

What is a species¹?

- *Morphological species concept (MSC):* The MSC classifies organisms into species based on their morphology. Individuals in the same species are similar to one another in morphology. Individuals in different species are different in morphology.

The Linnaean system of classification and most traditional methods of classification use the MSC.

The MSC emphasizes morphology rather than behavior in part because classification was and still is often done with preserved specimens or fossils.

One problem with the MSC is that it is difficult to say what differences in morphology are important for distinguishing species and how different two groups of organisms have to be in order for them to be classified as different species. Some species are polymorphic, but the traits that are polymorphic are not used to distinguish species. Males and females of sexually dimorphic species may be very different from each other, as in the birds of paradise, yet they are classified as members of the same species.

In practice, the application of the MSC to a group of organisms takes experience and practice.

In some species, it is difficult even for specialists to know whether a group is a single polymorphic species or several separate species. Adults of the tropical butterfly, *Astraptes fulgerator*, are monomorphic but the larvae are polymorphic.

- *The biological species concept (BSC):* The BSC groups organisms into species that are reproductively isolated from one another, meaning that members of different species do not interbreed under natural conditions or, if they do, they do not produce viable or completely fertile offspring.

The BSC is regarded as the correct definition of a species: The BSC fits well with the idea that species rather than individuals evolve. If members of the same species freely interbreed, then they are part of the same evolutionary unit. Different species evolve independently of one another.

If two groups are known to interbreed, then they will be classified as one species regardless of any differences in morphology. If two groups do not interbreed under natural conditions, then they are classified as two species regardless of how similar they are in morphology.

In a single geographic location, the MSC and BSC usually distinguish the same species. Native New Guineans distinguish the same species of birds of paradise as European ornithologists. Sometimes, close observation will allow splitting of what was thought to be a single species into two or more species.

¹ Species definitions other than the MSC and BSC will not be covered.

Even though the BSC is preferred, it cannot always be used in practice: For organisms that live in different geographic areas or that are known only from preserved specimens or fossils, it is impossible to know whether interbreeding would occur if the two groups were sympatric. In that case, the extent of morphological differences between sympatric species in the same group is used as a guide to determine whether groups in different areas are species, subspecies, or geographic races. It is ultimately a subjective judgment and, as in most such situations, people defend vigorously their own opinions.

Classification of species can change if new information is obtained: *Ensatina* salamanders in California provide an example of the problem of defining species in practice. If the intermediate forms were not known, the groups at the ends of the range would appear to be good species.

At one time, five species of baboon in the genus *Papio* were recognized, *P. anubis*, *P. cynocephalus*, *P. papio*, *P. ursinus* and *P. hamadryas*. Recent field studies showed that these species interbreed and produce viable hybrids when they are sympatric. They are now classified as subspecies of the single species *P. hamadryas*, for example, *P. h. anubis* and *P. h. hamadryas*.

The application of new genetic methods may help determine whether individuals that appear similar are really members of the same species. Differences in the DNA sequence show that *Astraptes fulgerator* is actually made up of at least 10 different species.

- *Species definitions are important for practical purposes:* The Endangered Species Act (ESA) of 1973 provided legal protection of species designated as being at risk of extinction. One recent example of the use of the ESA is the case of Baker's larkspur, *Delphinium bakeri*, a species found only near Marshal (on Tomales Bay). The ESA was used as a basis for efforts to block development that threatened the habitat of *D. bakeri*. If *D. bakeri* were a local population of a common species, the ESA could not be used in this way.

Conservation biologists have tried to reduce the importance of designating a group as a separate species by arguing that an isolated and distinctive population is an Evolutionarily Significant Unit and deserves legal protection whether or not it is classified as a species.

Example test question

Q1. What type of evidence would be best able to demonstrate that Baker's larkspur, *Delphinium bakeri*, is a separate species instead of a slightly different form of a widespread species?

- A. Baker's larkspur has flowers that differ in color from those of related species.
- B. Drawings made by early settlers in California show that Baker's larkspur once had a much larger geographic range.
- C. Baker's larkspur plants cannot be hybridized to plants from other geographic areas.

- D. Individual plants of Baker's larkspur are taller on average than related species found in the same area.
- E. None of the above.

Correct answer: C