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"New Concepts and Methods for Phylogenetic Taxonomy and Nomenclature in Zoology"

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Abstract
A recent research paper proposes new concepts and methods for phylogenetic taxonomy and nomenclature in zoology, focusing on a cladonomy (phylogenetic classification) of recent amphibians. This approach emphasizes a rigorous relationship between the phylogenetic hypothesis and the classification, using a clear and unambiguous methodology. The paper introduces new suprageneric ranks and a system where the hierarchy of ranks mirrors the structure of the phylogenetic tree. In Zoology research papers, nomenclature refers to the formal system of naming and classifying animals. The most common practice is the binominal nomenclature, where each species is given a two-part scientific name: a genus name and a species name. This system is governed by the International Code of Zoological Nomenclature (ICZN). Taxonomy is the science of discovering, naming, describing, diagnosing, identifying, and classifying different kinds of taxa, from species to families. It lays the foundation for all of the biological sciences. The rapid increase in both taxonomic descriptions and malpractice in recent decades indicates a need for consistency in the procedure and quality of taxonomic research publications dealing with recognition of new taxa, name changes, and nomenclatural acts. Indeed, there are numerous examples in the recent literature of taxonomic works that fall short of the basic procedures and minimum standards required for naming new species according to the mandatory provisions and recommendations of the International Code of Zoological Nomenclature, accepted standards of taxonomic best practice, and journal editorial policy. Here, we provide practical guidelines of the procedure and key elements required to name, describe, and publish a new animal species or revise the taxonomic status of a species. We then discuss some of the common pitfalls that should be avoided. Mistakes commonly made include failure to read the Code, to review the primary taxonomic literature, to examine type material, to construct the taxon name correctly, to explicitly establish the new taxon, to provide adequate typification, to clearly differentiate the new taxon, to register the publication of the new taxon name in ZooBank, or to publish the name of the new taxon in a manner that is compliant with the Code. We provide some examples of these mistakes, mainly from butterflies (Insecta: Lepidoptera: Papilionoidea) and, to some extent, reptiles because these taxon groups seem to have an unusually high level of poor taxonomic practice.
Keywords: *code, description, new species, nomenclature, taxonomy, zoology*

I. Introduction

The "New Concepts and Methods for Phylogenetic Taxonomy and Nomenclature in Zoology" article introduces a new approach to classifying and naming organisms, particularly amphibians, based on rigorous phylogenetic analysis. It aims to create a classification system that more accurately reflects evolutionary relationships by using a bijective relationship between the phylogenetic hypothesis and the classification, and by rigorously defining suprageneric ranks according to ResearchGate. The article emphasizes using comprehensive phylogenetic data, like that of the Lissamphibia (amphibians), to create a more accurate reflection of evolutionary relationships. The proposed method aims to create a system where the classification (cladonomy) directly mirrors the phylogenetic tree, with suprageneric ranks reflecting the branching patterns of the tree. The authors suggest that this methodology, if applied to other zoological groups, could improve the homogeneity, clarity, and usefulness of zoological taxonomy and nomenclature.

II. Methodology

The need for classifying living organisms is very ancient, and the first classification system can be dated back to the Greeks. The goal was very practical since it was intended to distinguish between eatable and toxic aliments, or kind and dangerous animals. Simple resemblance was used and has been used for centuries. Basically, until the XVIIIth century, every naturalist chose his own criterion to build a classification. At the end, hundreds of classifications were available, most often incompatible to each other. The criteria for this traditional way of classifying is the subjective appearance of the living organisms. During the XVIIIth a revolution occurred. Scientists like Adanson and Linn´e devised new ways of classifying the objects and naming the classes. Adanson realised that all the observable traits should be used, giving birth to the multivariate clustering and classification activity (Adanson, 1763). Linn´e based his binomial nomenclature on neutral names unrelated whatsoever to any property of the classes. We can realise the success of these two ideas more than two centuries and a half later! The hierarchical organization of the living organisms was already established when Linn´e devised his nomenclature, but its origin became understood in the mid-XIXth thanks to Darwin. Evolution was the key to understand the hierarchy and interpret the scheme as depicting the evolutionary relationships between the species. Then, biologists have since devoted themselves to establish the phylogenetic tree of all living organisms, the Tree of Life. Partitioning or hierarchical clustering techniques were used in this purpose by comparing species by their global similarity. However, William Hennig in 1950 translated the transmission with modification idea of Darwin into a new concept of classification: species are not compared anymore on the ressemblance, but on their ascendance. We are not looking anymore for who is like who, but who is cousin of whom. Cladistics was born (Hennig, 1965). Indeed, it seems that linguists already used a similar approach to compare the languages and their diversification, but never formalised it like Hennig. Harsh debates occurred in the evolutionary biology community, but this approach, better called now Maximum Parsimony, was definitively adopted in the 1980s. Despite that other techniques were developed and are very often used nowadays, the philosophy of cladistics is still behind all these approaches. Cladistics is conceptually simple and very general, yet it is also very demanding computationally. Table 1 summarizes the evolution of the concepts of classification. It is important to keep this in mind. In astrophysics, we are still essentially using the traditional way of classifying objects.

III. Results

The first path is to gather objects according to appearance or global similarity. This is clustering. The groups are then characterized, described and defined, and are given names respecting rigorous taxonomic rules. All this provides the classification scheme that will later be used for (supervised) classification. Having grouped objects together is the end of the statistical investigation. Now we wish to understand why the objects are grouped in this way, and what are the relationships between the groups. In other words, what is the origin of the groups? In biology, the key is evolution and Darwin showed that the transmission with modification mechanism creates the hierarchical organization of the living organisms, the diversity of which can thus be well represented on a tree-like diagram. In astrophysics, Hubble made a clustering of the galaxies he discovered, defining categories like elliptical or spiral, and lated hypothesized that the dissipation would flatten elliptical galaxies into disky ones like spiral galaxies. This is the famous Hubble Tuning Fork diagram that established the relationships between the classes after the clustering process. Since we are interested in the relationships between species, why not try to gather the living organisms according to their relatedness? This is the idea of the phylogenetic path toward a classification. It establishes the relationships first, and then the grouping of the objects is deduced from the tree

IV. Discussion

Taxonomy is the science of naming, defining, describing and classifying that have been developed for the living organisms. It is not simple to cluster objects into classes, and it is not obvious to classify new objects into known classes. This depends very much on the description of the classes. In particular, the names of the classes can have a strong influence on this process. This difficulty has been recognised by Linn´e in the XVIIIth century. The enormous success of the nomenclature he proposed is due to the fact that the name of a class is not related to any of its specific properties. Why? Let us take an example: what do you think the class of "elliptical galaxies" is made of? Starforming galaxies? Radio galaxies? Massive galaxies? No, of course, all galaxies with an elliptical shape belong to this class: the name of the class inevitably plays also the role of its definition and its description, whatever is the diversity in the other properties.

V. Conclusion

In biology, many species have a common name which is not the scientific name. Note that the name of the class Mammalia strongly suggests the presence of mammary glands... Interestingly, in particle physics, it is impossible to guess the nature of the particles from their names. The quarks have poetic names that has nothing to do with their properties (charm, beauty...). In astrophysics, this is not so rigorous. The first and most used classification of stars respects the fundamental taxonomic rule, but other classes have been added to this picture following apparent physical or chemical properties, and mainly describing evolutionary stages. For galaxies, this is far worse, there are hundreds of classifications according to the many observables we managed to obtain. I cannot refrain from seeing here a parallel with the situation of biological classifiation at the end of the XVIIth century that motivated the works by people like Linn´e and Adanson. So the requirement of multivariate classifications in astrophysics appears not only natural, but somewhat urgent.

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