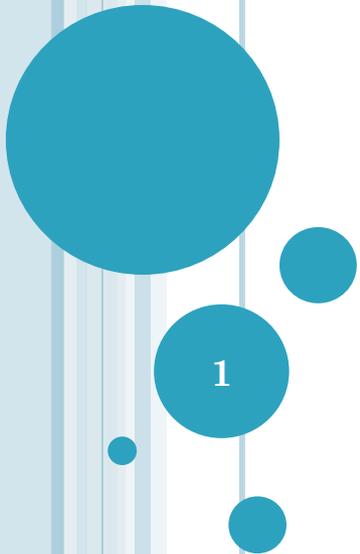


Spring 2020

Nomenclature and taxonomy.



Taxonomy, Systematics, & Nomenclature

THEORY, HYPOTHESIS, METHODS



Why?- We need to understand biodiversity

TOOLS, COVENTIONS



Why?- Practical use, information sharing

THEORY, HYPOTHESIS, METHODS



Scientific approach,
evidence

TOOLS, COVENTIONS



Scholarship,
infrastructure

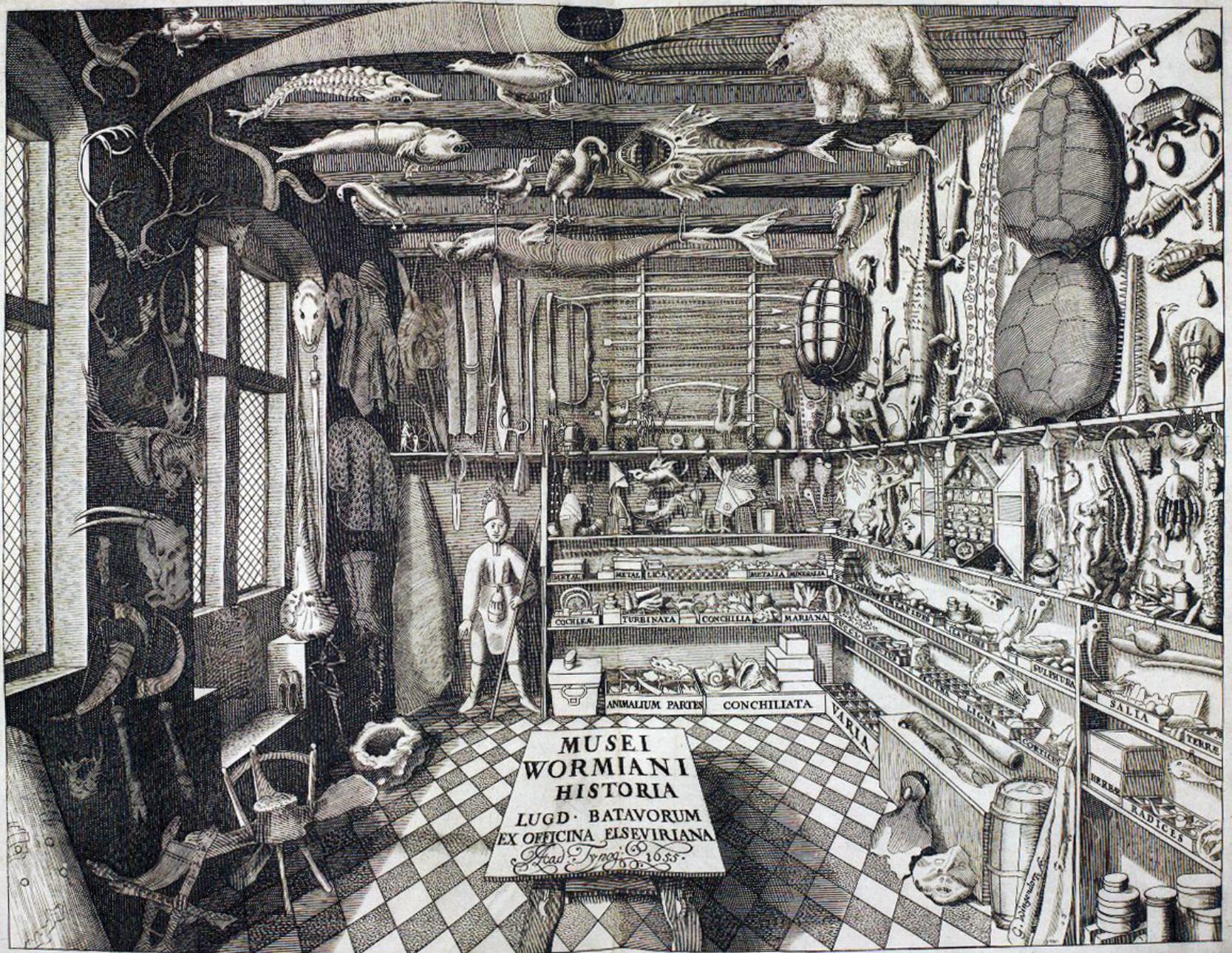
Taxonomy, Systematics, & Nomenclature

Nomenclature.

"Nomenclature is the system of scientific names for taxa (such as species, genera, or families) and the rules and conventions for the formation, treatment, and use of those names. It follows an internationally agreed, quasi-legal procedure."

Why regulate names?

What do we want to do with names?



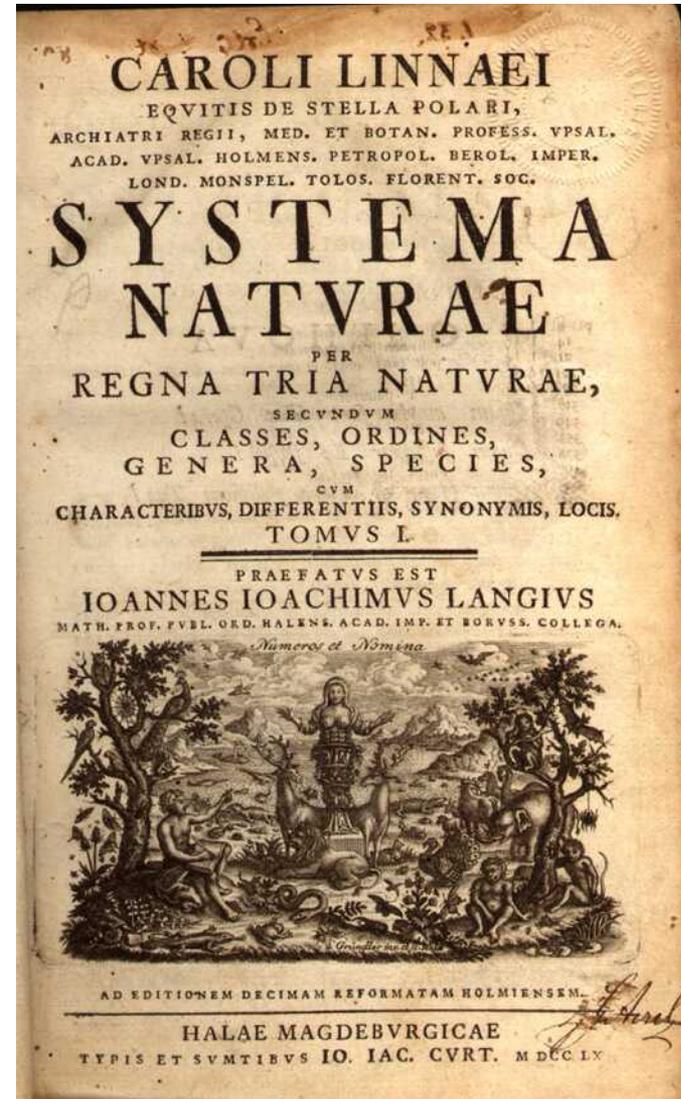


Carl von Linné
Painting by P. Krafft, 1774

Carolus Linnaeus

Species Plantarum 1753

Systema Naturae 1758



12. FELIS. *Dentes Primores æquales.*
Molares terni.
Lingua retrorsum aculeata.
Ungues retractiles.

Leo. 1. F. cauda elongata, corpore helvulo.
Felis cauda elongata floccosa, thorace jubato. Syst.
nat. 6. p. 4. n. 1.
Leo. Gesn. quadr. 572. Aldr. dig. 2. Jonst. quadr. 72.
Dodart. act. 1. t. 1. & 7. t. 7. Raj. quadr. 162.
Habitat in Africa.
Color luteo-rufus. Fons quadrata. Cor maximum. Ma-
ris Thorax hirsutus Caudaque floccosa.
Segnis, esuriens prædatur de Equis et majoribus quadru-
pedibus, nec nisi famelicus homine; fugatur accensa
flamma; canibus coercetur. Retro mingit & coitit
Rugitus horrendus a tracheæ annulis integris im-
bricatis.
Anatome. E. N. C. d. 1. a. 2. obf. 6. Barth. act.
1671. n. 17.

Tigris. 2. F. cauda elongata, corpore maculis omnibus virgatis.
Syst. nat. 4. n. 2.
Tigris. Gesn. quadr. 936. Aldr. dig. 101. Jonst. quadr.
84. Bont. jav. 52. t. 53. Raj. quadr. 165.
Habitat in Asia.
Magnitudo Leonis. Maculæ virgatæ, transversæ. Pul-
cherrimum animal tremendæ velocitatis, homini pess-
imus, desolat indos; Mas occidit proprios filios.
Anatome. E. N. C. d. 1. a. 2. obf. 7. & a 9. obf. 194.

Binomial names

Decoding a name

For first use add author & year where appropriate (if in doubt ask editor)

Genus upper case

Epithet lower case

Author & year in parentheses if originally described in different genus (ICZN)

Pterostichus californicus (Dejean 1828)

- Use Genus + epithet, no “naked” epithets.
- Set off from text. Usually italics or underline.
- Names are formed in taxonomic Latin

P. californicus

After first use in text, when clear, genus can be abbreviated. Do not start sentences with abbreviation.



Introductory pages

Preamble

Division I. Principles

Division II. Rules and Recommendations

Division III. Provisions for governance

Glossary

Indices

Appendices I-VII

How to cite the *Code*

INTERNATIONAL CODE OF
NOMENCLATURE
FOR
ALGAE, FUNGI, AND PLANTS
(SHENZHEN CODE)
2018



International Code of Nomenclature for algae, fungi, and plants

The *International Code of Nomenclature for algae, fungi, and plants* is the set of rules and recommendations that govern the scientific naming of all organisms traditionally treated as algae, fungi, or plants, whether fossil or non-fossil, including blue-green algae (*Cyanobacteria*), chytrids, oomycetes, slime moulds, and photosynthetic protists with their taxonomically related non-photosynthetic groups (but excluding *Microsporidia*). Before 2011 it was called the *International Code of Botanical Nomenclature* (ICBN).

This edition of the *Code* embodies the decisions of the Nomenclature Section of the XIX International Botanical Congress (IBC), which took place in Shenzhen, China in July 2017. This *Shenzhen Code* supersedes the *Melbourne Code* (McNeill & al. in *Regnum Veg.* 154. 2012), published after the XVIII IBC in Melbourne, Australia in 2011. The rules of the *Shenzhen Code* became effective

immediately upon acceptance of the resolution at the closing plenary session of the XIX IBC on 29 July 2017, that the decisions and appointments of its Nomenclature Section be approved. The *Shenzhen Code* in its final form was published on 26 June 2018 (printed version). This electronic version was made available on 27 June 2018. A [PDF version](#) was made available to members of the [International Association for Plant Taxonomy](#) on 27 January 2019.

International Commission on Zoological Nomenclature

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INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE

Fourth Edition

[Incorporating [Declaration 44](#), amendments of [Article 74.7.3](#), with effect from 31 December 1999 and the Amendment on e-publication, [amendments to Articles 8, 9, 10, 21 and 78](#), with effect from 1 January 2012]

**adopted by the
International Union of Biological Sciences**

The provisions of this Code supersede those of the previous editions with effect from 1 January 2000



ISBN 0 85301 006 4

The Official Registry of Zoological Nomenclature

ZooBank provides a means to register new nomenclatural acts, published works, and authors.

246,478

Nomenclatural Acts

Most recent: *Papilio pumilio* Hoffmannsegg, 1803
Registered by Tahsin Yazicioglu on 16 Mar



107,843

Publications

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68,835

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the U.S. National Science Foundation grants DBI-1062441 and DBI-0956415.



XXIII.—*On the true Method of discovering the Natural System in Zoology and Botany.* By HUGH E. STRICKLAND, M.A., F.G.S., &c.*

It is probable that most men have an instinctive belief in the truth of the system of Zoology and Botany, but the subject could give them no ground for their belief, of the nature of which a knowledge of the principles of science which hangs over the subject is more secure and metaphysically involved, and still more so in the theories which have been followed.

This essay is contrary to the arguments are of little value in investigating the subject which has hitherto been followed.

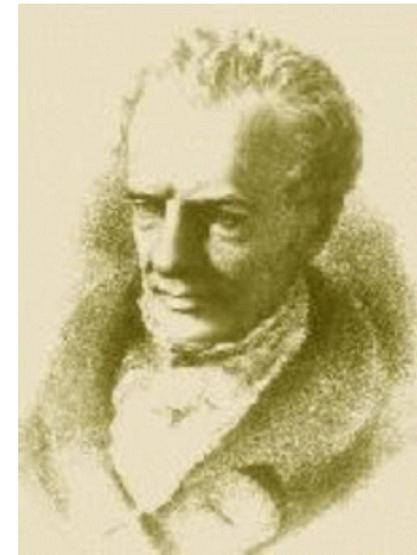
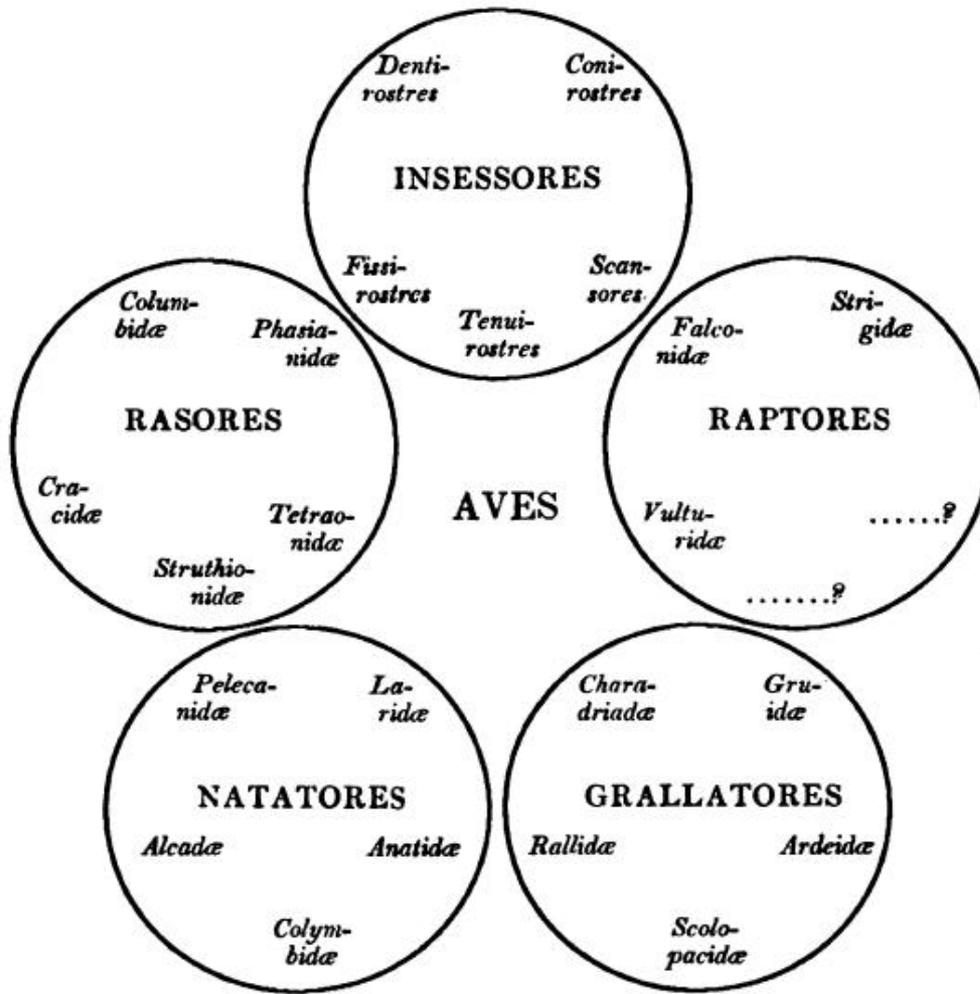
The postulate with which I begin, to let it be granted that there are such things as *species*, distinct in their characters and permanent in their duration. This being admitted, we define the natural system to be *the arrangement of species according to the degree of resemblance in their essential characters*. In other words, the natural system is that ar-



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William Sharp Macleay

Quinarian arrangement of Vigors (1824). Question marks indicate taxa that were yet to be identified.

XXXIX.—*Series of Propositions for rendering the Nomenclature of Zoology uniform and permanent, being the Report of a Committee for the consideration of the subject appointed by the British Association for the Advancement of Science*.*

‘the rules very useful; it is quite a comfort to have something to rest on in the turbulent ocean of nomenclature, (& am accordingly grateful to you) though I find it very difficult to obey always’

(Darwin to Strickland, 29 January 1849; N-168).

XXXIX.—*Series of Propositions for rendering the Nomenclature of Zoology uniform and permanent, being the Report of a Committee for the consideration of the subject appointed by the British Association for the Advancement of Science*.*

ALL persons who are conversant with the present state of Zoology must be aware of the great detriment which the science sustains from the vagueness and uncertainty of its nomenclature. We do not here refer to those diversities of language which arise from the various methods of classification adopted by different authors, and which are unavoidable in the present state of our knowledge. So long as naturalists differ in the views which they are disposed to take of the natural affinities of animals there will always be diversities of classification, and the only way to arrive at the true system of nature is to allow perfect liberty to systematists in this respect. But the evil complained of is of a different character. It consists in this, that when naturalists *are* agreed as to the characters and limits of an individual group or species, they still disagree in the appellations by which they distinguish it. A genus is often designated by three or four, and a species by twice that number of precisely equivalent synonyms; and in the absence of any rule on the subject, the naturalist is wholly at a loss what nomenclature to adopt.

If the science is not regulated then what is regulated in the codes?

- Nomenclatural stability and clarity
- Universality
- Uniqueness

How are names regulated?

-Priority: first validly published form of the name except where this violates uniqueness, distinctness, clarity, and nomenclatural stability.

- **Priority-** first published name is the correct one to use. (except when it is not)
- **Availability-** a properly published name is “available” (known as “validly published” in ICBN)
- **Validity-** the correct name to use (known as “correct name” in ICBN)
- No “case law”

This New Crayfish Species Was Named After Edward Snowden

by  Johnnie Fleming

 Twitter

 Facebook



 AUGUST 25, 2015

 0 COMMENTS



Cherax snowden crayfish – Christian Lukhaup

Why all the attention to the form of a name? What's the harm?

Drosophila Fallen
Drosophila falleni

Cherax snowden
Cherax snowdeni

Historical legacy: messy names in the (mostly) old literature.

Primary Homonyms. Same name used for two species.

Carabus limbatus Fabricius, 1776 [senior homonym]

Carabus limbatus Say, 1823 [junior homonym (=later homonym in ICBN)]

Secondary Homonyms. Classification change causes conflict.

Feronia strenua Panzer, 1779 and *Pterostichus strenuus* LeConte, 1852 were put in *Pterostichus* by Csiki (1930), so *P. strenuus* LeConte becomes a secondary junior homonym and must have new name. [*Pterostichus substrennus* Csiki 1930]

Objective synonyms. (nomenclatural synonyms ICBN).

spelling mistakes, unjustified emendations, e.g., *Abaris* vs. *Abarys* or *Rabdotus* vs. *Rhabdotus*.

Subjective synonyms. (taxonomic synonyms ICBN).

Conflicting species definitions and hypotheses. Subjective, but hopefully analysis-based, decision that two described forms constitute one species.

Abaris darlingtoni Straneo 1939 = *Abaris aenea* Dejean 1831.

Nomenclature - Taxonomy

- Subjective synonyms
- Types

Rules – Scientific Concepts

Function of types:

- Acts as an objective basis for the linking of nomenclature to taxonomy
- voucher (or “supervoucher”) of our research
- a single datum that provides a fixed reference point for our character descriptions
- not necessarily average or typical in the sense of being the common form
- can't represent variation

Types.

Designation of a type specimen was made mandatory in 1958 in the ICBN, but not until 1999 in the ICZN (it remained a recommendation for many years).

The “type” is the name bearing specimen associated by description and publication given the rules of nomenclature.

Some of the kinds of types

- Type series. All specimens on which a description is based (may be only one).
- Syntypes- Two or more specimens included in the type series

Primary types, these have nomenclature status:

Holotype- Single specimen chosen as the nomenclature type.

Lectotype- A single specimen subsequently chosen from the syntypes to act as nomenclature type.

Neotype- A single specimen subsequently chosen to act as nomenclature type when all syntypes have been destroyed.

Isotype- A duplicate holotype (botany).

Hapantotype- An ontogenetic series that acts as nomenclature type (protistans, ICZN)

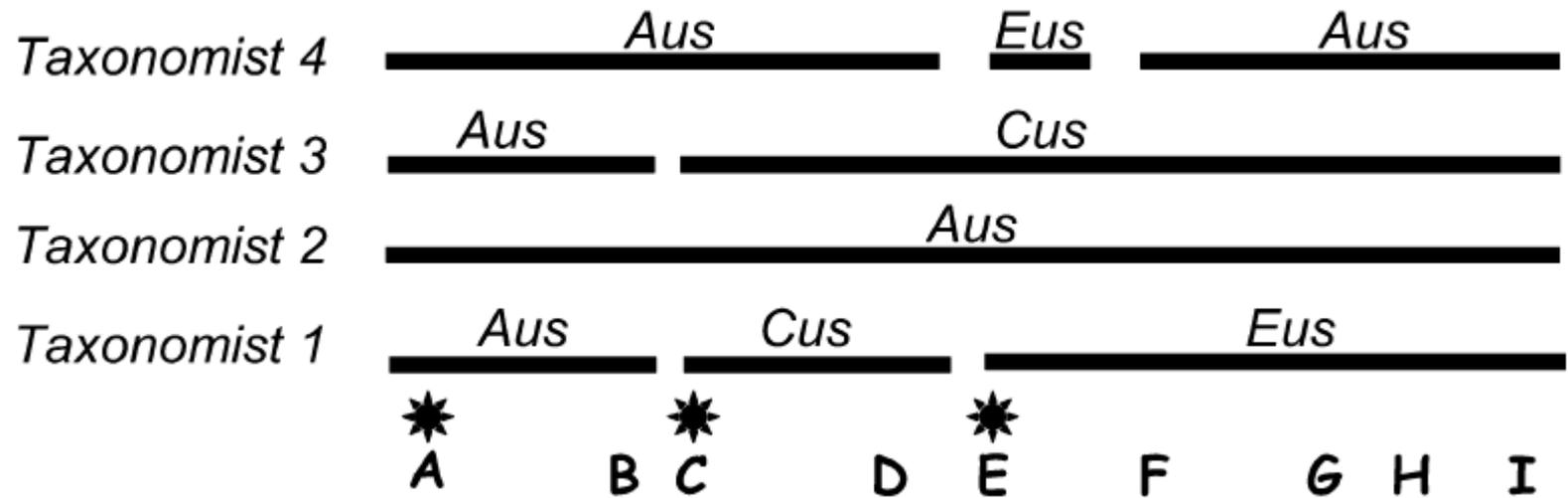
Some of the kinds of types, cont.

Secondary types, have no “legal” status

Paratype- non-holotype syntypes. Usually distributed as vouchers.

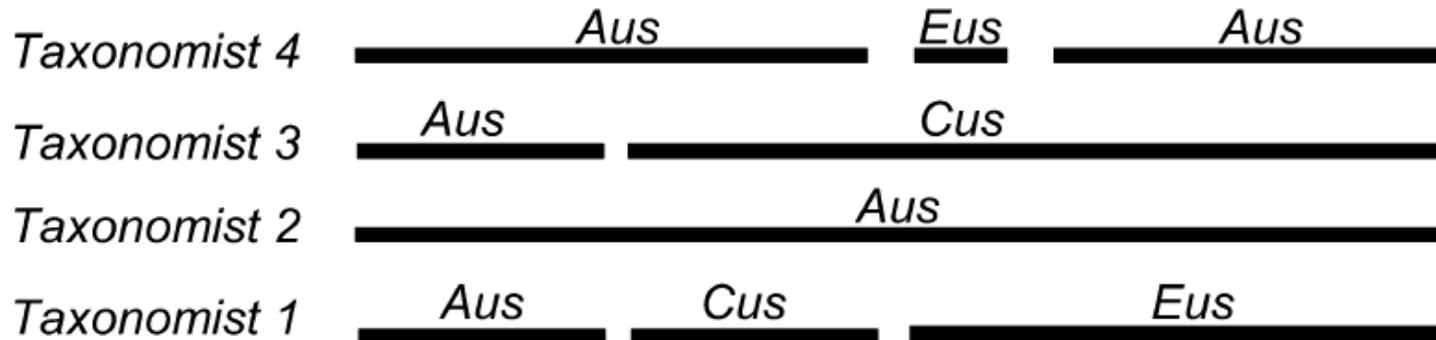
Allotype- paratype selected to represent the opposite sex from the holotype.

Other unregulated and less useful “types” include homeotype, topotype, plesiotype, hypotype, heautotype, onomatype, morphotype, metatype, ideotype.



*Type species

Type species of a genus.



*Type species

Integrative Taxonomy:

Activities- taxonomists diagnose, delimit, describe and arrange species into classifications, establishing taxonomic hypotheses.

Taxonomy.

Taxonomy is a science using morphological, behavioral, genetic and biochemical observations, to identify and describe biological diversity.

Taxonomy identifies and enumerates the components of biological diversity providing basic knowledge of all biological important taxa.

Integrative Taxonomy. The use of multiple independent or nearly independent lines of evidence and appropriate tests to establish taxonomic entities.

Applied Taxonomy. The implementation of techniques and technology to identify a semaphorant [an organism at a point in time] or sample as a token of a taxonomic entity.

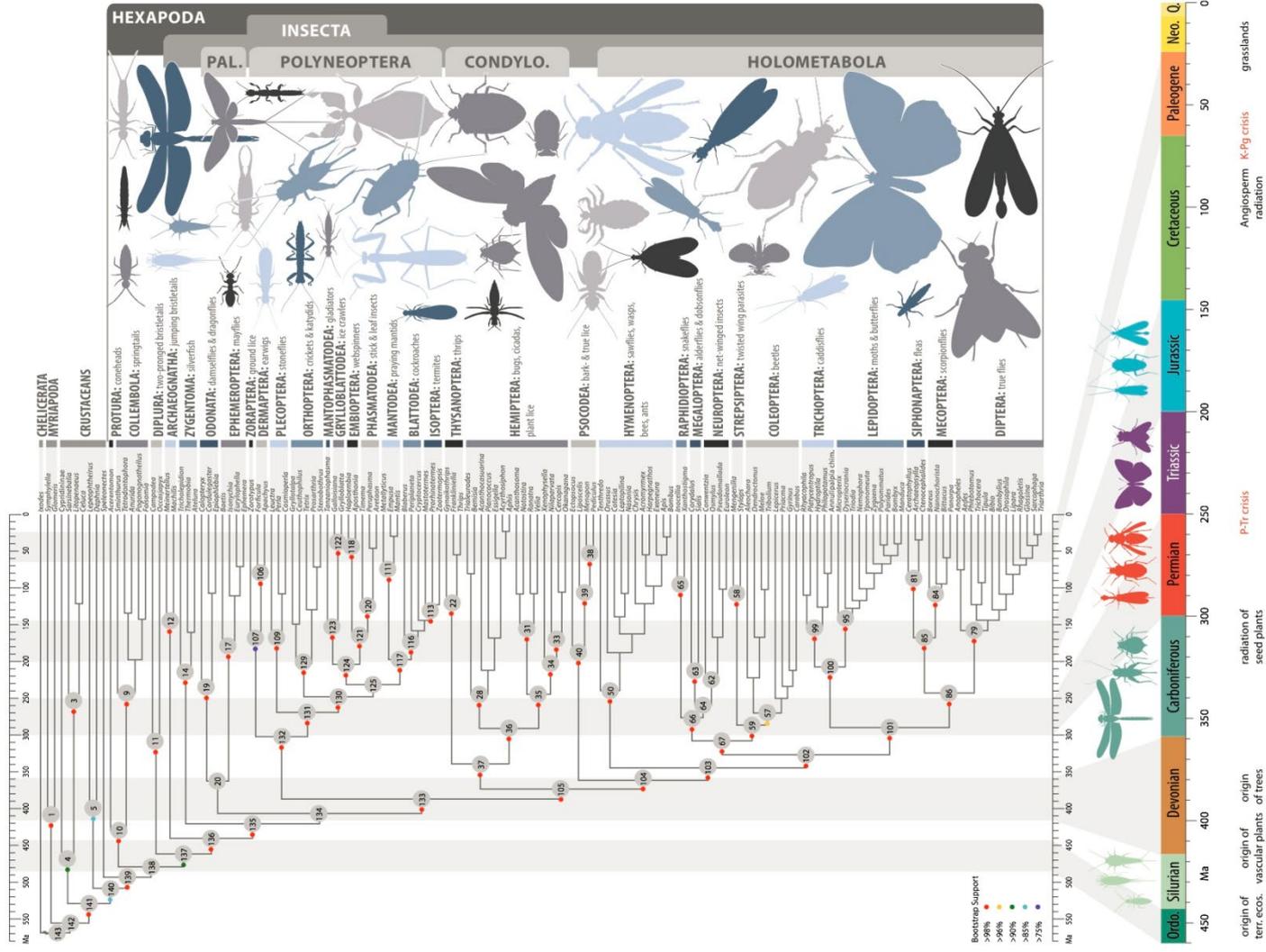
Applied Taxonomy. The implementation of techniques and technology to identify a semaphorant [an organism at a point in time] or sample as a token of a taxonomic entity.

Activities.

Taxonomists provide identifications and identification tools for those biological entities (taxa or clades).

Biological Systematics depends heavily on phylogenetics.

- Phylogenetic trees are made with historically informative characteristics.
- Phylogenetics frequently tests and alters hypotheses



Tree from 1KITE project: 1,478 protein-coding genes

A multigene phylogenetic analysis results in a redefinition of the genus *Notonomus* Chaudoir (Coleoptera, Carabidae) and descriptions of new species of the subgenus *Leiradira* Castelnau

Kipling Will

Essig Museum of Entomology, University of California, Berkeley, CA, USA. Email: kipwill@berkeley.edu



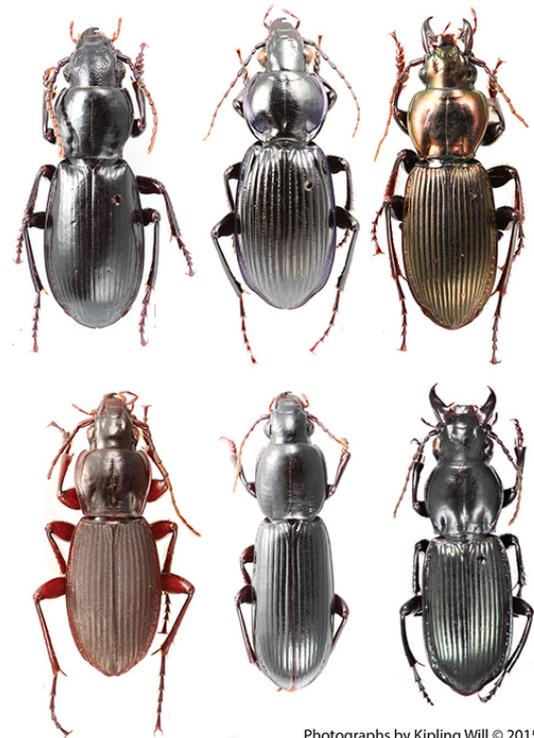
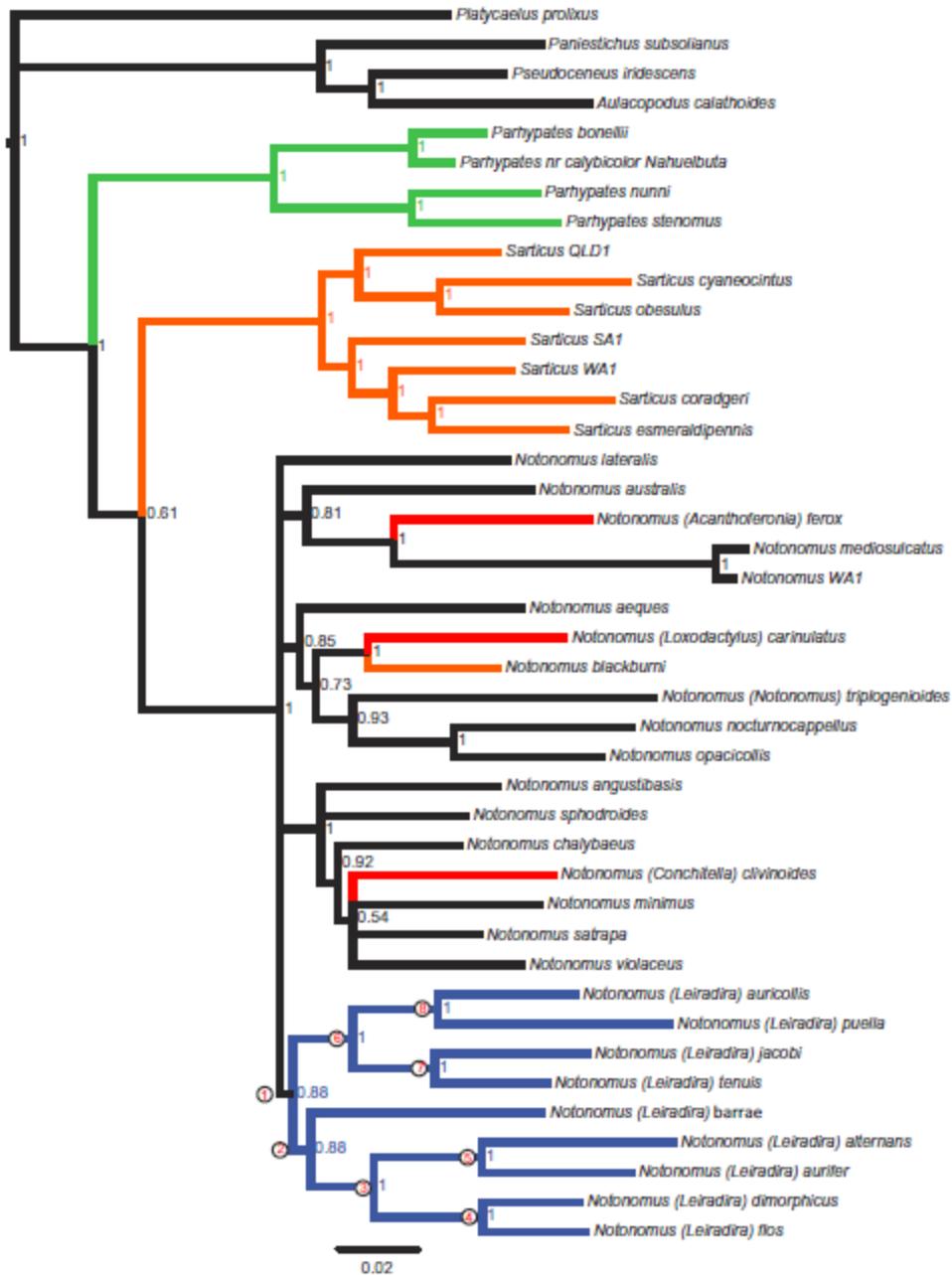
Photographs by Kipling Will © 2015

Table 1. Taxa included in phylogenetic analysis by group or subgenus

Species	Group or subgenus
<i>N. aequus</i>	aeques-grp
<i>N. angustibasis</i>	angustibasis-grp
<i>N. australis</i>	australis-grp
<i>N. chalybeus</i>	chalybeus-grp
<i>N. dimorphicus</i>	doddi-grp
<i>N. flos</i>	doddi-grp
<i>N. minimus</i>	kingi-grp
<i>N. lateralis</i>	lateralis-grp
<i>N. auricollis</i>	Leiradira
<i>N. puella</i>	Leiradira
<i>N. mediosulcatus</i>	mediosulcatus-grp
<i>N. alternans</i>	Metadira
<i>N. aurifer</i>	Metadira
<i>N. opacicollis</i>	opacicollis-grp
<i>N. triplogenioides</i>	s.str.
<i>N. satrapa</i>	satrapa-grp
<i>N. sphodroides</i>	sphodroides-grp
<i>N. jacobi</i>	Stomimorphus
<i>N. tenuis</i>	Stomimorphus
<i>N. barrae</i>	unplaced
<i>N. nocturnocappellus</i>	unplaced
<i>N. violaceus</i>	violaceus-grp



Photographs by Kipling Will © 2015



Photographs by Kipling Will © 2015

Notonomus Chaudoir, 1865
 subgenus *Leiradira* Castelnau, 1867
alternans (Darlington, 1953), comb. nov.
alticola (Darlington, 1961), comb. nov.
auricollis (Castelnau, 1867), comb. nov.
aurifer (Darlington, 1961), comb. nov.
barrae, sp. nov.
dimorphicus (Darlington, 1961) comb. nov.
flos (Darlington, 1961) comb. nov.
hephaestus, sp. nov.
iridescens, sp. nov.
jacobi (Darlington, 1961), comb. nov.
latreillei (Castelnau, 1867), comb. nov.
opacistriatis Sloane, 1902
puella (Tschitschérine, 1898), comb. nov.
smilodon, nom. nov.
soror (Darlington 1961), comb. nov.
spectabilis, sp. nov.
tenuis (Darlington, 1961), comb. nov.
thynnefiliarum, sp. nov.
vadosus, sp. nov.
viridis, sp. nov.
 subgenus *Acanthoferonia* Moore, 1965
ferox (Moore, 1965), comb. nov.
 subgenus *Loxodactylus* Chaudoir, 1865
australiensis (Sloane, 1895), comb. nov.
carinulatus (Chaudoir, 1865), comb. nov.
 subgenus *Conchitella* Moore, 1962
clivinoides (Moore, 1962), comb. nov.
incertae sedis
blackburni (Sloane, 1895), comb. nov.
impar (Sloane, 1893), comb. nov.
nocturnocappellus, sp. nov.
parallelomorphus Chaudoir, 1878, comb. nov., replacement name for *Notonomus auricollis* (Castelnau, 1867: 211), synonymy by Straneo (1936), preocc. *Leiradira auricollis* Castelnau, 1867.

Species treatments

Notonomus alternans (Darlington), comb. nov.
 (Figs 10C, 11E, F)

N. opacistrans but not found in *N. alternans*.

Description

Size. Overall length (SBL) 10.9–15.4 mm. Greatest width over elytra 3.7–5.1 mm.

Colour. Head black. Pronotum black. Elytra black. Body ventral surface piceous. Legs piceous. Mouthparts piceous. Antennae piceous.

Microsculpture. Dorsal and ventral lustre moderately shiny. Head dorsally with microsculpture absent or not visible at 50× magnification. Pronotum dorsally with microsculpture absent or not visible at 50× magnification. Elytra with microsculpture absent or not visible at 50× magnification. Microsculpture of elytral striae slightly opaque, width not significantly widening apically, striae narrower than or, at most, of about equal width of adjacent intervals near elytral apex.

Head. Eyes medium size, slightly produced. Ocular ratio 1.40–1.50. Antennae clearly geniculate, first antennomere longer than 2+3. Frontal impressions deep, divergent, slightly recurved. Labrum with six setae on anterior margin. Labrum anterior margin moderately emarginate. Occlusal margin of right mandible with long, blade-like anterior retinacular tooth. Gula very wide, nearly width of head. Mentum tooth low, broad, shallowly emarginate. Apical labial palpomere apically expanded, subsecuriform. Lacinia with a row of thick setae medially, mixed with finer setae and additional, more irregular rows of fine setae dorsally and ventrally.

Thorax. Basal pronotal seta in lateral bead near hind angle. Tarsomere 5 ventrally glabrous. Elytral intervals 3, 5 and 7 slightly wider than 2, 4 and 6. Elytral interval 3 with two setigerous punctures or with three setigerous punctures. Elytral striae all more or less impressed throughout their length. Elytral plica not externally visible, internal ridge present.

Abdomen. Ventrites 4–6 with shallow basolateral sulcus. Male aedeagus with long flagellum.

Notonomus alticola (Darlington), comb. nov.

(Figs 12A, 13A, B)

Leiradira (Metadira) alticola Darlington, 1961b: 6.

Material examined

Notonomus impar (Sloane), comb. nov.

Sarticus impar Sloane, 1903: 614.

Sloane noted in his treatment of this species that, like *N. blackburni*, it deviated from the typical characteristics of *Sarticus* species (Sloane 1903: 610). The holotype is now highly damaged and is missing both the prothorax and head. Fortunately, features noted by Sloane such as the uneven widths of the intervals and ventral punctation allow for confident identification of intact, associated specimens in the ANIC collection that appear to have been studied and identified as this species by Sloane. Based on this series of specimens, it is clear that Sloane's initial hesitation to place this species in *Sarticus* was justified. Though the pronotum is rounded at the hind angles the lateral margins are not explanate as is typical of *Sarticus*. Ventral punctation is common among *Sarticus*, but this varies between species (Lutshnik 1916) and the pronotal form falls well within variation found in *Notonomus*.

Key to subgenera and species

- 1. Gula very wide (Fig. 17A), reaching or surpassing the buccal fissure laterally, sutures often very lightly marked
..... *Leiradira sensu* Darlington 2
Gula narrow (Fig. 17B), not as wide or up to just a little wider than the apices of the mental epilobes, sutures usually clearly evident..... Other *Notonomus* spp. 19
- 2. Mentum tooth absent 3
Mentum tooth present, usually broad and little produced 7

- mesh of microsculpture. Elytra with noticeable purpurescent or bronze colour *Notonomus jacobi*
- Head and pronotum without microsculpture. Colour black, with slight iridescence throughout *Notonomus tenuis*
- 11. Anterior margin of the labrum with six setae 12
Anterior margin of the labrum with four setae *Notonomus iridescens*
- 12. Striae deeply impressed throughout their length 13
Striae scarcely impressed or absent *Notonomus vadosus*
- 13. Elytral striae without or with slightly opaque microsculpture, not significantly widening apically, narrower or, at most, of about equal width of the intervals near the apex 14
Elytral striae with strongly opaque microsculpture, greatly widening and anastomosing apically, wider than the intervals near the apex 16
- 14. Elytral intervals nearly of equal width. Elytral interval 3 with one setigerous puncture 15
Elytral intervals 3, 5 and 7 much wider than 2, 4 and 6. Elytral interval 3 with two setigerous punctures *Notonomus alternans*
- 15. Elytra broad, elongate ovoid. Slight metallic sheen throughout. Head and pronotum, particularly the pronotum near the base, cuprous. Elytra purpurescent with distinct blue to purple margins. Mesh microsculpture evident on elytra *Notonomus alticola*
Body form narrow, elytra parallel-sided. Black and more or less iridescent throughout. Transversely stretched microsculpture scarcely visible on elytra *Notonomus soror*
- 16. Elytral intervals 3, 5 and 7 about twice as wide as adjacent intervals 1, 2, 4 and 6 in the basal third of the elytra 17
Elytral intervals 3, 5 and 7 at least five times as wide as adjacent intervals 2, 4 and 6 in the basal third of the elytra 18
- 17. Pronotum clearly cordiform, as broad as, or wider than width of elytra, vividly metallic green. Head with more or less green metallic colour. Elytra iridescent with slight purple colour *Notonomus viridis*