nomina published in a non-latinized form. *Zootaxa*, 2106, 1–12.
Dubois, A. (2010) Zoological nomenclature in the century of extinctions: Priority *vs*. "usage". *Organisms, Diversity & Evolution*, in press.
Dubois, A. & Ohler, A. (1997) Early scientific names of Amphibia Anura. I. Introduction. *Bulletin du Muséum national d'Histoire naturelle*, (4), 18 (3-4), 297–320.
Dubois, A. & Raffaëlli, J. (2009) A new ergotaxonomy of the family Salamandridae Goldfuss, 1820 (Amphibia, Urodela). *Alytes*, 26 (1-4), 1–85.
Duellman, W.E. & Wiens, J.J. (1993) Hylid frogs of the genus *Scinax* Wagler, 1830, in Amazonian Ecuador and Peru. *Occasional Papers of the Museum of natural History of the University of Kansas*, 153, 1–57.
Duméril, A.-M.-C. & Bibron, G. (1841) *Erpétologie générale ou histoire naturelle complète des Reptiles*. Tome 8. Paris, Roret, i–vii + 1–792.
Elliot, D.G. (1873) *A monograph of the Paradiseidae, or birds of paradise*. London, Elliot, i–xxxii + 62 unnumbered pages, 36 unnumbered plates.
Esnault, Y., Jaillon, O., Aury, J., Weissenbach, J. & Crollius, H.R. (2005) *Tetraodon*, poisson au génome modèle. *Biofutur*, 24 (254), 24–28.
Fitzinger, L.I. (1826) *Neue Classification der Reptilien*. Wien, Heubner, i–viii + 1–66, 1 tab.
Follett, W.I. (1955) *An unofficial interpretation of the International Rules of Zoological Nomenclature as amended by the XIII International Congress of Zoology, Paris, 1948, and by the XIV International Congress of Zoology, Copenhagen, 1953*. California Academy of Sciences and Society of Systematic Zoology, [i] + i–v + 1–99.
Forshaw, J.M. & Cooper, W.T. (1979) *The birds of paradise and bower birds*. Sydney & London, Collins, i–xii + 13–304.
Forskål, P. (1775) *Descriptiones animalium avium, amphibiorum, piscium, insectorum, vermium*… Hauniae, Mölleri, 1–20 + i–xxxv + 1–164, 1 pl.
Fraser-Brunner, A. (1943) Note on the plectognath fishes. VIII. The classification of the suborder Tetraodontoidea, with a synopsis of the genera. *Annals & Magazine of natural History*, (11), 10, 1–18.
Frith, C.B. & Beehler, B.M. (1998) *The birds of paradise*. Paradisaeidae. Oxford, Oxford University Press, i–xxx + 1–613, pl. 1–15.
Fritzsche, R.A. & Fuiman, L. (1982) Agnatha. *In*: S. P. Parker, *Synopsis and classification of living organisms*, Vol. 2, New York, McGraw-Hill, 830–831.
Gilliard, E.T. (1969) *Birds of paradise and bower birds*. London, Weidenfeld & Nicolson, i–xxiii + 1–485.
Gistel, J. (1848) *Naturgeschichte des Thierreichs für höhere Schulen*. Stuttgart, Hoffmann, i–xi + 1–216 + i–iv, pl. 1–32.
Gmelin, J.F. (1789) *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locus*. Editio decima tertia, aucta, reformata. Tomus 1, pars 3. Lugduni, Delamollière, 1033–1516.
Goldfuss, G.A. (1820) *Handbuch der Zoologie*. Dritter Theil, zweite Abtheilung. Nürnberg, Johann Leonhard Schrag, i–xxiv + 1–512, pl. 3–4.
Gray, G.R. (1840) *A list of the genera of birds with an indication of the typical species of each genus*. London, Taylor, i–viii + 1–80.
Gray, G.R. (1849) *The genera of birds*. Volume 1. London, Longman & Co., i–xvi + 1–300, pl. 1–72.
Gray, J.E. (1850) *Catalogue of the specimens of Amphibia in the collection of the British Museum*. Part II. *Batrachia Gradientia, etc*. London, Spottiswoodes & Shaw, 1–72, pl. 3–4.
Hemming, F. (Ed.) (1953) *Copenhagen decisions on zoological nomenclature. Additions to, and modifications of, the Règles internationales de la nomenclature zoologique; approved and adopted by the Fourteenth International Congress of Zoology, Copenhagen, August, 1953*. International Trust for Zoological Nomenclature, London, i–xxxi + 1–135.
Hemming, F. (Ed.) (1956*a*) Opinion 401. Suppression under the Plenary Powers of the generic name *Colymbus* Linnaeus, 1758, and addition to the Official List of Generic Names in Zoology of the generic names *Gavia* Forster, 1788, and *Podiceps* Latham, 1787 (class Aves). *Opinions & Declarations rendered by the international Commission on zoological Nomenclature*, 13 (1), 1–64.

Hemming, F. (Ed.) (1956*b*) Direction 38. Rejection for nomenclatorial purposes of the anonymously published work entitled Ornithologia britannica issued in 1771 and believed to have been written by Marmaduke Tunstall and matters incidental thereto (cancallation of Opinion 38). *Opinions & Declarations rendered by the International Commission on Zoological Nomenclature*, 11 (D), 83–94.

Hillis, D.M. (2007) Constraints in naming parts of the tree of life. *Molecular Phylogenetics & Evolution*, 42, 331–338.

Hoese, D.F. (2006*a*) Order Tetraodontiformes. Introduction. *In*: Beesley & Wells (2006): 1859.

Hoese, D.F. (2006*b*) Suborder Tetraodontoidei. Introduction. *In*: Beesley & Wells (2006): 1868.

Hoese, D.F., Bray, D.J. & Allen, G.R. (2006) Tetraodontidae. Blowfishes, pufferfishes, puffers, toadfishes, toadoes, tobys (CAAB: 37467000). *In*: Beesley & Wells (2006): 1912–1929.

Huxley, T.H. (1868) On the classification and distribution of the Alectoromorphae and Heteromorphae. *Proceedings of the zoological Society of London*, 1868, 294–319.

Iredale, T. (1948) A check list of the birds or paradise and bower-birds. *Australian Zoologist*, 11, 161–189.

Iredale, T. (1950) *Birds of paradise and bower birds*. Melbourne, Georgian House, [i] + 1–xii + 1–239, pl. 1–33 + 1.

Jaillon, O., Aury, J.-M., Brunet, F., Petit, J.-L., STange-Thomann, N., Mauceli, E., Bouneau, L., Fischer, C., Ozouf-Costaz, C., Bernot, A., Nicaud, S., Jaffe, D., Fisher, S., Lutfalla, G., Dossat, C., Segurens, B., Dasilva, C., Salanoubat, M., Levy, M., Boudet, N., Castellano, S., Anthouard, V., Jubin, C., Castelli, V., Katinka, M., Vacherie, B., Biémont, C., Skalli, Z., Cattolico, L., Poulain, J., de Berardinis, V., Cruaud, C., Duprat, S., Brottier, P., Coutanceau, J.-P., Gouzy, J., Parra, G., Lardier, G., Chappie, C., McKernan, K., McEwan, P., Bosak, S., Kellis, M., Volff, J;-N., Guigó, R., Zody, M.C., Mesirov, J., Lindblad-Toh, K., Birren, B., Nusbaum, C., Kahn, D., Robvinson-Rechavi, M., Laudet, V., Schachter, V., Quétier, F., Saurin, W., Scarpelli, C., Wincker, P., Lander, E.S., Weissenbach, J. & Crollius, H.R. (2004) Genome duplication in the teleost fish *Tetraodon nigroviridis* reveals the early vertebrate proto-karyotype. *Nature*, 431, 946–957.

Jerdon, T.C. (1862) *The birds of India*. Volume I. Calcutta, [i–xvii] + i–xlv + 1–535.

Jordan, D.S. (1885) *A catalogue of the fishes known to inhabit the waters of North America, north of the Tropic of Cancer, with notes on the species discovered in 1883 and 1884*. Washington, Government Printing Office, 1–185.

Jordan, D.S. (1907) *Fishes*. New York, Henry Holt & Co., i–xv + 1–788.

Koerber, S. (2009) From sponges to primates: emendation of 30 species nomina dedicated to the Swedish zoologist Einar Lönnberg. *Zootaxa*, 2201, 63–68.

Kottelat, M. (1989) Zoogeography of the fishes from Indochinese inland waters with an annotated check-list. *Bulletin zoölogische Museum Universiteit van Amsterdam*, 12 (1), 1–54.

Kottelat, M. (2001) Nomenclatural status of names of tetraodontiform fishes based on Bibron's unpublished work. *Zoosystema*, 23 (3), 605–618.

Kuhl, H. & Van Hasselt, J.C. (1822) Uittriksels uit brieven van de Heeren Kuhl en Van Hasselt, aan de Heeren C. J. Temmnick, Th. Van Swinderen en W. De Haan. *Algemeene Konst-en Letter-Bode*, 7, 99–104.

Kuhn, O. (1965) *Die Amphibien.* Krailling bei München, Oeben, 1–102.

Lafresnaye, F. (1850) Essai d'une monographie du genre *Picucule* (Buffon), *Dendrocolaptes* (Hermann, Illiger), devenu aujourd'hui la sous-famille Dendrocolaptinae (Gray, Genera of Birds) de la famille Certhiadae de Swains. *Revue et Magasin de Zoologie*, (2) 2, 369–388. [Not seen].

Latham, J. (1790) *Index ornithologicus, sive systema ornithologiæ; complectens avium divisionem in classes, ordines, genera, species, ipsarumque varietates: adjectis synonymis, locis, descriptionibus…* Vol. 1. London, Leigh & Sotheby, i–xviii + 1–500. [Not seen].

Laurenti, J.N. (1768) *Specimen medicum, exhibens synopsin Reptilium emendatam cum experimentis circa venena et antidota Reptilium austriacorum.* Viennae, Joan. Thom. Nob. de Trattnern, i–ii + 1–215, pl. 1–5.

Le Danois, Y. (1959) Etude ostéologique, myologique et systématique des poissons du sou-ordre des Orbiculates. *Annales de l'Institut océanographique*, 36 (1), 1–274.

Le Danois, Y. (1961) Catalogue des types de poisons Orbiculates du Muséum national d'Histoire naturelle. II. Familles des Tetraodontidae, Lagocephalidae, Colomesidae, Diodontidae et Triodontidae. *Bulletin du Muséum national d'Histoire naturelle*, (2), 33 (5), 462–478.

Lesson, R.P. (1830) *Traité d'ornithologie ou Tableaux méthodiques des ordres, sous-ordres, familles, tribus, genres, sous-genres et races d'oiseaux*. Volume 1, livre 3. Paris, Levrault, 161–240.

Lesson, R.P. (1831) *Traité d'ornithologie ou Tableaux méthodiques des ordres, sous-ordres, familles, tribus, genres, sous-genres et races d'oiseaux.* Volume 1, livre 8. Paris, Levrault, 561–659.

Lévêque, C., Paugy, D., Teugels, G.G. & Romand, R. (1989) Inventaire taxinomique et distribution des poissons d'eau douce des bassins côtiers de Guinée et de Guinée Bissau. *Revue d'Hydrobiologie tropicale*, 22 (2), 107–127.

Linnaeus, C. (1744) *Systema Naturae in quo proponuntur natura regia tria secundum classes, ordines, genera et species.* Editio quarta ab auctore emendata et aucta. Parisiis, Sumptibus Michaelis-Antonii David, [i] + i–xxvi + 1–108, 1 pl.

Linnaeus, C. (1758*a*) *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis.* Editio decima, reformata. Tomus I. Holmiae, Laurentii Salvii, [i–iv] + 1–824.

Linnaeus, C. (1758*b*) *Opera Varia in quibus continentur Fundamenta Botanica, Sponsalia Plantarum, et Systema Naturae, in quo proponuntur naturae regna tria secundum classes, ordines, genera et species*. Lucae, Typographia Juntiniana, [i–iv] + 1–376, 1 pl.

Linnaeus, C. (1759) *Animalium Specierum in classes, ordines, genera, species methodica dispositio, additis characteribus, differentiis atque synonymis, accomodata ad Systema Naturae & in formam enchyridii redacta, secundum decimam Holmensem editionem.* Lugduni Batavorum, Theodorum Haak, [i–iv] + 1–256.

Linnaeus, C. (1761) *Fauna Svecica*. Editio altera, auctior. Stocholmiae, Laurentii Salvii, [i–l] + 1–579, pl. 1–2.

Linnaeus, C. (1766) *Systema Naturae*. Editio duodecima, reformata. Tomus I, Pars I. Holmiae, Laurentii Salvii, 1–532.

Linnaeus, C. (1767) *Systema Naturae*. Editio duodecima, reformata. Tomus I, Pars II. Holmiae, Laurentii Salvii, 533–1327 + i–xxxiv.

Linnaeus, C. (1894) *Systema Naturae. Regnum animale.* Editio decima, 1758, Cura Societatis Zoologicae Germanicae iterum edita. Lipsiae, Guilielmi Engelmann, [i–iv] + 1–824 + i–iv.

Loche, [Capt. V.] (1860) Description de deux nouvelles espèces d'Alouettes découvertes dans le Sahara algérien par le commandant Loche. *Revue et Magasin de Zoologie*, (2) 12 (Avril), 148–151.

Mayr, E. (1962) Family Paradisaeidae. *In*: E. Mayr & J.C. Greenway, Jr. (Eds.), *Check-list of birds of the world. A continuation of the work of James L. Peters*, Vol. 15, Cambridge, Massachusetts, Museum of Comparative Zoology, 181–204.

McAllister, D.E. (1960) List of the marine fishes of Canada. *National Museum of Canada Bulletin*, 168, *Biological Series*, 62, i–iv + 1–76.

Melville, R.V. (1995) *Towards stability in the names of animals.* London, International Trust for Zoological Nomenclature, i–xi + 1–92.

Merrem, B. (1820) *Versuch eines Systems der Amphibien. Tentamen systematis amphibiorum*. Marburg, Iohann Christian Krieger, (i–xv + 1–191) × 2, 1 pl.

Meyer, A. (1926) *Logik der Morphologie im Rahmen einer Logik der gesamten Biologie*. Berlin, Julius Springer, i–vii + 1–290.

Michel, E., Nikolaeva, S., Dale-Skey, N. & Tracey, S. (Eds.) (2009*a*) Contributions to the discussion on electronic publication II. *Bulletin of zoological Nomenclature*, 66 (1), 4–19.

Michel, E., Nikolaeva, S., Dale-Skey, N. & Tracey, S. (Eds.) (2009*b*) Contributions to the discussion on electronic publication. *Bulletin of zoological Nomenclature*, 66 (3), 205–224.

Neave, S.A. (Ed.) (1939) *Nomenclator zoologicus*. Vol. II. D–L. London, Zoological Society of London, i–iv + 1–1025.

Neave, S.A. (Ed.) (1940*a*) *Nomenclator zoologicus*. Vol. III. M–P. London, Zoological Society of London, i–iv + 1–1065.

Neave, S.A. (Ed.) (1940*b*) *Nomenclator zoologicus*. Vol. IV. Q–Z and supplement. London, Zoological Society of London, i–iv + 1–758.

Nelson, J.S. (2006) *Fishes of the world.* Fourth edition. Hoboken, New Jersey, John Wiley & Sons, i–xix + 1–601.

Nemésio, A. (2007) "Page priority" does not exist in the *Code*: *Neomegalotomus parvus* (Westwood, 1842) has precedence over *Neomegalotomus simplex* (Westwood, 1842) (Hemiptera, Heteroptera, Alydidae). *Zootaxa*, 1524, 57–59.

Ng, P.K.L., Guinot, D. & Davie, P.J.F. (2008) Systema Brachyurorum. Part I. An annotated checklist of extant brachyuran crabs of the world. *The Raffles Bulletin of Zoology*, Suppl. 17, 1–286.

Oken, L. von (1816) *Lehrbuch der Naturgeschichte. Dritter Theil, Zoologie. Zweite Abtheilung, Fleischthiere.* Jena, Schmid, i–xvi + 1–1272.

Pennisi, E. (2001) Linnaeus's last stand? *Science*, 291, 2304–2307.

Peters, J.L. (1951) *Check-list of birds of the world*. Museum of Comparative Zoology, Cambridge, Massachusetts, 7, i–x + 1–318.

Potapov, R.L. (1993) New subspecies of the Himalayan Snowcock, *Tetraogallus himalayensis sauricus*, subsp. nova. *Russian Journal of Ornithology*, 2 (1), 3–5.

Potapov, R.L. (2007) On the name of a new subspecies of the Himalayan Snowcock *Tetraogallus himalayensis sauricus* Potapov, 1993. *Russian Journal of Ornithology*, 16, 654–655.

Poynton, J.C. (1964) The Amphibia of Southern Africa: a faunal study. *Annals of the Natal Museum*, 17, 1–334.

Procé, M. de (1822) Sur plusieurs espèces nouvelles de poissons et de crustacés observées dans un voyage de France à Manille. *Bulletin de la Société philomathique de Paris*, 1822, 129–134.

Rafinesque, C.S. (1815) *Analyse de la nature ou Tableau de l'univers et des corps organisés*. Palerme, Jean Barravecchia, 1–124, 1 pl.

Rafinesque-Schmaltz, C.S. (1814) *Principes généraux de Somiologie ou les loix* [*sic*] *de la nomenclature et de la classification de l'empire organique ou des animaux et des végétaux, contenant les règles essentielles de l'art de leur imposer des noms immuables et de les classer méthodiquement.* Palerme, Franc. Abate, 1–52.

Randall, J.E. & Lim, K.K.P. (Eds.) (2000) A checklist of the fishes of the South China Sea. *The Raffles Bulletin of Zoology*, suppl. 8, 569–667.

Rentz, D.C. (1973) On chresonymy. *Systematic Zoology*, 22 (2), 195.
Richmond, C.W. (1908) Generic names applied to birds during the years 1901 to 1905, inclusive, with further additions to Waterhouse's *Index generum avium. Proceedings of the Unites States national Museum*, 35, 583–655.
Roberts, T.R. (1986) Tetraodontidae. *In*: J. Daget, J.-P. Gosse & D. F. E. Thys van den Audenaerde (Eds.), *Check-list of the freshwater fishes of Africa*, Bruxelles (ISNB), Tervuren (MRAC) & Paris (ORSTOM), 434–436.
Roberts, T.R. (1998) Freshwater fugu or puffersishes of the genus *Tetraodon* from the Mekong basin, with descriptions of two new species. *Ichthyological Research*, 45 (3), 225–234.
Savage, J.M. (1986) Review of Dubois (1984). *Copeia*, 1986, 259–262.
Schneider, I.G. (1799) *Historiae Amphibiorum naturalis et literariae. Fasciculus primus, continens Ranas, Calamitas, Bufones, Salamandras et Hydros, in genera et species descriptos notisque suis distinctos.* Jena, Frommann, i–xv + 1–264, pl. 1–2.
Scopoli, I.A. (1777) *Introductio ad historiam naturalem, sistens genera lapidum, plantarum, et animalium hactenus detecta, caracteribus essentialibus donata, in tribus divisa, subinde ad leges naturae.* Pragae, Gerle, [i-x] + 1–506 + i–xxxvi.
Sepkoski, J. (2002) A compendium of fossil marine animal genera. *Bulletins of American Paleontology*, 363, 1–560.
Sharpe, R.B. (1879) Contributions to the ornithology of Borneo. Part IV. On the birds of the province of Lumbidan, north-western Borneo. *The Ibis*, (4) 3, 233–272.
Shaw, G. (1804) *General zoology or Systematic natural history.* Vol. 5, Part 2. *Pisces*. London, Kearsley, [i] + i–viii + 251–463, pl. 133–182.
Sherborn, C.D. (1902) *Index Animalium*. Cambridge University Press, London, i–lix + 1–1195.
Sibley, C.G. & Ahlquist, J.E. (1990) *Phylogeny and classification of birds. A study in molecular evolution*. New Haven & London, Yale University Press, i–xxiii + 1–976.
Simpson, G.G. (1940) Types in modern taxonomy. *American Journal of Science*, 238, 413–431.
Smith, H.M. & Pérez-Higareda, G. (1986) Nomenclatural name-forms. *Systematic Zoology*, 35, 421–422.
Smith, H.M. & Smith, R.B. (1973) Chresonymy ex synonymy. *Systematic Zoology*, "1972", 21, 445.
Smith, H.M. & Smith, R.B. (1993) *Synopsis of the herpetofauna of Mexico. Volume VI. Bibliographic addendum IV and index, bibliographic addenda II-IV 1979–1991*. Niwot, Colrado, Univesity Press of Colorado, i–ix + 1–1082.
Sundevall, C.J. (1836) Ornithologiskt system. *Kongliga Svenska Vetenskaps-Akademins Handlingar*, "1835", 43–130.
Swainson, W. (1824) An inquiry into the natural affinities of the Laniadae, or shrikes; preceded by some observations on the present state of ornithology in this country. *Zoological Journal*, 1, 289–307.
Swainson, W. (1837) *Birds of West Africa*. Volume 1. Edinburgh, Lizars, 1–286.
Swainson, W. & Richardson, J. (1832) *Fauna boreali-americana*. Part 2. *The birds*. London, Murray, i–lxvi + 1–523.
Tschudi, J.J. (1838) *Classification der Batrachier, mit Berücksichtigung der fossilen Thiere dieser Abtheilung der Reptilien*. Neuchâtel, Petitpierre, i–ii + 1–98, pl. 1–6.
Tyler, J.C. (1980) Osteology, phylogeny, and higher classification of the fishes of the order Plectognathi (Tetraodontiformes). *NOAA technical Reports, NMFS Circulars*, 434, i–xii + 1–422.
Van de Peer, Y. (2004) *Tetraodon* genome confirms Takifugu findings: most fish are ancient polyploids. *Genome Biology*, 5 (12), 250.
Vieillot, L.P. (1816) *Analyse d'une nouvelle ornithologie élémentaire*. Paris, Deterville, [i] + 1–70.
Vieillot, L.P. & Oudart, M.P. (1825) *La galerie des oiseaux*. Paris, Constant-Chantpie, [i–vii] + i–iii + 1–344, pl. 1–198.
Vigors, N.A. (1824) Sketches in ornithology; or, observations on the leading affinities of some of the more extensive groups of birds. On the groups of the Falconidae. *Zoological Journal*, 1, 308–346.
Vigors, N.A. (1825*a*) Observations on the natural affinities that connect the orders and families of birds. *Transactions of the Linnean Society of London*, 14 (3), 395–517.
Vigors, N.A. (1825*b*) Sketches in ornithology; or, observations on the leading affinities of some of the more extensive groups of birds. (Continued from p. 197). *The zoological Journal*, 2 (7), 368–405.
Wager, V.A. (1961) The plain rana. *African Wild Life*, 15, 151–156.
Wheeler Q.D., Raven, P.H. & Wilson, E.O. (2004) Taxonomy: impediment or expedient? *Science*, 303, 285.
Willem, V. (1947) Contributions à l'étude des organes respiratoires chez les Téléostéens Plectognathes. 5^{e} partie: Tétrodontes et Diodon. *Bulletin du Musée royal d'Histoire naturelle de Belgique*, 23 (17), 1–17.
Wilson, S.B. (1890) On a new finch from Midway island, North Pacific. *The Ibis*, (6) 2, 339–341.

Appendix 1. Some technical terms here used for concepts and tools of zoological nomenclature.

For each term, this list provides: the etymology [Gr, Greek; Lat, Latin]; a definition; the reference to creation of the term; the equivalent term or expression used in the *Code* for the same concept, if available.

Allelonym.—Gr: ἀλλήλων (*allelon*), "the one… the other…"; ὄνομα (*onoma*), "name".—One of two or several alternative nomina having the same onomatophore proposed for the same taxon (same content) in the same publication.—Dubois 2006*a*: 183.—*Code*: no term.

Alloneonym. —Gr: ἄλλος (*allos*), "other"; νέος (*neos*), "new"; ὄνομα (*onoma*), "name".—Neonym not directly derived from an archaeonym through unjustified emendation.—Dubois 2000: 52.—*Code*: new replacement name, *nomen novum*.

Ameletograph.—Gr: ἀμελής (*ameles*), "inattentive, careless"; γράφω (*grapho*), "I write".—Spelling of a nomen used inadvertently in a publication.—Dubois 2000: 54 (as *ameletonym*); this paper.—*Code*: no term.

Anoplonym.—Gr: ἄνοπλος (*anoplos*), "unarmed"; ὄνομα (*onoma*), "name".—Published but nomenclaturally unavailable nomen according to the Rules of the *Code*.—Dubois 2000: 50.—*Code*: unavailable name.

Apograph.—Gr: ἀπό (*apo*), "away from, far from"; γράφω (*grapho*), "I write".—Any subsequent spelling of a nomen.—This paper.—*Code*: subsequent spelling.

Apohypse.—Gr: ἀπό (*apo*), "away from, far from"; ὕψος (*hupsos*), "height".—Any subsequent rank of a nomen.—This paper.—*Code*: no term.

Aponym.—Gr: ἀπό (*apo*), "away from, far from"; ὄνομα (*onoma*), "name".—Any subsequent paronym of a protonym (modified in spelling, rank and/or, if relevant, onymorph).—Dubois 2000: 51.—*Code*: no term.

Aponymorph. – Gr: ἀπό (*apo*), "away from, far from"; ὄνομα (*onoma*), "name"; μορφή (*morphe*), "form, shape".—Any subsequent onymorph of a nomen.—This paper.—*Code*: no term.

Archaeonym.—Gr: ἀρχαῖος (*arkhaios*), "ancient"; ὄνομα (*onoma*), "name".—Original nomen that has been replaced by a neonym.—Dubois 2005*b*: 88, 2006*a*: 182.—*Code*: no term.

Arhizonym.—Gr: ἀ- (*a-*), "without"; ρίζα (*rhiza*), "root, stem"; ὄνομα (*onoma*), "name".—Family-series nomen incorrectly formed, as not being based on the stem of an available genus-series nomen, and therefore nomenclaturally unavailable (anoplonym).—Dubois 2006*a*: 178.—*Code*: no term.

Author.—Person(s) to whom a published work, protonym, protaxon or nomenclatural act is attributed.—Traditional term in zootaxonomy.—*Code*: author.

Autoneonym.—Gr: αὐτός (*autos*), "same"; νέος (*neos*), "new"; ὄνομα (*onoma*), "name".—Neonym directly derived from an archaeonym through unjustified emendation.—Dubois 2000: 52.—*Code*: unjustified emendation.

Binomen.—Lat: *bis*, "twice"; *nomen*, "name".—Nomen of rank species, composed of two terms, the generic substantive and the specific epithet.—Traditional term in zoological nomenclature.—*Code*: binomen.

Chresonym.—Gr: χρῆσις (*chresis*), "use"; ὄνομα (*onoma*), "name".—Subsequent use or citation of a nomen under any of its paronyms.—Dubois 1982: 267.—*Code*: no term.

Chresonymy.—List of chresonyms.—Smith & Smith 1973: 445.—*Code*: no term.

Class-series.—In the nomenclatural hierarchy, the set of nomina ranked above the family-series, which are not fully regulated by the *Code*.—Dubois 2000: 40.—*Code*: no term.

Combination.—Any onymorph of a nomen implying association between a generic substantive and a specific or subspecific epithet, irrespective of potential other words in the binomen or trinomen.—Traditional term in zootaxonomy.—*Code*: combination.

Doxisonym.—Gr: δόξα (*doxa*), “opinion”; ἴσος (*isos*), “equal”; ὄνομα (*onoma*), “name”.—Any of two or more nomina based on different onomatophores but considered, for subjective (taxonomic) reasons, to denote the same taxon, whose inclusive extension includes both their onomatophores.—Dubois 2000: 57.—*Code*: subjective synonym.

Eugraph.—Gr: εὖ (*eu*), “well, easily”; γράφω (*grapho*), “I write”.—Correct spelling of a nomen for a given taxon in a given taxonomy.—This paper.—*Code*: correct original spelling, justified emendation, mandatory change.

Euhypse.—Gr: εὖ (*eu*), “well, easily”; ὕψος (*hupsos*), “height”.—Correct rank of a nomen for a given taxon in a given taxonomy.—This paper.—*Code*: no term.

Eunym.—Gr: εὖ (*eu*), “well, easily”; ὄνομα (*onoma*), “name”.—Correct paronym (spelling, onymorph and rank) of a nomen for a given taxon in a given taxonomy.—Dubois 2000: 54.—*Code*: no term.

Eunymorph.—Gr: εὖ (*eu*), “well, easily”; ὄνομα (*onoma*), “name”; μορφή (*morphe*), “form, shape”.—Correct onymorph of a nomen for a given taxon in a given taxonomy.—This paper.—*Code*: no term.

Exoplonym.—Gr: ἔξοπλος (*exoplos*), “disarmed”; ὄνομα (*onoma*), “name”.—Hoplonym permanently invalidated, either as a result of the Rules of the *Code* or of a specific action of the ICZN under its Plenary-Powers.—Dubois 2000: 51.—*Code*: no term.

Explicit Internal First-Reviser Action (EIFRA).—Choice of lectoprotograph of a nomen, originally published as two or more symprotographs, effected under Art. 24.2.4 by the original author(s) of the nomen, through explicit mention of the symprotographs and choice among them.—This paper.—*Code*: no term.

External First-Reviser Action (EFRA).—Choice of lectoprotograph of a nomen, originally published as two or more symprotographs, effected under Art. 24.2.3 by (a) subsequent author(s) not being original author of the nomen, through explicit mention of the symprotographs and choice among them.—This paper.—*Code*: no term.

Family-series.—In the hierarchy of classification, the highest-ranking set of nomina fully regulated by the *Code*. It includes nomina of taxa at the ranks of family, subfamily, tribe, superfamily, and any additional ranks that may be required.—Dubois 2000: 40.—*Code*: family group.

First-Reviser.—Author of a nomenclatural act modifying the status of a taxomen.—Traditional term in zoological nomenclaure.—*Code*: First Reviser.

First-user.—Person(s) to whom the first publication of an aponym is attributed.—Dubois 2000: 42.—*Code*: no term.

Genus-series.—In the nomenclatural hierarchy, the set of nomina ranked between the species-series and the family-series. It includes nomina of taxa at the ranks of genus and subgenus.—Dubois 2000: 40.—*Code*: genus group.

Heterochresonym.—Gr: ἕτερος (*eteros*), “other, different”; χρῆσις (*chresis*), “use”; ὄνομα (*onoma*), “name”.—Chresonym incorrectly used to designate a taxon (misidentification).—Dubois 2000: 59.—*Code*: no term.

Hoplonym.—Gr: ὅπλον (*hoplon*), “tool, arm, weapon”; ὄνομα (*onoma*), “name”.—Nomenclaturally available nomen according to the Rules of the *Code*.—Dubois 2000: 50.—*Code*: available name.

Implicit Internal First-Reviser Action (IIFRA).—Implicit choice of lectoprotograph of a nomen, originally published as two or more symprotographs, effected under Art. 24.2.4 by the original author(s) of the nomen, by simple use of one of the symprotographs but without mention of the other(s).—This paper.—*Code*: no term.

Internal First-Reviser Action (IFRA).—Explicit or implicit choice of lectoprotograph of a nomen, originally published as two or more symprotographs, effected under Art. 24.2.4 by the original author(s) of the nomen.—This paper.—*Code*: no term.

Isonym.—Gr: ἴσος (*isos*), “equal”; ὄνομα (*onoma*), “name”.—Any of two or more nomina based on the same onomatophore.—Dubois 2000: 57.—*Code*: objective synonym.

Lectarchaeonym.—Gr: λεκτός (*lectos*), “chosen”; ἀρχαῖος (*arkhaios*), “ancient”; ὄνομα (*onoma*), “name”.—Hoplonym resulting from one of the spellings of a nomen, originally published as two or more symprotographs, having been chosen after 1999 by discovery of an IFRA under Art. 24.2.4, thus nullifying another choice made before 2000 through an EFRA under Art. 24.2.3.—This paper.—*Code*: no term.

Lectautoneonym.—Gr: λεκτός (*lectos*), "chosen"; αὐτός (*autos*), "self, oneself"; νέος, (*neos*), "new"; ὄνομα (*onoma*), "name".—Hoplonym resulting from one of the spellings of a nomen, originally published as two or more symprotographs, having been chosen before 2000 under Art. 24.2.3 by an EFRA, but this choice having been nullified after 1999 by discovery of an anterior IFRA under Art. 24.2.4.—This paper.—*Code*: no term.

Lectonym.—Gr: λεκτός (*lectos*), "chosen"; ὄνομα (*onoma*), "name".—One of two of several allelonyms which was given precedence over the leiponym(s) by a First-Reviser action.—This paper.—*Code*: no term.

Lectoprotograph.—Gr: λεκτός (*lectos*), "chosen"; πρῶτος (*protos*), "first"; γράφω (*grapho*), "I write".—Meletograph of a nomen as chosen among symprotographs by a First-Reviser action under Art. 24.2.—This paper.—*Code*: correct original spelling.

Leiponym.—Gr: λείπω (*leipo*), "I leave, I abandon"; ὄνομα (*onoma*), "name".—One of two of several allelonyms which was not given precedence over the lectonym by a First-Reviser action.—This paper.—*Code*: no term.

Leipoprotograph.—Gr: λείπω (*leipo*), "I leave, I abandon"; πρῶτος (*protos*), "first"; γράφω (*grapho*), "I write".—Any original ameletonym among symprotonyms rejected by a First-Reviser action under Art. 24.2.—This paper.—*Code*: incorrect original spelling.

Meletograph.—Gr: μελέτη (*melete*), "attention, care"; γράφω (*grapho*), "I write".—Spelling of a nomen used intentionally in a publication.—Dubois 2000: 54 (as *meletonym*); this paper.—*Code*: no term.

Neonym. – Gr: νέος (*neos*), "new"; ὄνομα (*onoma*), "name".—Nomen established expressly to replace an already established nomen (its archaeonym), and having the same onomatophore.—Dubois 2000: 52.—*Code*: new replacement name, *nomen novum*.

Nomen.—Lat: *nomen*, "name".—Scientific name as defined by the *Code*.—Dubois 2000: 39.—*Code*: scientific name.

Nominal-series.—Any of the sets of coordinated nomina interacting for priority regarding synonymy and homonymy (species-series, genus-series, family-series or class-series).—Dubois 2000: 40.—*Code*: group of names (English); niveau nomenclatural (French).

Nothograph.—Gr: νόθος (*nothos*), "wrong, illegitimate"; γράφω (*grapho*), "I write".—Incorrect spelling of a nomen for a given taxon in a given taxonomy.—This paper.—*Code*: incorrect spelling.

Nothohypse.—Gr: νόθος (*nothos*), "wrong, illegitimate"; ὕψος (*hupsos*), "height".—Incorrect rank of a nomen for a given taxon in a given taxonomy.—This paper.—*Code*: no term.

Nothonym.—Gr: νόθος (*nothos*), "wrong, illegitimate"; ὄνομα (*onoma*), "name".—Incorrect paronym (spelling, onymorph or rank) of a nomen for a given taxon in a given taxonomy.—Dubois 2000: 54.—*Code*: no term.

Nothonymorph.—Gr: νόθος (*nothos*), "wrong, illegitimate"; ὄνομα (*onoma*), "name"; μορφή (*morphe*), "form, shape".—Incorrect onymorph of a nomen for a given taxon in a given taxonomy.—This paper.—*Code*: no term.

Onomatophore.—Gr: ὄνομα (*onoma*), "name"; φέρω (*phero*), "I bear, I carry".—Objective standard of reference of inclusive ostension whereby the taxonomic allocation of a nomen can be determined: the nomen can be potentially applied to any taxon that includes the onomatophore.—Simpson 1940: 421.—*Code*: name-bearing type.

Onymorph.—Gr: ὄνομα (*onoma*), "name"; μορφή (*morphe*), "form, shape".—Any particular association between genus-series substantive(s) and species-series epithet(s).—Smith & Pérez-Higareda 1986: 422.—*Code*: no term.

Orthochresonym.—Gr: ὀρθός (*orthos*), "right, correct"; χρῆσις (*chresis*), "use"; ὄνομα (*onoma*), "name".—Chresonym correctly used to designate a taxon.—Dubois 2000: 59.—*Code*: no term.

Parograph.—Gr: παρά (*para*), "near, beside, along"; γράφω (*grapho*), "I write".—Any of the avatars of the spelling of a nomen.—This paper.—*Code*: no term.

Parohypse.—Gr: παρά (*para*), "near, beside, along"; ὕψος (*hupsos*), "height".—Any of the avatars of the rank of a nomen.—This paper.—*Code*: no term.

Paronym.—Gr: παρά (*para*), “near, beside, along”; ὄνομα (*onoma*), “name”.—Any of the avatars (spellings, ranks or onymorphs) of a nomen.—Dubois 2000: 53.—*Code*: no term.

Paronymorph.—Gr: παρά (*para*), “near, beside, along”; ὄνομα (*onoma*), “name”; μορφή (*morphe*), “form, shape”.—Any of the avatars of the onymorph of a nomen.—This paper.—*Code*: no term.

Protograph.—Gr: πρῶτος (*protos*), “first, earliest”; γράφω (*grapho*), “I write”.—Original spelling of a nomen.—This paper.—*Code*: original spelling.

Protohypse.—Gr: πρῶτος (*protos*), “first, earliest”; ὕψος (*hupsos*), “height”.—Original rank of a nomen.—This paper.—*Code*: no term.

Protonym.—Gr: πρῶτος (*protos*), “first, earliest”; ὄνομα (*onoma*), “name”.—Original spelling, rank and, if relevant, onymorph of a nomen.—Dubois 2000: 51.—*Code*: synonym.

Protonymorph.—Gr: πρῶτος (*protos*), “first, earliest”; ὄνομα (*onoma*), “name”; μορφή (*morphe*), “form, shape”.—Original onymorph of a nomen.—This paper.—*Code*: no term.

Species-series.—In the nomenclatural hierarchy, the lowest-ranking set of nomina which are fully regulated by the *Code*, ranked below the genus-series, and which designate taxa at the ranks of species, subspecies, species aggregate and subspecies aggregate.—Dubois 2000: 40.—*Code*: species group.

Symprotograph.—Gr: σύν (*syn*), “together”; πρῶτος (*protos*), “first, earliest”; γράφω (*grapho*), “I write”.—One of two or more alternative original spellings of a nomen.—This paper.—*Code*: one of multiple original spellings.

Symprotohypse.—Gr: σύν (*syn*), “together”; πρῶτος (*protos*), “first, earliest”; ὕψος (*hupsos*), “height”.—One of two or more alternative original ranks of a nomen.—This paper.—*Code*: no term.

Symprotonym.—Gr: σύν (*syn*), “together”; πρῶτος (*protos*), “first, earliest”; ὄνομα (*onoma*), “name”.—One of two or more alternative original protonyms of a nomen.—This paper.—*Code*: no term.

Symprotonymorph.—Gr: σύν (*syn*), “together”; πρῶτος (*protos*), “first, earliest”; ὄνομα (*onoma*), “name”; μορφή (*morphe*), “form, shape”.—One of two or more alternative original onymorphs of a nomen.—This paper.—*Code*: no term.

Synonym.—Gr: σύν (*syn*), “together”; ὄνομα (*onoma*), “name”.—Any of two or more protonyms considered, either for objective (*isonym*) or for subjective (*doxisonym*) reasons, to denote the same taxon in a given taxonomy.—Traditional term in zootaxonomy.—*Code*: synonym.

Synonymy.—List of synonyms.—Traditional term in zootaxonomy.—*Code*: synonymy.

Taxomen.—Gr: τάξις (*taxis*), “order, arrangement”; Lat: *nomen*, “name”.—The permanent association between a nomen (hoplonym) and an onomatophore, allowing objective, non-ambiguous and stable allocation of nomina to taxa.—Dubois 2000: 40.—*Code*: nominal taxon.

Taxon.—Gr: τάξις (*taxis*), “order, arrangement”.—Any taxonomic unit recognized by a zoologist, whether named or not.—Meyer 1926: 127.—*Code*: taxon, taxonomic taxon.

Trinomen.—Lat: *tres*, “three”; *nomen*, “name”.—Nomen of rank subspecies, composed of three terms, the generic substantive and the specific and subspecific epithets.—Traditional term in zoological nomenclature.—*Code*: trinomen.