A portrait of Carl Linnaeus, a Swedish naturalist and taxonomist, wearing a large, curly wig and a dark coat. The portrait is the background of the slide.

Module

Introduction to Zoological Nomenclature

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History of scientific nomenclature

Taxa have always been named and classified (e.g. Greek and Roman naturalists; medieval herbalists; folk taxonomists)

- Names used by Pre-Linnaean naturalists:

- ✓ Latin
- ✓ *nomina specifica*; binominal, trinominal or even polynominal names (e.g. *Iris perpusilla saxatilis Norbonensis a caulis ferme*)
- ✓ names inconsistent and often paragraphs long serving as diagnosis, description and as key to identification
- ✓ constantly changing names

- Linnaeus' 18th century taxonomic system [cf. *Species plantarum* (1753) and *Systema naturae* (1758)]

- ✓ Latin
- ✓ *nomina trivialia*; always binominal in structure
- ✓ name divorced from diagnosis and description
- ✓ minimization of classification

History of nomenclature?

Why nomenclature

On name changes

Ruling principles of nomenclature

- No science
- Typification
- Priority
- Synonymy
- Homonymy

Requirements of availability?

What's in a name?

Other systems



- 1758 Formal starting point = 10th Edition of Linnaeus's *Systema Naturae* (also Clerck's *Aranei Svecici*)
- 1842 Strickland Code (botany and zoology)
- 1889 First ICZ meeting (Paris); tentative adoption of a set of rules
- 1901 Fifth ICZ meeting (Berlin); "Rules of Zoological Nomenclature"; published as *Règles Internationales de la Nomenclature Zoologique* (French, English & German)
- 1961 First edition of the Code of Zoological Nomenclature
- 1964 Second edition
- 1985 Third edition (glossary added; French = English)
- 1988 Launch of fourth edition project
- 1995 Draft of fourth edition released by Secretariat
Distribution of hard copies; Discussion forum on internet; New concepts and provisions published in *Bull. Zool. Nomenclature*
- 1999 Fourth edition (current edition)
Takes effect from 1 January 2000; Cladists already perceive it as too prescriptive (taxa and their names forced in arbitrary ranks of Linnean hierarchy) and too permissive (applies also to non-monophyletic groups)

Why nomenclature?

background observations & definitions

- ✓ Living world is divided in groups of organisms: *taxa*
- ✓ Taxa are arranged in a series of levels: *taxonomic hierarchy*
- ✓ Levels of the taxonomic hierarchy, the *taxonomic ranks*, are named: *e.g.* genus, family, order, class, phylum
- ✓ Taxa at the same level belong to the same *taxonomic category*
- ✓ *Nomenclature* is the part of taxonomy that assigns names to these groupings, according to sets of rules called *the codes of nomenclature*

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Why nomenclature?

the Codes

- ✓ Greuter, W., et al. (eds), 2000. International Code of Botanical Nomenclature (St Louis Code). Regnum Vegetabile 138. Koeltz Scientific Books, Königstein.
- ✓ Trehane, P., et al. (eds). 1995. International Code of Nomenclature for Cultivated Plants. Adapted by the International Committee for the Nomenclature of Cultivated Plants of the I.U.B.S. Regn. Veget. 133.
- ✓ Sneath, P.H.A., et al. (eds), 1992. International Code of Nomenclature of Bacteria. Washington (+ : Skerman, V.D.B. et al., 1980. Approved Lists of Bacterial Names).
- ✓ International Commission on Zoological Nomenclature, 1999. International Code of Zoological Nomenclature, 4th edition. Adopted by the I.U.B.S. The International Trust for Zoological Nomenclature, London.

History of nomenclature?

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Avoiding a Tower of Babel

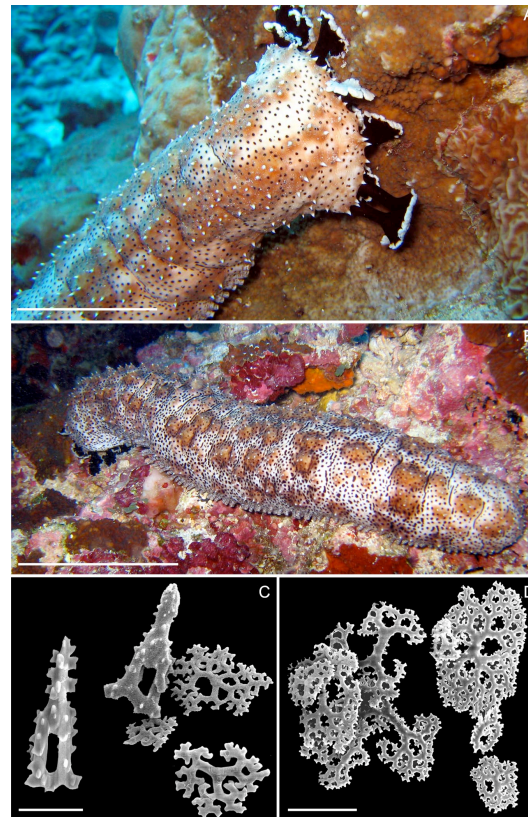
“The objects of the Code are to promote stability and universability in the scientific names of animals and to ensure that the name of each taxon is unique and distinct.

All its provisions and recommendations are subservient to those ends and none restricts the freedom of taxonomic thought or actions”

(ICZN 1999:2)

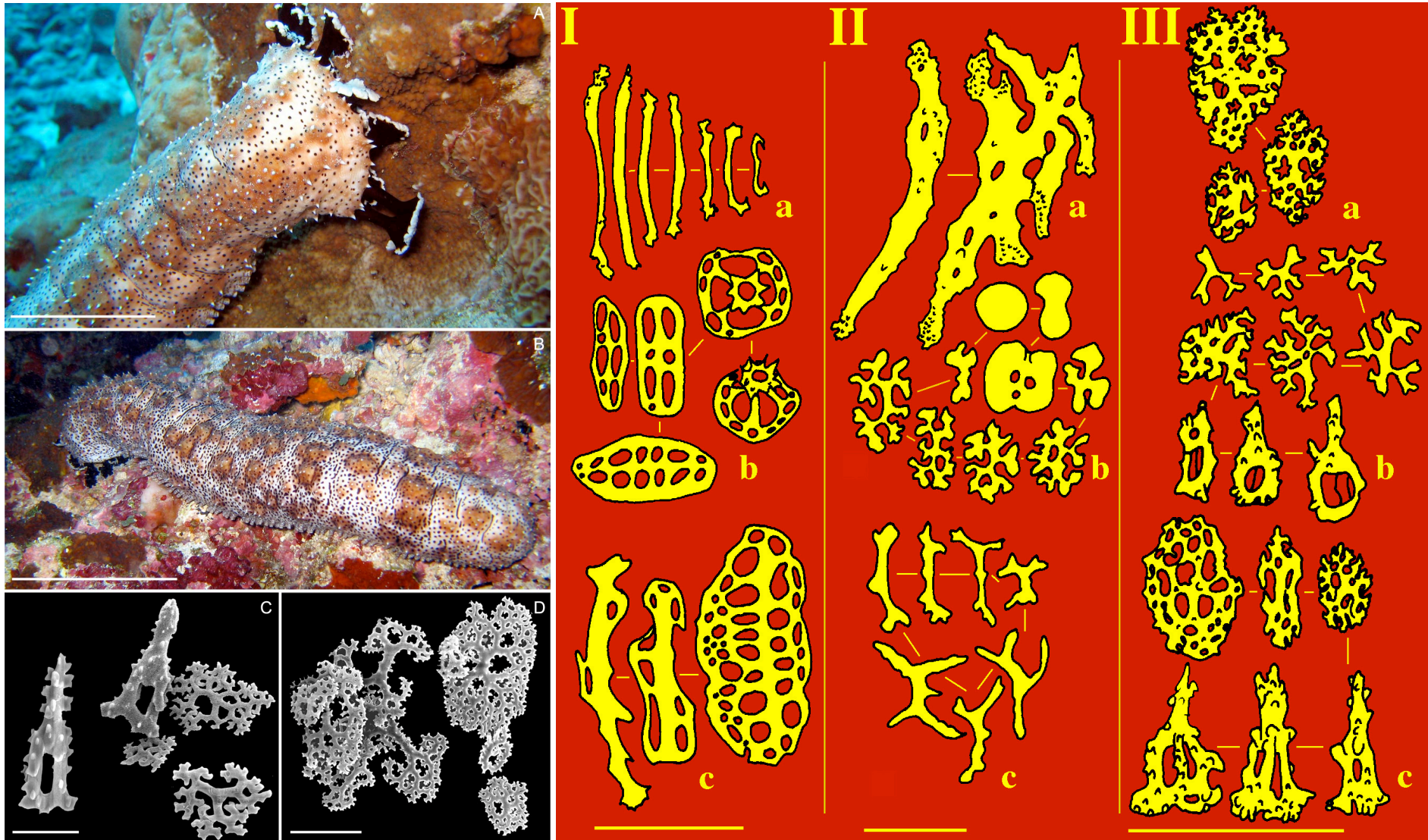
But why do names change?

1. Scientific research leads to improvement in the understanding of relationships (e.g. transfer of species to the more correct genus)



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But why do names change?



Holothuria graeffei Semper, 1868 => *Bohadschia graeffei* (Semper, 1868) => *Pearsonothuria graeffei* (Semper, 1868)

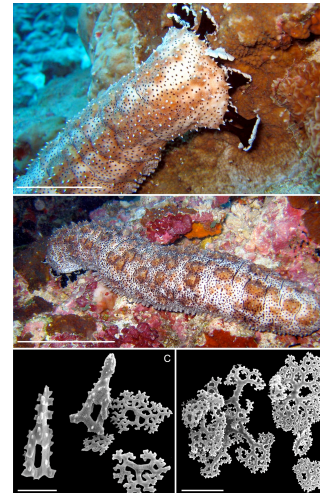
But why do names change?

1. Scientific research leads to improvement in the understanding of relationships (e.g. transfer of species to the more correct genus)

Holothuria graeffei Semper, 1868

Bohadschia graeffei (Semper, 1868)

Pearsonothuria graeffei (Semper, 1868)



2. Application and use of nomenclatural rules (e.g. correction of errors, homonym discovery) (e.g. *H. gräffei* Semper, 1868 => *H. graeffei* Semper, 1868)

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But why do names change?

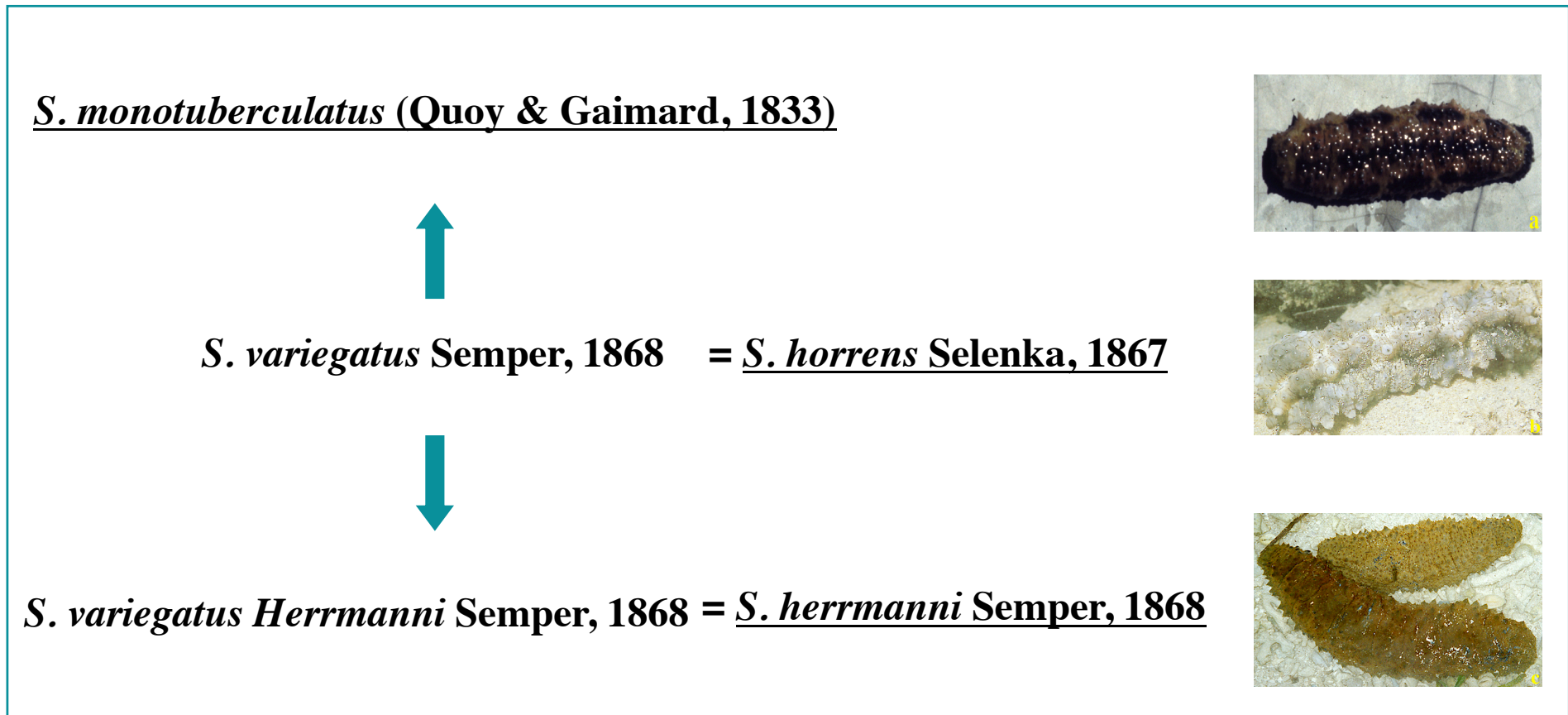


Fig. *The Stichopus variegatus* problem. Valid names are underlined. a. *S. monotuberculatus*; b. *S. horrens*; c. *S. herrmanni*. Photo's (a) & (c) Y. Samyn; (b); from Guille *et al.*, 1986.

Ruling principles of nomenclature

Only a tool! Not science!!!



Taxonomy = science

The taxonomist decides on the utilised principles (e.g. cladistics or phenetics); science knows no authority

Nomenclature = tool

Taxonomists artificially produce names; no science involved, so rules can be imposed on this process

Nomenclature only follows taxonomy

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Ruling principles of nomenclature

Only a tool! Not science!!!

Nomenclature can easily be regulated by ruling principles

- Principle of Typification (Identity of a name relies on its type, not on its description)
- Principle of Priority (“the oldest fool is always right”)
- Principle of Synonymy (1 taxon can only have one name)
- Principle of Homonymy [1 name can apply to only 1 taxon (but see independence of codes)]

But!

- Interpretation and administration
- No “case-laws”

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Ruling principles of nomenclature

Principle of typification

Art. 61.1. Each nominal taxon in the family, genus or species groups has actually or potentially a name-bearing type. The fixation of the name bearing type of a nominal taxon provides the objective standard of reference for the application of the name it bears.

61.1.1. The valid name from a taxon is determined only from the name-bearing type(s)

61.1.2. Objectivity through typification is continuous through the hierarchy of names, from species to family group

61.1.3. Name-bearing types (generally) are stable and provide objective continuity in the application of names

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Ruling principles of nomenclature

Principle of typification

⇒ Types are international standards for scientific names

⇒ Identity of a name relies only on its type, not on its description or diagnosis

Note: The principle of typification has nothing to do with typological thinking!

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Ruling principles of nomenclature

Sorts of types (in the species group)

Original designation
(fixed in the original publication)



Subsequent designation
(fixed in a subsequent publication)

Holotype: the single specimen upon which a new species-group taxon is based in the original publication

Paratypes: remaining specimens of the original type series (see also allotype, isotype)

Syntypes: specimens of a type series that collectively constitute the name-bearing type

Hapantotypes: (special case for protistans; see Art. 73.3)

Lectotype: a syntype designated as the single-name bearing type specimen, after the establishment of a nominal species or subspecies (except hapantotypes)

Paralectotypes: each specimen of the former syntype series remaining after lectotype designation (see also isolectotype)

Neotype: the single specimen designated as the name-bearing type when no name-bearing type specimen (i.e. holotype, lectotype, syntype or prior neotype) is believed to be extant.

Ruling principles of nomenclature

Sorts of types (in the species group)

Terms not regulated or recognised by the Code

Allotype: a designated specimen of opposite sex of the holotype

Cotype: a term formerly used for either syntype or paratype

Genotype: a term formerly used to designate the holotype

Topotype: a term formerly utilised for a specimen originating from the type locality (the geographical place of capture, collection or observation of the name-bearing type of a nominal species or subspecies) of the species or subspecies to which it is thought to belong, whether or not the specimen is part of the type series

Isotype: duplicate material of the holotype, collected at the same time and place by the same collector (botany)

For typification in the family group (see chapter 14 ICZN)

For typification in the genus group (see chapter 15 ICZN)

For typification in the species group (see chapter 16 ICZN)

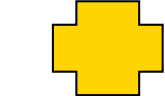
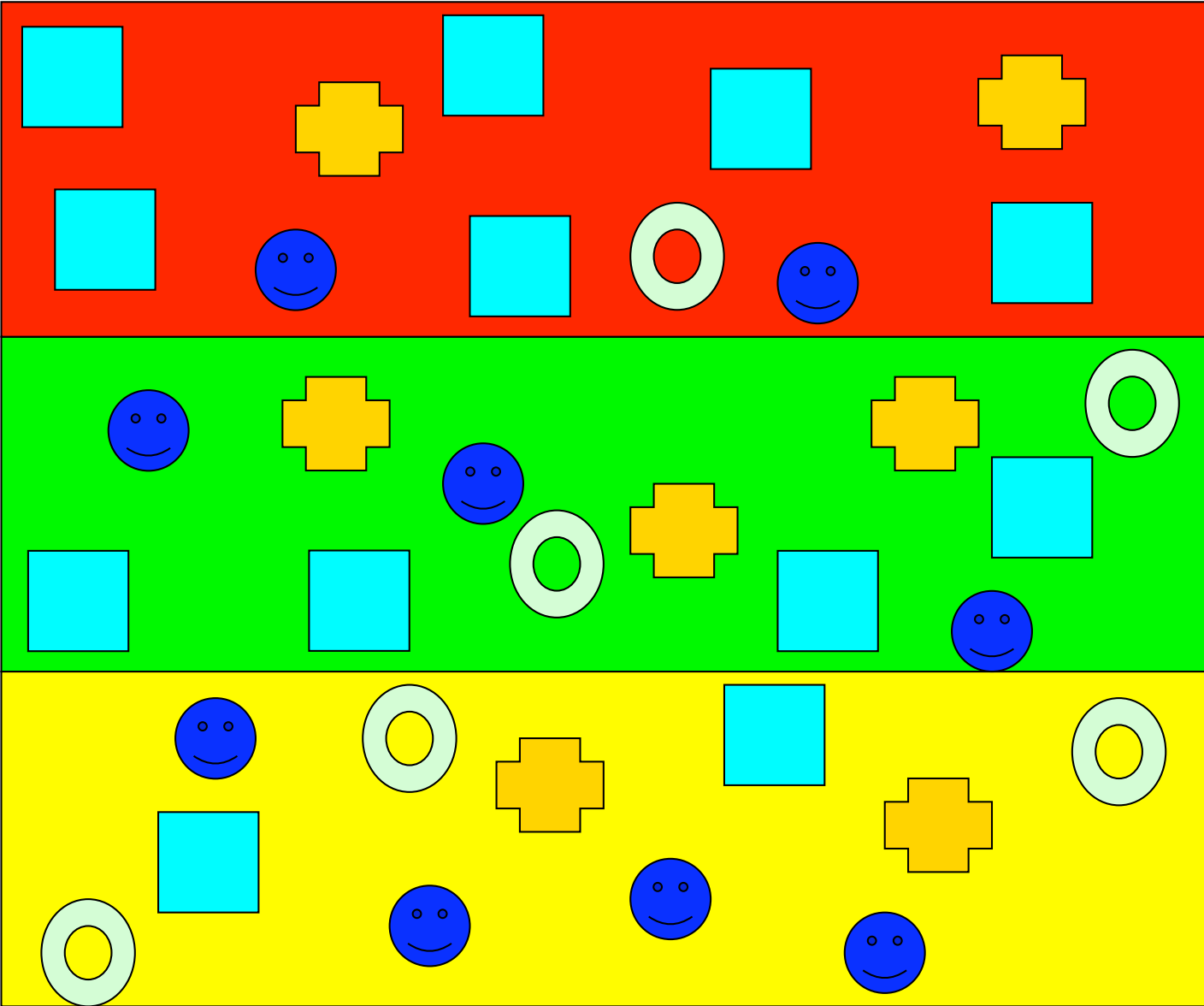
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Field situation

 *Location 1*

 *Location 2*

 *Location 3*



Species 1



Species 2

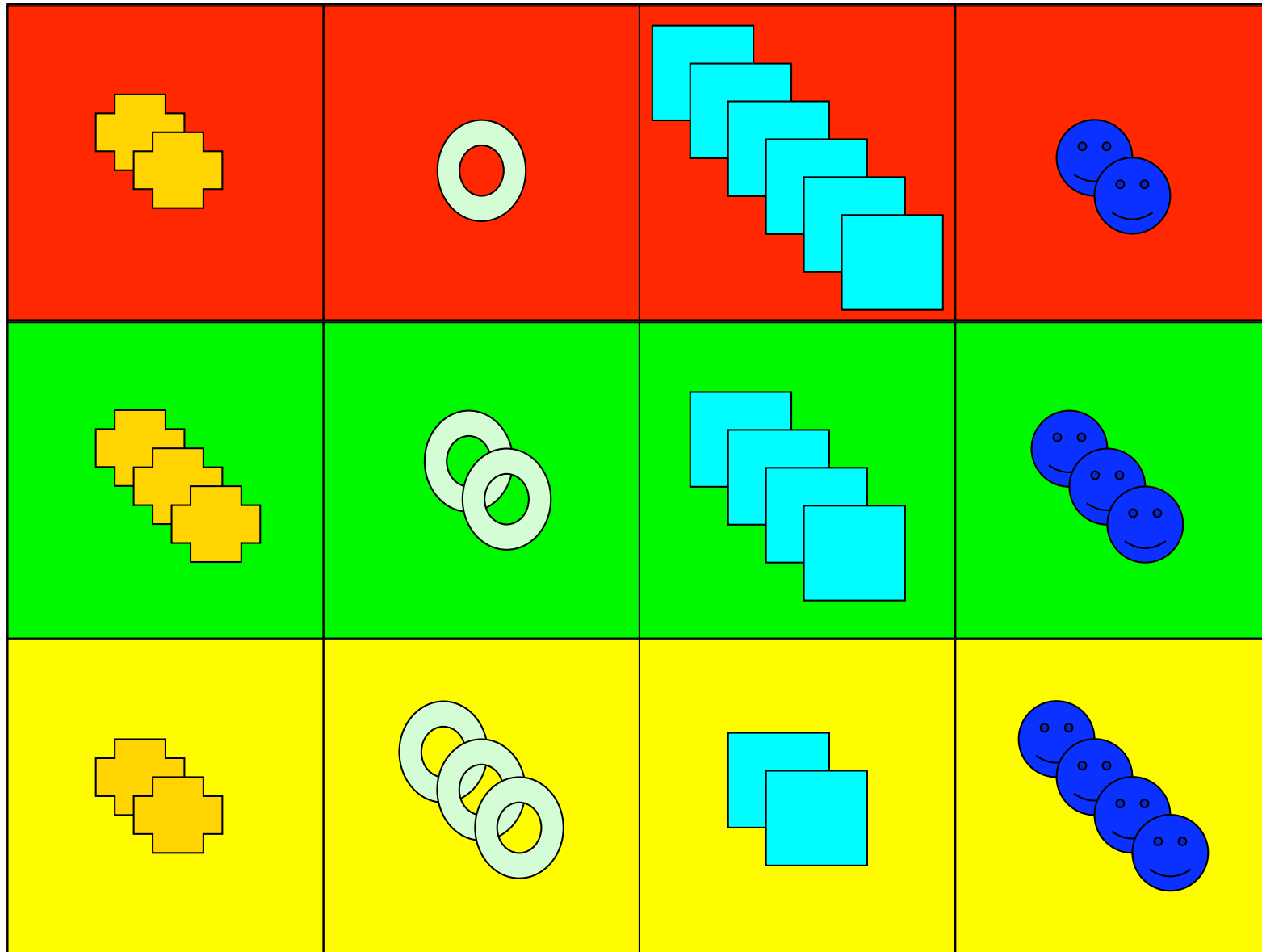


Species 3



Species 4

Taxonomic situation



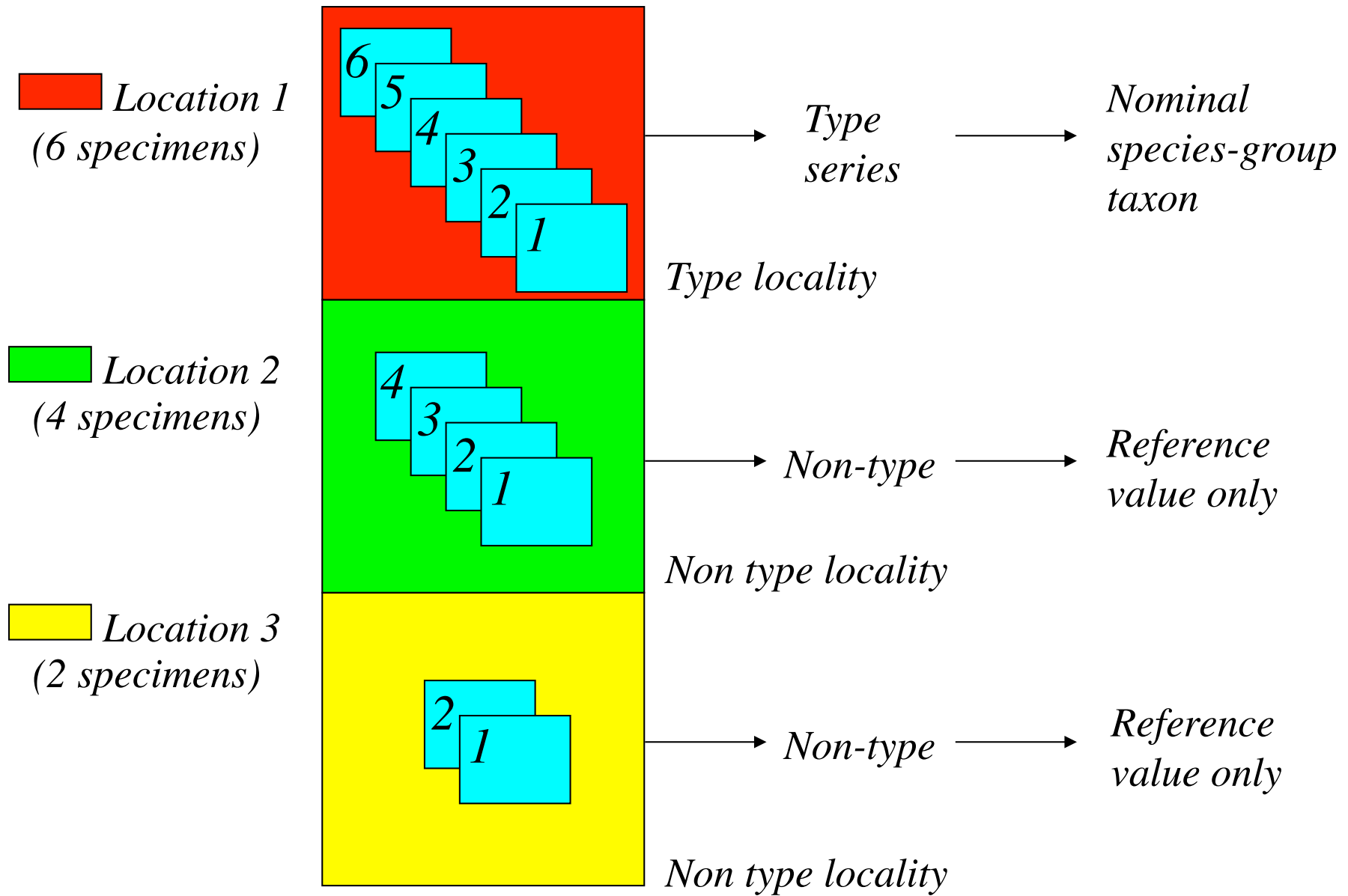
↓
known species

↓
known species

↓
new species

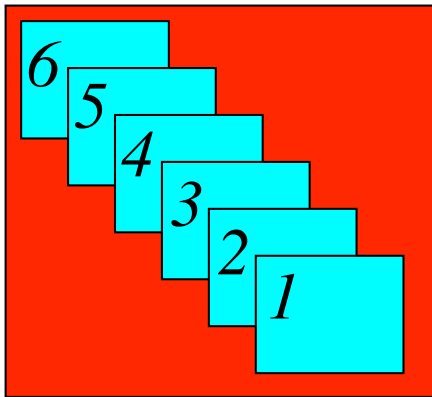
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known species

Taxonomic situation

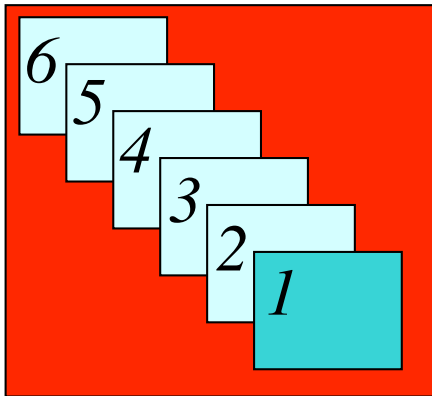


Nomenclatural situation

original designation



***Syntypes:** all the specimens in the type series that collectively constitute the name-bearing type.*

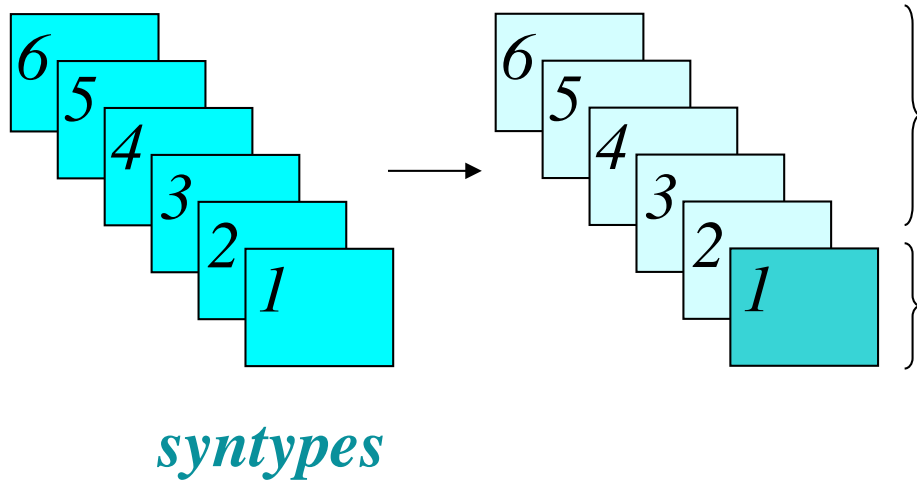


***Paratypes:** remaining specimens of the original type series*

***Holotype:** the single specimen upon which a new species-group taxon is based*

Nomenclatural situation

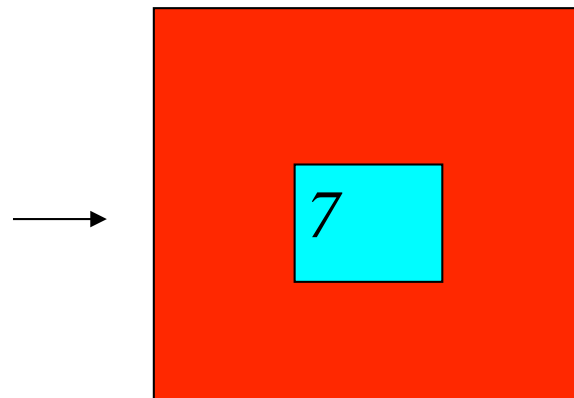
Subsequent designation



***Paralectotypes:** each specimen of the former syntype series remaining after lectotype designation*

***Lectotype:** one of the syntypes designated as the single-name bearing type specimen*

all name-bearing types lost



***Neotype:** the single specimen designated as the name-bearing type when no name-bearing type specimen (i.e. holotype, lectotype, syntype or prior neotype) remains. Specimen as near as possible from type locality.*

Ruling principles of nomenclature

Principle of typification by example

Genus *Pinus* Linnaeus, 1753 (pine trees)

Taxonomy: five distinct genera

Genus 1 : *P. cedrus*

Genus 2 : *P. larix*

Genus 3 : *P. picea*, *P. balsamea*

Genus 4 : *P. abies*

Genus 5 : *P. sylvestris*, *P. pinea*, *P. cembra*, *P. strobus*, *P. taeda*

Q: Who's the real *Pinus*?

Type of *Pinus* = *P. sylvestris*; hence Genus 5

Others: new genus names (*Cedrus*, *Larix*, *Picea* and *Abies*, respectively)

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Ruling principles of nomenclature

Principle of priority

Basic aim of zoological nomenclature is to get stable and universal scientific names

Availability & Validity

Name to be used = valid name

Valid name is chosen from available names

THUS:

- Available name can be valid or not
- Unavailable name can never valid

Availability exists under (*all*) strict conditions (cf. Chapter 4: Criteria of availability):

e.g.

- Date of publication
- Format of name
- Format of description

Principle
of
Priority
(or usage)

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Ruling principles of nomenclature

Principle of priority

Principle of Priority (Art. 23)

Art. 23.1. The valid name of a taxon is the oldest available name applied to it, unless that name has been invalidated or another name is given precedence by any provision of the Code or by any ruling of the Commission

- Validity of synonyms
- Relative precedence of homonyms
- Correctness of spellings
- Validity of nomenclatural acts
 - Principle of first reviser
 - Fixation of name-bearing types

But with recognition of the purpose of the Code, *i.e.*
STABILITY

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Ruling principles of nomenclature

Principle of priority
Availability exemplified

Two distinct species are recognised; how to name them?



Name given:

Holothuria scabra var. *versicolor* Conand, 1986

Later raised to

Holothuria scabra *versicolor* Conand, 1986



Name given:

Holothuria scabra Jaeger 1833

The name *versicolor* is however not available (art 15.2) and cannot be made available by subsequent action (art 45.5)

Ruling principles of nomenclature

Principle of priority

An example



Holothuria scabra var. *versicolor* Conand, 1986 is a *nomen nudum*

Which name to use?

The first available (=oldest or senior) synonym:

Holothuria timana Lesson, 1830

But this name has been suppressed by the ICZN (Opinion 762)

Which name then?

The next available subjective synonym

Holothuria tigris Brandt, 1835 harms stability

Holothuria aculeata Semper, 1868?



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Ruling principles of nomenclature

Principle of priority

An example

Holothuria aculeata Semper, 1868?



Holothuria aculeata Semper, 1868



Holothuria sp. nov.

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Ruling principles of nomenclature

Principle of synonymy

Synonym: each of two or more names of the same rank used to denote the same taxonomic taxon (2 or more names = 1 taxon)

- *Nomenclatural* (= *objective, homotypic*) synonyms (e.g., replacement names: *nomina nova* (arts 67.8; 72.7, ...))
- *Taxonomic* (= *subjective, heterotypic*) synonyms (most common)
- Junior synonym: the latter of the synonyms established
- Senior synonym: the earlier of the synonyms established

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Ruling principles of nomenclature

Principle of synonymy exemplified



Subjective synonym (each of two or more names whose synonymy is only a matter of individual opinion)

Holothuria decorata Marenzeller, 1882
Holothuria fasciola Quoy & Gaimard, 1833
Holothuria flammea Quoy & Gaimard, 1833
Stichopus flammeus Brandt, 1835
Holothuria fuscopunctata Quoy & Gaimard, 1833
Stichopus gyriifer Selenka, 1867
Holothuria hilla Lesson, 1830
Labidodemas leucopus Haacke, 1880
Holothuria macleari Bell, 1884
Holothuria minax Théel, 1886
Holothuria monacaria Lesson, 1830
Labidodemas neglectum Haacke, 1880
Holothuria ondatjei Bell, 1887
Holothuria umbrina Rüppell & Leuckart, 1828
Holothuria zihuatanensis Caso, 1964

“*Oldest fool*” →

Ruling principles of nomenclature

Principle of synonymy exemplified



Objective synonym (each of two or more different names applied to one and the same taxon based on the same type)

Penaeus setifer (Linnaeus, 1767)

Cancer setiferus Linnaeus, 1767

Astacus setiferus (Linnaeus, 1767)

Cancer (Gammarellus) setiferus Linnaeus, 1767

“*Objective synonym*”



Penaeus fluviatilis Say, 1818 (an objective synonym of *Cancer setiferus* L., 1767, through the type selection by Holthuis, 1964, Bull. zool. Nomencl., 21(3):233).

Ruling principles of nomenclature

Principle of homonymy

Homonym (in the species group): each of two or more available specific or subspecific names having the same spelling which were established for different nominal taxa (1 name = 2 or more taxa)

- Originally combined with the same generic name (Primary homonym)
- Subsequently combined with the same generic name (Secondary homonym)

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Ruling principles of nomenclature

Principle of homonymy exemplified in the genus group

Argus Bohadsch, 1761(gastropod);
Argus Scopoli, 1763 (butterfly);
Argus Scopoli, 1777 (butterfly);
Argus Poli, 1791 (mollusk);
Argus Temminck, 1807 (bird);
Argus Lamarck, 1817 (hesperid);
Argus Boisduval, 1832 (lycaenid);
Argus Walckenaer, 1836 (arachnid);
Argus Gray, 1847(mollusk);
Argus Gerhard, 1850 (lycaenid)

Only the original name is valid,
all the rest are homonyms

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Ruling principles of nomenclature

Principle of homonymy

An example in the species group



Lecane ornata (Harring & Myers, 1926)

Lecane ornata (Daday, 1897) [recognised as
synonym of *L. ludwigii* (Eckstein, 1883)]

Problem: Availability of name *L. ornata*!

What name for *L. ornata* (Harring & Myers,
1926) non (Daday, 1897)?



No “Oldest fool” available!

***Nomen novum* required:**

Solution: *L. myersi* Segers, 1993

Ruling principles of nomenclature

Synonyms & homonyms

Synonyms: 2 or more names = 1 taxon

Homonyms: 1 name = 2 or more taxa

Who's right?

Principle of Priority:

“the oldest fool is always right”

But This Can Cause Problems

The commission can intervene!

(nomina rejicienda, conservanda)

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Requirements of availability for names

- Name or nomenclatural act must be *Published*;
- Scientific names must be spelled using the 26 letters of the *Latin Alphabet*;
- Consistent application of *binominal nomenclature* in the work in which the new name or nomenclatural act is published;
- *Derivation*: a name may be derived from any language, or even an arbitrary combination of letters if this is formed to be used as a word (not cbafdg);

=> lots of freedom allowed!

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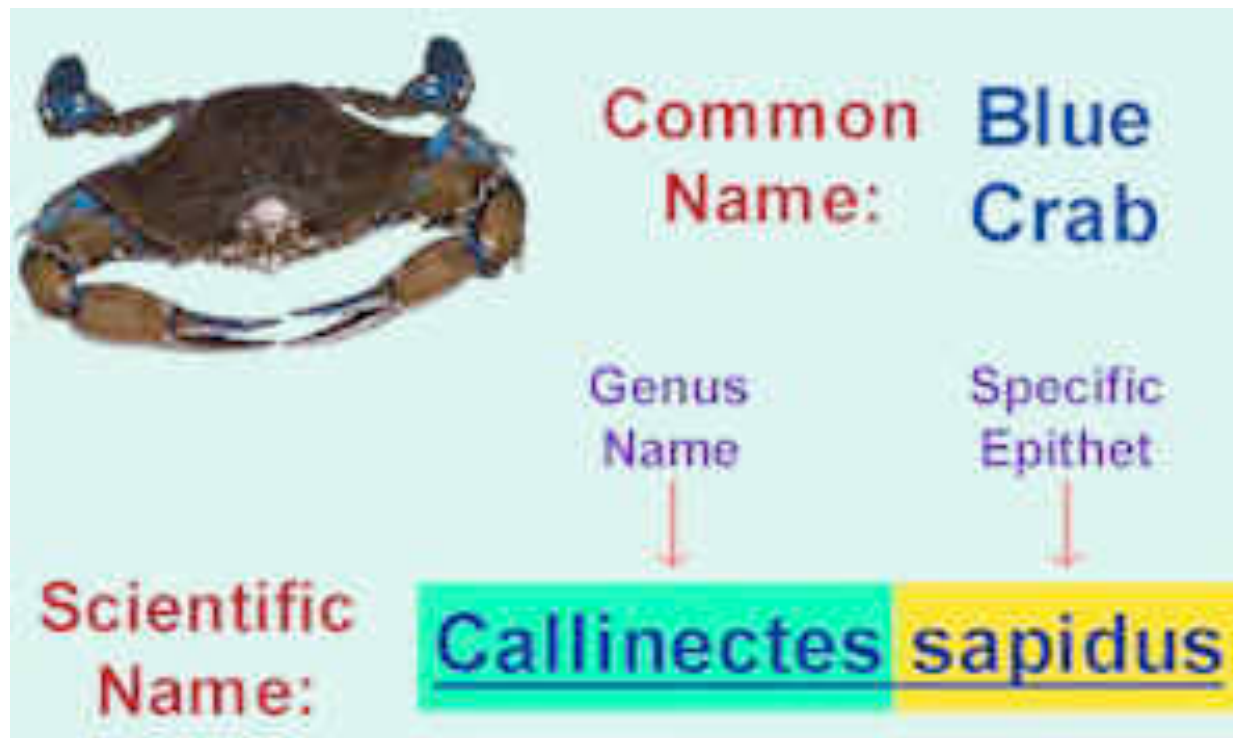
Requirements of availability for names

- Names to be used as valid when proposed
- Publication of a name as a synonym does not thereby make the name available;
- **New requirements for species-group names published after 1999:**
 - **Explicit indication of name as intentionally new**
(n.sp., gen. nov., nom. nov.,...)
 - **Fixation of name-bearing types explicit designation & deposition**

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What's in a name?

- Names of taxa above species:
uninominal: e.g., Stichopodidae, *Thelenota*
- Names of species are binomial



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What's in a name?



Original name: *Mülleria nobilis* Selenka, 1867

... with corrected spelling: *Muelleria nobilis* Selenka, 1867

Transferred to other genus: *Holothuria nobilis* (Selenka, 1867)

When subgenus is added, remains a binomen:

Holothuria (Microthele) nobilis (Selenka, 1867)

Or short: *Holothuria (M.) nobilis* (Selenka, 1867)

- **Or shorter:** *H. nobilis*

What's in a name?



From: *Monostyla closterocerca* Schmarda, 1853

To: *Lecane (Monostyla) closterocerca* (Schmarda, 1853)

Or even (Recommendation 51 G):

Lecane (Monostyla) closterocerca (Schmarda, 1853)

Edmondson, 1935

To the trinomen

Lecane (Monostyla) closterocerca amazonica Koste, 1972

non Murray, 1913



What's in a name?

Nomenclature as a metalanguage

Scientific names are Latin

Rules of Latin linguistics apply:

e.g. agreement in gender

Thyonidium magnum Ludwig, 1882

Phyllophorus magnus; Ludwig 1889-92

Neothyonidium magnum; Heding & Panning
1954

Massinium magnum; Samyn & Thandar 2003

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What's in a name?

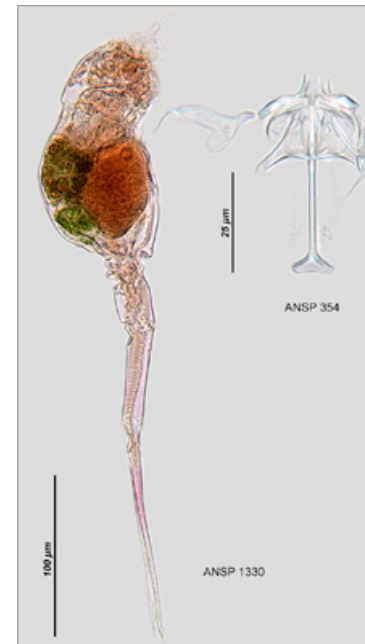
Nomenclature as a metalanguage

Formation of species names:

After **features**: adjectives

e.g.:

- *Lepadella minuta*
- *Scaridium grande*
- *S. longicaudum*
- *Brachionus bidentatus*
- *Keratella taurocephala*



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What's in a name?

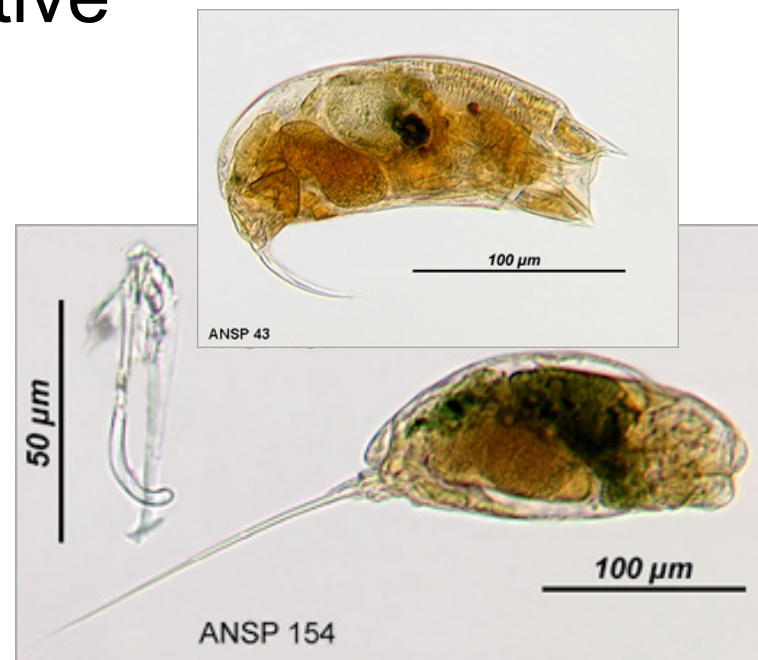
Nomenclature as a metalanguage

Formation of species names:

After **features**: adjectives

After **other species**: noun in apposition, adjective

e.g., *Trichocerca tigris*,
T. rattus, *T. cavia*, *T. mus*, *T. musculus*, *T. porcellus*, *T. orca*.
also: *Seison nebaliae*.



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 - No science
 - Typification
 - Priority
 - Synonymy
 - Homonymy
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Nomenclature as a metalanguage

Formation of species names:

After **features**: adjectives

After **other species**: noun in apposition, adjective

After **people**: noun in genitive case

- one man: *Lecane dumonti* or *L. ludwigii*
- one woman: *Lecane robertsonae*
- several man/woman: *L. gallagherorum*
- several woman: stem + *arum*

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Formation of species names:

After **features**: adjectives

After **other species**: noun in apposition, adjective

After **people**: noun in genitive case

After **places**: adjectival toponym

e.g., *Lecane papuana*

Brachionus budapestinensis

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Nomenclature as a metalanguage

Formation of species names:

no diacritic or other marks,
ligature, apostrophes, etc....:

- *Trichocerca dixon-nutalli* becomes *T. dixonnutalli*;
- *Dicranophorus lütkeni* becomes *D. luetkeni*;
- *Filinia novaezaelandiae*;
- (ñ becomes n, ø becomes o, ...)

But

- *Zygiella x-notata*
- *Polygonia c-album*



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Some examples

One-letter difference:

Genus ***Eucosma*** (Moths, Northern Mexico:
Kearfoot, 1907)

<i>E. fandana</i>	<i>E. sandana</i>
<i>E. gandana</i>	<i>E. tandana</i>
<i>E. handana</i>	<i>E. vandana</i>
<i>E. kandana</i>	<i>E. wandana</i>
<i>E. mandana</i>	<i>E. xandana</i>
<i>E. nandana</i>	<i>E. yandana</i>
<i>E. pandana</i>	<i>E. zandana</i>
<i>E. randana</i>	



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More examples

Fun with Latin:

Stupidogobius Aurich, 1938 (stupid fish)

Ytu brutus Spangler, 1980 (waterbug)

Localities:

Panama canalia Marsh, 1993 (braconid)

Alabama Grote, 1895 (butterfly)

Australia Girault, 1928 (parasitic wasp);

Babylonia Schlulter, 1838 (mollusk);

Cuba Dyar, 1919 (butterfly);

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And still more examples

Mythology:

Zeus Linnaeus, 1758 (fish), *Kali* Lloyd, 1909 (fish)
Satan Hubbs & Bailey, 1947 (fish),...

Persons (“honorifics”):

Cartwrightia cartwrighti Cartwright, 1967 (scarab)
Hoia hoi (parasitic copepod), after Ju-Shey Ho
Leonardo davincii Bleszynski, 1965 (pyralid butterfly)
Muscatheres Evenhuis 1986 (“there are only 3
Muscatheres known”)

But also:

Dyaria Neumoegen, 1893 (liparid butterfly) after Mr. Dyar.

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Reaching the absurd

Games with letters/statistics:

Aa Baker, 1940 (mollusk)

Aaadonta Solem, 1976 (endodontoid slug)

Cavaticovelia aaa Gagne, 1975 (Hawaiian bug)

Aragara Walker, 1860 (fly; longest palindrome)

Ia io Thomas, 1902 (bat; shortest binomen)

Gammaracanthuskytodermogammarus

loricatobaicalensis Dybowski, 1926 (amphipod; the longest binomen)

Zyzyxdonta Solem, 1976 (endodontoid slug,

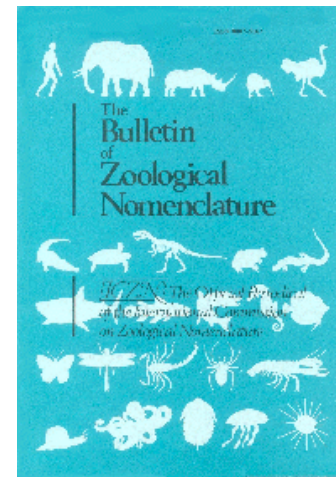
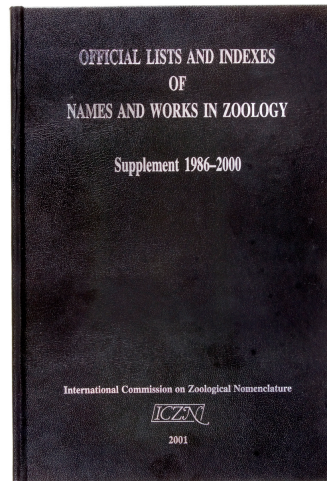
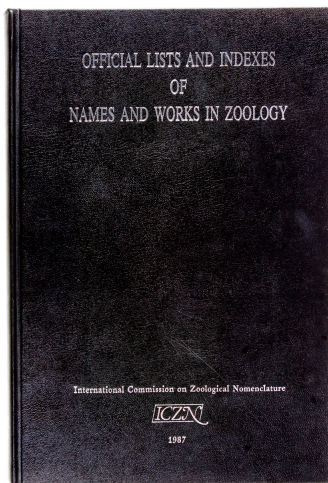
with opposite features of *Aaadonta*)

Zyzyzus Stechow, 1921 (Coelenterata)

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Read more on:

- <http://www.iczn.org/>
- <http://scientific.thomson.com/support/products/zr/zoological-glossary/>
- [Zoobank](#)
- [Funny names](#)



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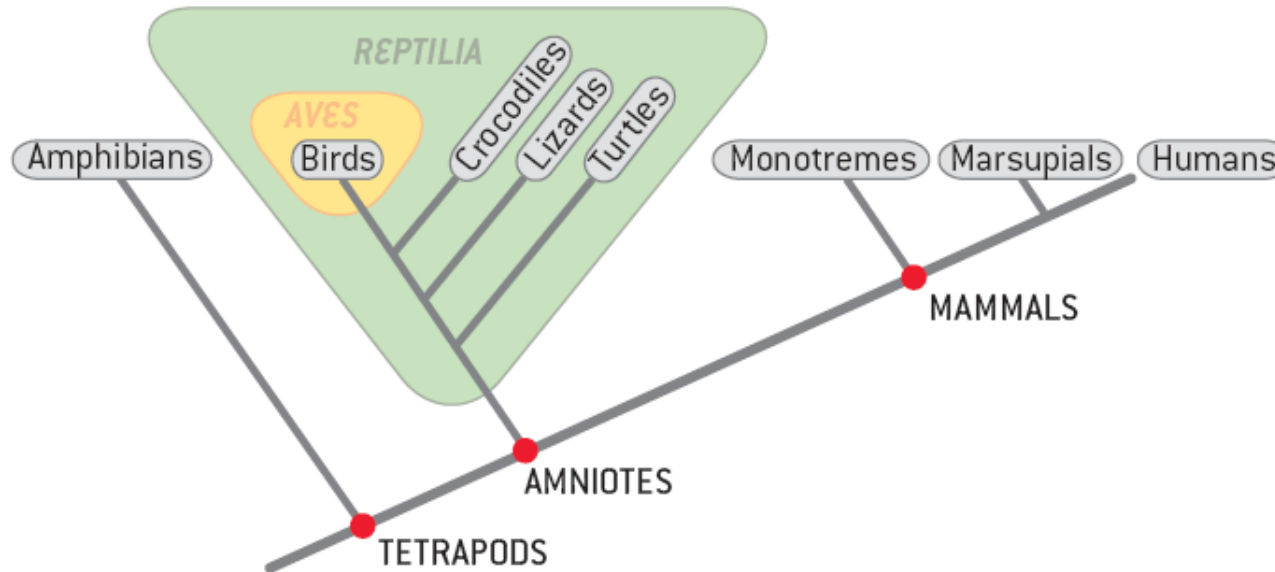
Also consider this: the 'Phylocode'?

It is a Code that dwells on the philosophy that:

- no equivalency exists between different taxa (species perhaps excluded)
- the only objective truth is the historical reality of phylogeny
- measures of morphological distinctiveness used to ascribe rank must be excluded
- names must reflect clades

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the 'Phylocode'?



PHYLOCODE might put birds in a “clade” named *Aves*, within a larger *Reptilia* clade that encompasses a reptile ancestor and all its descendants. Current classification makes birds and reptiles separate, equal “classes.”

Claims to:

- bring more stable names than those under the Linnean system
- Read more at <http://www.phylocode.org>

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Thank you for
your attention