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# Language, Nature, and Society: A Grey Future for the Linnaean Names of Animals and Plants

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**Abstract.** The essay examines the historical foundations and current challenges of Linnaean taxonomy in light of contemporary debates on biological nomenclature, data management, and social pressures. It traces the persistence of Linnaean principles, such as the fixity of species and the universality of names, through the evolutionary and digital ages, highlighting the growing instability of taxonomic concepts and the fragmentation of species lists. Particular attention is given to recent calls for reform, including the replacement of politically or culturally sensitive names and the proposal to adopt indigenous nomenclatures. These developments are assessed as potential threats to the consistency and universality of scientific naming, revealing tensions between scientific governance, technological mediation, and societal values in the representation of biodiversity.

**Keywords:** Linnaean taxonomy, biological nomenclature, species concept, biodiversity data, semantic instability, decolonization of science.

## Linnaean origins

It is not difficult to guess the ambitions of the twenty-eight-year-old Carolus Linnaeus at the time he published the first edition (1735) of *Systema Naturae*. His goal of charting the whole created world was clear, even if, by the author's own admission, those twelve *in-folio* pages were *conspectus tantum operis et quasi mappa geographica* – a mere overview and a kind of map of the future fully-fledged work. Gaps in the listing of natural objects known at the time, and the subjectivity of their distribution in

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genera, orders, and classes were obvious, but Linnaeus was committed to spending the rest of his life on the production of an increasingly informative and satisfactorily organized *Systema*.

Such an ambitious target might have been easily criticized as overambitious, not only because of the unknown and eventually enormous size of the task, but foremost because it rested on a couple of principles whose reliability was not necessarily granted. First, that the living world is articulated into a large number of immutable kinds, or *species*; second, that these species could be objectively recognized and merely awaited description and naming. The pious Linnaeus could justify his approach to what we now call *biodiversity* invoking the words of *Genesis* 2, 19: "So out of the ground the Lord God formed every animal of the field and every bird of the air, and brought them to the man to see what he would call them; and whatever the man called every living creature, that was its name".

An increasing number of naturalists joined Linnaeus in this project of mapping the living world. Witness Giuseppe Olivi (1792, 4-5, my transl.):

> In order to obtain a satisfactory and comprehensive knowledge of the vast landscape of Nature, a methodical arrangement and a nomenclature become indispensable, if we do not want confusion to throw us into an inextricable labyrinth. [...] Therefore, in the need to follow a method of nomenclature, and in the scarcity of monographs about the organic productions of our sea [...] it was very convenient to follow the most correct, the most concise, the most expressive of all languages and systems – that of the famous Cavalier Linnaeus.

At the time, even the inventory of the most popular groups of living beings such as birds, mammals, butterflies, and flowering plants was still largely incomplete. Nevertheless, the geographer and zoologist Eberhard August Wilhelm von Zimmermann was able to offer at the time an amazingly perceptive and articulated calculation: that the number of existing animal species would be about seven million (Zimmermann 1783), very close to some recent estimates (e.g., 7.77 million in Mora *et al*. 2011). It was, in any case, universally accepted that the living world is made up of species, which have existed since they were created and do not lose their identity and distinction despite a few rare cases of hybridization.

One would expect that Linnaeus' program would have required a radical revision with the advent of an evolutionary view of the living world – if it ever would survive at all. In theory at least, many biologists would agree with Darwin (1859, 469) "that no line of demarcation can be drawn between species and varieties". In practice, however, zoological and botanical systematics continued until present to expand the Linnean catalogue of living species. However, over time, the program of charting the system of living beings fell dramatically in public appreciation, both among scientists in general and in the lay public at large. Physics and astronomy, rather than biology, came to be regarded as the 'real' sciences; within biology, only those fields based on experiment and capable of producing mathematically expressible results were seen as truly scientific. Only in the last few decades has the decline in visibility of biological systematics been reversed, as a consequence of the increasingly shared understanding that a sound knowledge of biological diversity would play a major role in our effort to contrast its current ruinous decline.

From a political and media standpoint, this message was first launched at the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992. Article 2 of the Convention issued at that Conference (Secretariat of the Convention on Biological Diversity, 1992) specified: "For the purposes of this Convention: 'Biological diversity' means the variability among living organisms from all sources [...]; this includes diversity within species, between species and of ecosystems". Ecologists apparently took for granted that biological systematics could offer an uncontroversial tool to describe and eventually steer the management of the fragile diversity of life on Earth. Problems, however, were not slow to crop up.

## The unfinished catalogue

Ecologists were aware of the existing gaps in the current inventory of life. A large part of our knowledge of the world's species is recorded in a corpus of biodiversity literature comprising several hundred million pages, and represented in natural history collections estimated to contain 2–3 billion specimens (Minelli 1993; Agosti and Egloff 2009). Together, these two large, distributed archives host a bulky (but poorly organized) record of biodiversity. Yet a great many species are still to be described and named, especially in poorly studied groups such as bacteria and fungi, but also insects, worms, etc. Less obvious is that taxonomists are currently unable to offer even a simple list of the living species described so far. Consider the *Catalogue of Life*, described on the project's portal as "the most complete authoritative list of the world's species – maintained by hundreds of global taxonomists".[1] The actual state of affairs is considerably less satisfactory. Lists are complete and regularly updated for many groups, such as flowering plants and vertebrates, but there are still significant gaps – amounting to tens of thousands of species – even in the lists of other popular groups such as beetles.

An acceptable catalogue of life is not the product of a mere bibliographic compilation exercise. Unlisted species are the most conspicuous shortcoming of global lists such as the *Catalogue of Life*, but they are not

[1] https://www.catalogueoflife.org/data/metadata

the worst. The main problem lies in the very lacunose critical revision of this literature-extracted information. This step cannot be accomplished by automated means. Only a competent specialist can decide whether a species name, wherever it occurs, has been consistently applied to one and the same species. Similarly, only a specialist can decide whether two or more names should be regarded as synonyms, only the oldest of which is accepted as the valid name of a species.

A curated global list of accepted species names would be the modern version of *Systema Naturae*, but this target does not seem to be within sight – especially because of the extensive and deep-seated fragmentation in the governance of taxonomic lists. This issue has been discussed in a constructive and articulated way in a massive issue of *Organisms Diversity and Evolution* (Conix *et al*. 2021; Hobern *et al*. 2021; Lien *et al*. 2021; Pyle *et al*. 2021; Thiele *et al*. 2021; Thomson *et al*. 2021).

## Taxonomic concepts and semantic instability

What does the so-called scientific name of a species actually contain? In the absence of further qualifications, a Linnaean name may become semantically equivocal because taxonomists may diverge in their classifications. For example, how many species of giraffe are there? One (*Girafa camelopardalis*), as traditionally accepted (Wilson and Mittermeier 2011), or four (Fennessy *et al*. 2016), or even six or more (Groves and Grubb 2011)? For example, *Girafa camelopardalis* is a distinct species (the reticulated giraffe) in Fennessy *et al*. (2016), which is not the same as *Girafa camelopardalis* sensu Wilson and Mittermeier (2011), who include also the Southern giraffe (*Girafa giraffa*) and the Masai giraffe (*Girafa tippelskirchi*), distinct giraffe species according to other authors. *Girafa camelopardalis* sensu Wilson and Mittermeier (2011) (all living giraffes) and *Girafa camelopardalis* sensu Fennessy *et al*. (2016) (northern giraffe) are thus different *taxonomic concepts* (Berendsohn 1995; Minelli 2019). Unweaving this plurality of meanings of identical Linnaean names requires a sound knowledge of the literature and a careful evaluation as only a specialist can (subjectively) undertake.

Taxonomic groups for which two or more conflicting taxonomies coexist are anything but rare. For example, ca. 10,000 species and 22,000 subspecies of birds are currently recognized (Lepage 2019), but over 1.5 million distinct taxonomic concepts are available for them in the literature (Lepage *et al*. 2014). This is far from being an academic quibble, because sometimes animal names can end up in legislation, e.g., for conservation or pest management purposes, and this can happen only if the concerned animals are regarded as distinct enough as to deserve a species name.

## A possible final blow to the Linnaean dream?

Despite ongoing efforts to stabilize zoological and botanical naming systems, there are clear signs that a fully comprehensive and standardized list of all living species may *not* become the definitive new stage in the development of biological systematics, even though that is the direction in which the field currently aims.

In *A History of the Warfare of Science with Theology in Christendom*, Andrew Dickson White (1896, 43) mentioned "Darwin's remark on the stimulating effect of mistaken theories, as compared with the sterilizing effect of mistaken observations: mistaken observations lead men astray, mistaken theories suggest true theories". I do not know if and where Darwin actually expressed this opinion; nevertheless, I think we must take it very seriously when trying to extract from the literature an accurate representation of current knowledge of global biodiversity. The weight of erroneous observations on our ability to recover a correct message from extensive data mining in the literature is too often ignored.

It can be arbitrary to decide whether or not the mass of publications containing our information on biodiversity – estimated by Agosti *et al.* (2023) to be around 500 million pages – justifies calling biological systematics a big science: each one of the distinct bits of information in which we are interested occurs in a vanishingly small number of sentences, very often only once. Accessibility to the whole published material and sophisticated algorithms for indexing their contents are invaluable aids for exploring this treasure trove of information, but the interpretation and validation of the individual items necessarily rest on the expert judgment of specialists. It is not a job for machines, however intelligent. The necessary information to base this evaluation on is not fully contained in the taxonomic literature, regardless of how complete its archived and digitized contents are. The mere citation of a scientific name does not guarantee that the corresponding voucher specimens have been correctly identified. Even the most exhaustive mining of the whole taxonomic literature since Linnaeus cannot protect us from the alternative taxonomic treatments mentioned above, or from positively wrong information contained in technical papers. Very frequently, without personal examination of the specimens on which a new species was created or subsequently recorded, this risk cannot be definitely ascertained – even by qualified specialists. A notable example is an Italian entomologist who described, in a series of papers, twenty-one new species of flies, all of which, after careful examination of the specimens on which they were described, were recognized as synonyms of previously described ones (Rognes 2014; Barták and Kubík 2016).

## Rules under attack

Taxonomists have long dreamed of working in an ivory tower, sheltered from incursions of the outside world. The uninterrupted continuity of their work in the footsteps of Linnaeus – including the survival of Latin in nomenclature – and the adoption of international codes of nomenclature (International Commission on Zoological Nomenclature 1999; Turland *et al*. 2018), inspired by the principles of universality and uniqueness of scientific species names, had until recently gone unquestioned and prevented interchange with vernacular names. However, things are changing due to social pressures, most of them from outside the taxonomic community, but occasionally supported by some professional taxonomists.

For example, requests have been made to replace politically incorrect names with socially acceptable ones, some of which have been accepted. The 20th International Botanical Congress (Madrid 2024) decided that the stability of scientific nomenclature should be challenged when it comes to politically incorrect names. A motion was passed concerning the international usage of more than 300 plant names with epithets such as *cafra, caffra, cafrorum*, and *cafrum*: these are to be replaced by *afra, afrorum,* and *afrum* to reflect their African origins, while removing the old terms considered offensive or derogatory today in Southern Africa (Smith and Figueiredo 2024).

Apart from questions of local political correctness, this decision is potentially ruinous for the future of scientific nomenclature. On one hand, it negates, potentially to a considerable extent, the application of the pivotal principle of botanical and zoological nomenclature, i.e., priority. On the other, and perhaps more damagingly, it ignores the fundamental divide between scientific and vernacular names. Vernacular names are words in common languages, always subject to modification or replacement according to the vagaries of usage, including cross-language borrowings. Scientific names, by contrast, are crystallized, invariable formulae. Sadly, in the current rush to refurbish language(s), the contrast between scientific and vernacular names is frequently ignored. Gillman and Wright (2020) proposed that indigenous names long in use should replace the scientific names assigned by botanists. This retroactive rule would apply even in the case of well-known plants whose scientific names are undisputed and widely used, such as the Linnaean name *Diospyros virginiana* for the common persimmon, which would then become *Diospyros pessamin*. If such changes are allowed, where would the endpoint of this language-purging fury be set?

## Taming the semantic becoming

In the life sciences, several important terms such as species, gene, individual, and homology, have been used in a plurality of different meanings. Different strategies have been suggested to come to terms with this polysemy (Brigandt 2003; Pavlinov 2020; Minelli 2022, 2024). A first strategy is to accept as legitimate only one of the different meanings in which the term has been used. Another is to select a concept so generalized as to accommodate the greatest number of different meanings. The third, pluralistic way is to welcome the polysemic nature of the term.

This approach is particularly fit for those concepts that Stengers (1987) called *nomadic*, because they play roles in different disciplines but acquire ever new meanings in each of the disciplines where they find a different point of anchoring. *Species*, for example, is a good example of a nomadic concept, as it takes on different meanings when we move, for example, from Linnaean taxonomy to conservation issues to population genetics.

Disciplines are traditionally taken for granted as *anchor points,* with concepts moving among them. However, it may be fruitful to reverse the traditional relationship between disciplines and core concepts by fixing a few *anchor concepts* and exploring their diverging association with *nomadic disciplines* (Minelli 2020a, 2020b).

From this perspective, we should not worry if we realize that describing the diversity of life on our planet – and operating on it – requires a plurality of species-level units. Eventually, if the only trait common to all the species of the Linnaean tradition is that they are phenomenological entities deemed worthy of a name (Sterelny 1999), this might still function as an anchor concept to which we operationally refer in the daily business of naming basically discrete segments of biodiversity. However, if this is the only sense in which Linnaean species are objectively comparable across the entire tree of life, we must abandon pie charts that segment global biodiversity into sectors sized proportionally to the number of named species. No unchallenged ontology supports their putative equivalence anymore.

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