



Fungi: neither plants nor animals

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Throughout the history of the natural sciences, philosophers, and then biologists, tried to include fungi, sometimes among animals, sometimes among plants (that's why, today, fungi are studied in the discipline of Botany). Later, when science evolved substantially, fungi were finally placed as a separate kingdom (Verma 2016).

But what are fungi anyway? We've all seen mushrooms in the fruit and vegetable section, both in markets and in stores, but are they really plants?

At first impression plants and fungi are very similar (Figure 1). Both plants and fungi are sessile, so they cannot move. At the same time, there are many differences between them. Plants contain chlorophyll (have autotrophic nutrition). Mushrooms completely lack this quality. They do not photosynthesize. Fungi have heterotrophic nutrition, that is, they live on organisms that have already prepared the nutritious substance. Plants have leaves, flowers and reproduce in a specific way. Mushrooms also lack these characteristics. So, we cannot say they are plants. But they don't seem to be animals either.



Figure 1. *Agaricus* spp.

Animals (also called Metazoa) are multicellular eukaryotic organisms that form the biological kingdom Animalia. Animals consume ready-made organic matter (so they are heterotrophs), breathe oxygen, can move, can reproduce sexually, and develop from a blastula (a globular embryonic stage with cells arranged in a single layer). Fungi do not have a blastula stage, and are not motile, but sessile. Why were fungi, however, likened to animals?

While the plant cell wall is composed of cellulose, the fungal cell wall is composed of proteins, glucan, chitin, and chitosan. The latter two are polysaccharides that also appear in the exoskeleton of insects and crustaceans, so they are features found in the animal kingdom.

Some fungi store energy in the form of glycogen (Zeitz et al 2019), just like animals. In animals, glycogen is stored in the liver and skeletal muscles (Petrescu-Mag & Proorocu 2022a). In the case of plants, the energy reserve is stored in the form of starch.

Mushrooms are totally heterotrophic, that is, they must feed on ready-made organic matter. Fungi cannot make their own food (they don't have pigments such as chlorophyll). Unlike fungi, plants produce their own organic matter from carbon dioxide and water through photosynthesis (they have chlorophyll and other similar pigments) (Croft et al 2020).

Fungi are able to degrade complex molecules to obtain energy (similar to animals) (Sarrocco 2016), while plants can only use simple molecules.

The resemblance of fungi to animals shows us that the transition from plants to animals is not abrupt, but that there are intermediate forms of life between the two kingdoms. Similarly, in the universe, matter passes from inorganic to organic form through intermediate substances (Petrescu-Mag et al 2011), and the transition from non-living to living is also done in small steps, being very difficult to delimit the living from the non-living (Petrescu-Mag & Proorocu 2022b).

Conflict of interest. The authors declare no conflict of interest.

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