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Keywords (separated by “-”)	Pattern of recurrence - Taxonomic category - Unit of biodiversity	

## Species

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## Keywords

Pattern of recurrence; Taxonomic category; Unit of biodiversity

## Synonyms

Lowest taxonomic category

## Definition

In biology, species is the basic rank (category) supporting the taxonomic hierarchy that attempts to embrace all of the biological diversity present in the biosphere.

## Overview

Aristotle first enunciated the idea of species about 2,400 years ago (fourth century before Christ). Linnaeus, in the eighteenth century, consolidated its use within a scientific framework and initiated the modern binomial classification. Since then, it has been used to identify each of the different biological units that can be observed in nature. As Jody Hey states, “species are categories motivated by recurrent observations about the world, and as humans are great observers of patterns of recurrence they devise categories as a response.” However, such patterns of recurrence are necessarily different for different kinds of organisms that exhibit distinct levels of morphological and/or physiological complexity. The idea of what a species may be depends on the type of organisms under study and the ability of the taxonomists to identify the phenotypic, genetic, and ecological singularities that make a unit different from its closest relatives. For organisms exhibiting complex morphologies such as plants and animals, the circumscription of the unit is mainly based on simple, easily recognizable, observable traits requiring no experimentation on living specimens. However, for morphologically simpler organisms such as prokaryotes and some microscopic eukaryotes, simple ocular examination is insufficient. In such taxonomies, there is a need to experiment with living specimens in the laboratory in order to retrieve enough genetic and phenotypic information to establish the taxa boundaries.

Over the years, philosophers and taxonomists have insistently tried to formulate the essence of what this biological unit could be. However, the search for a universal concept that describes the basic taxonomic rank soon became the focus of strong debates. Hitherto, more than 25 different concepts have been formulated. The most widely known is the “biological species concept” (BSC) by Ernst Mayr who understood “species as groups of actually or potentially interbreeding natural populations which are reproductively isolated from other such groups.” However, while this concept works for most animals, it

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is not applicable to the vast majority of the biological entities that do not reproduce sexually. Among the different concepts formulated, scientists debate between the use of those of high theoretical load (such as “evolutionary” (ESC) or “cohesive” (CSC) species concepts, both considered synonyms) and those that can be considered theory-free (such as the “phenetic” (PhSC) or the “polythetic” (PtSC) species concepts, both considered synonyms). The former formulates that species is “an entity composed of organisms which maintains its identity from other such entities through time and over space, and which has its own independent evolutionary fate and historical tendencies”; the latter is formulated as “a similarity concept based on statistically co-varying characteristics which are not necessarily universal among the members of the taxa.” The success of the PhSC or PtSC is mainly based on the achievement of as many independent characters as possible. However, neither concept is well accepted. The ESC or CSC is very difficult to apply, and the PhSC or PtSC lacks a theoretical background.

Each discipline in biology creates its own classification and especially tailors its species circumscriptions in a manner that best fits the patterns of recurrence that they observe. Either we admit that biological diversity is so vast and evolutionary constraints are so varied among different biological lines of descent that a variety of species concepts are necessary to accurately capture the complexity of variation patterns in nature (pluralistic view) or if we want to achieve a universal concept that takes into account all biological diversity (monistic view), we have to admit that the concept of species may lack applicability and may not be operative.

As a final remark, we can consider species as each of the recurrence patterns that humans observe in nature, each of them having a different evolutionary fate. The ability to recognize species depends on the biological complexity of the organisms under observation and the technological capacities available to recognize their unique properties. The final circumscription of a species will depend on the scientists’ abilities to recognize genetic and/or phenotypic complexities.

## See Also

- [Darwin’s Conception of Origins of Life](#)
- [Evolution, Biological](#)
- [Phylogeny](#)
- [Taxonomy](#)

## References and Further Reading

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