Domain Eukarya

The Fungi

- **All fungi are eukaryotic**
- Fungi are among the **most diverse and widely distributed organisms** and are of **great environmental and medical importance**
- Many fungi are **free-living in soil or water**; others form **parasitic** or **symbiotic relationships** with plants or animals



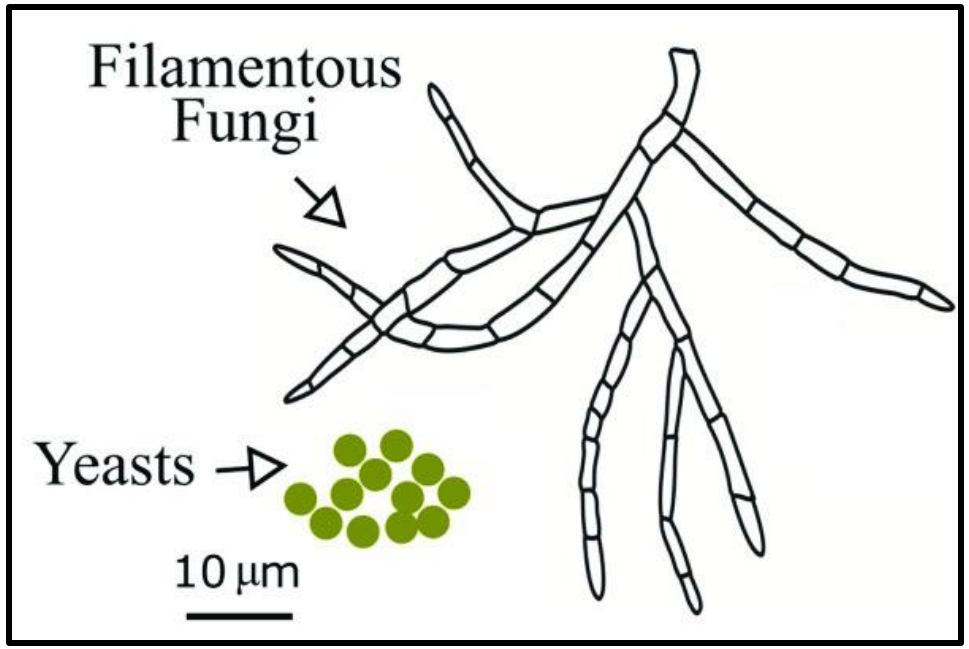


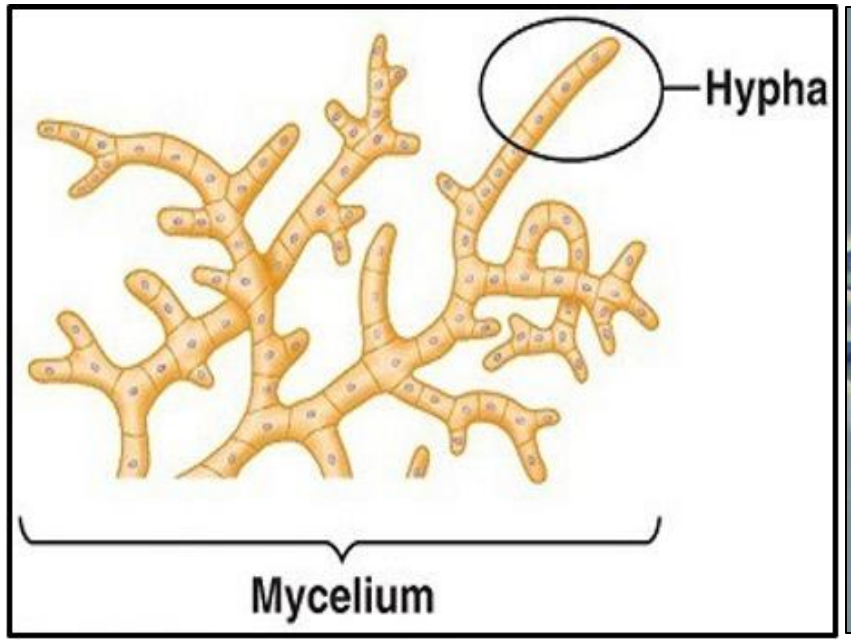


Body Shape and Structure

The **fungal body structures can be one of the following:**

1. **Multicellular filaments hyphae** branch repeatedly into a complicated network called the mycelium (most common)
2. **Unicellular (yeast-like)** are usually spherical or oval (less common)







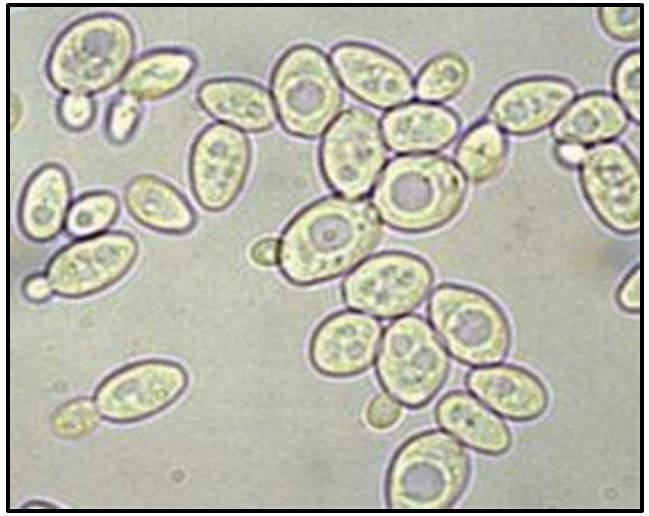
Mycelium of multicellular fungi

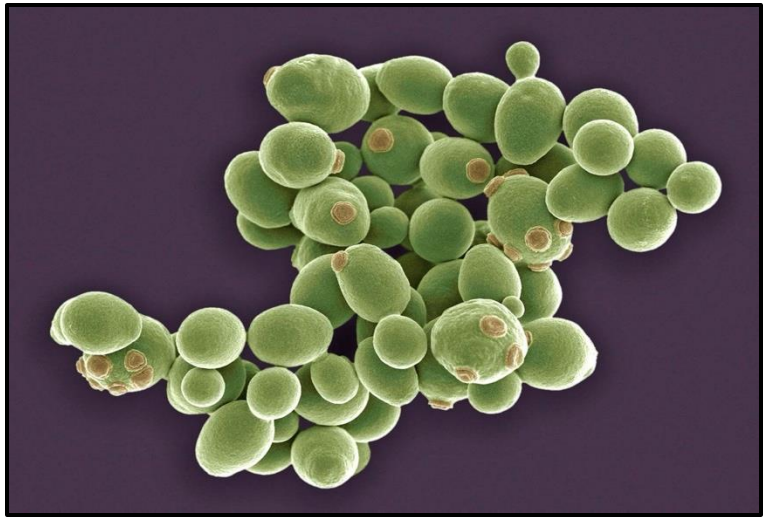


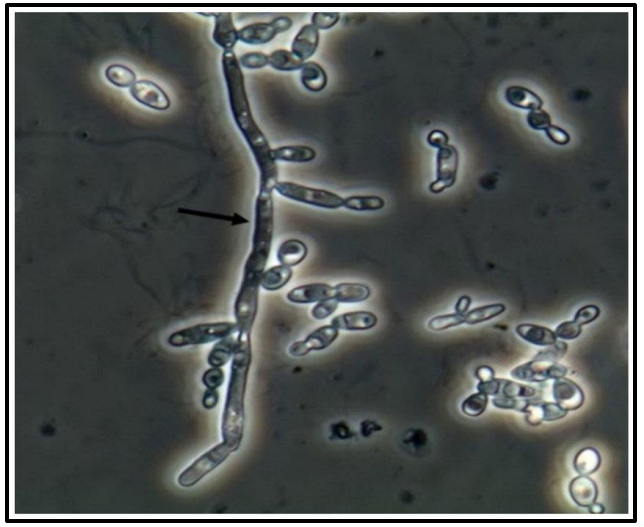


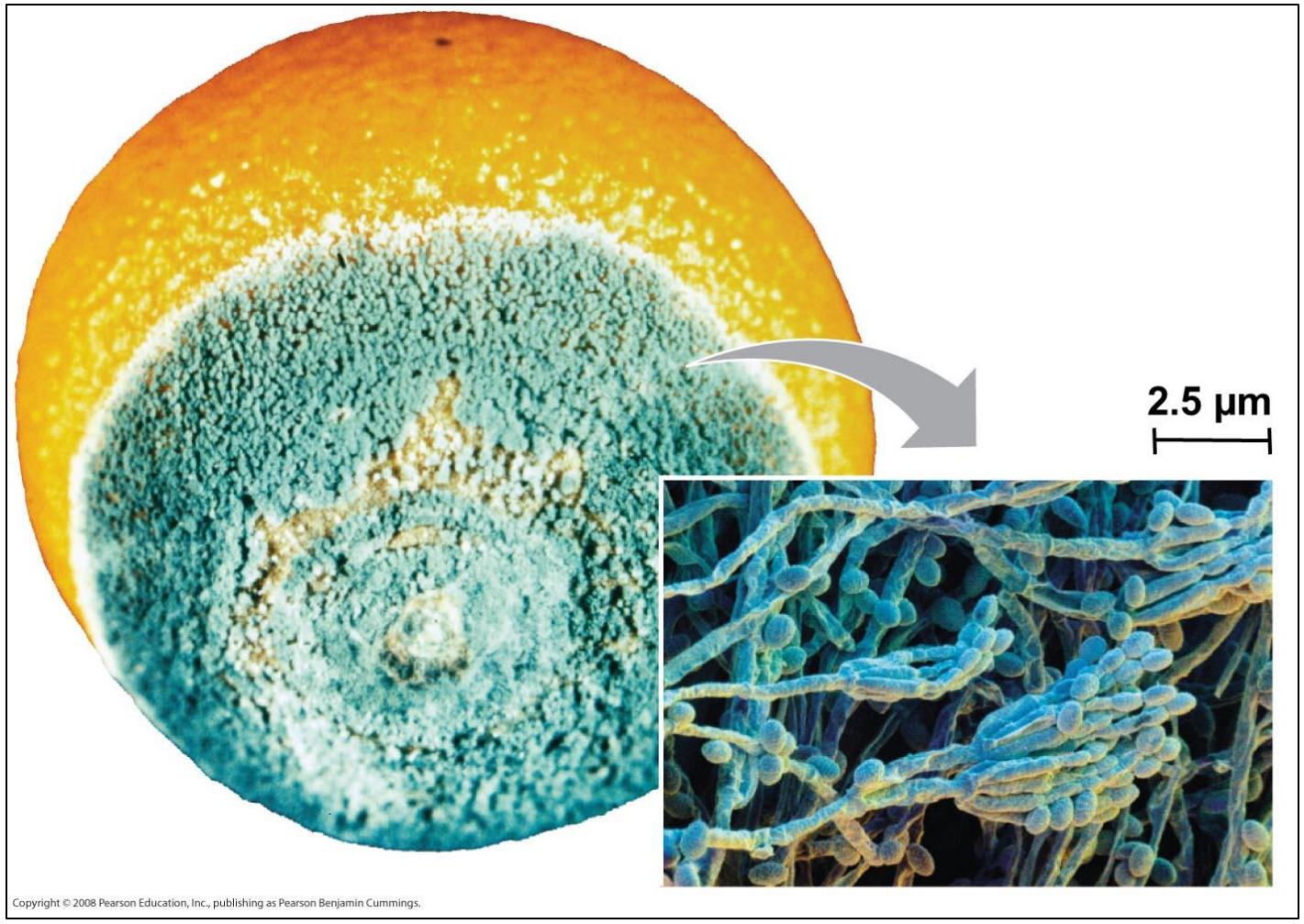


Unicellular fungi (yeast-like)

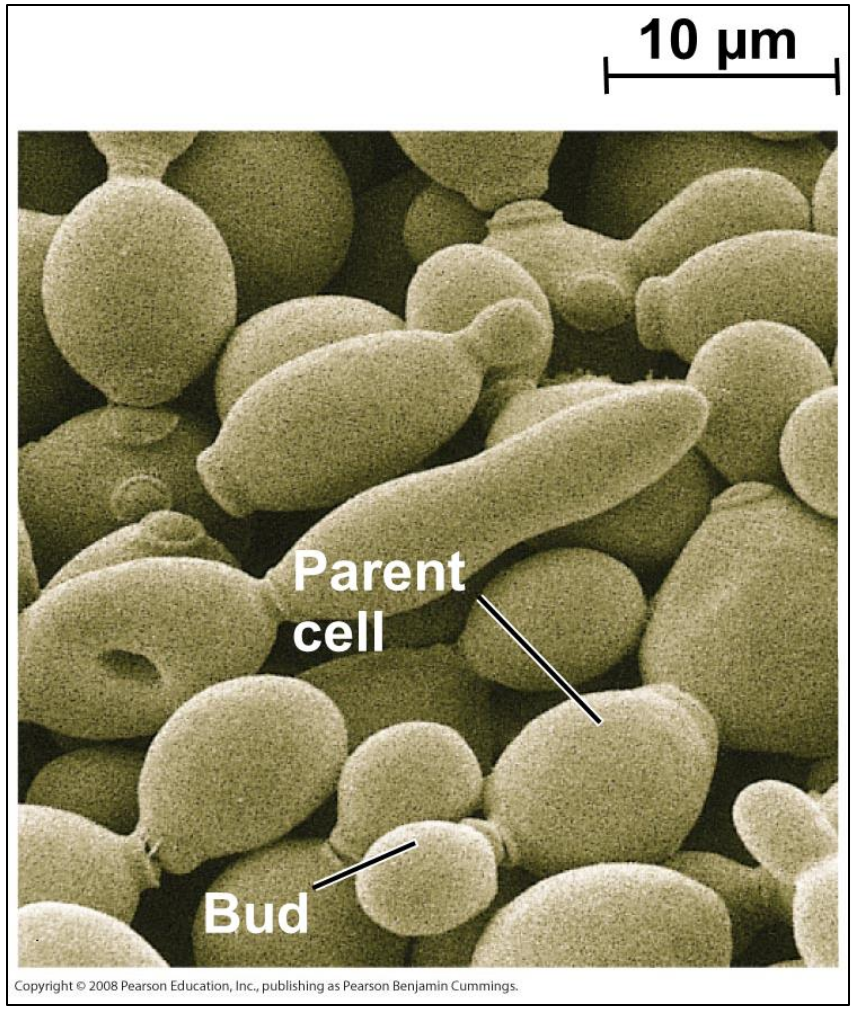








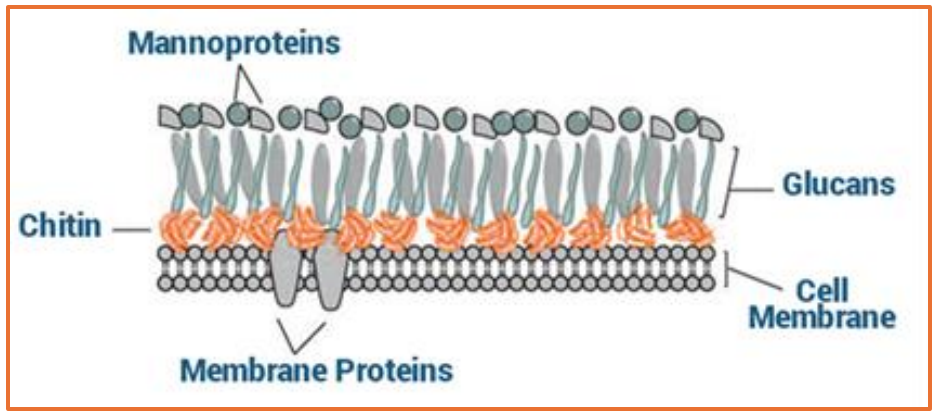
Penicillium: a mold that decomposes food

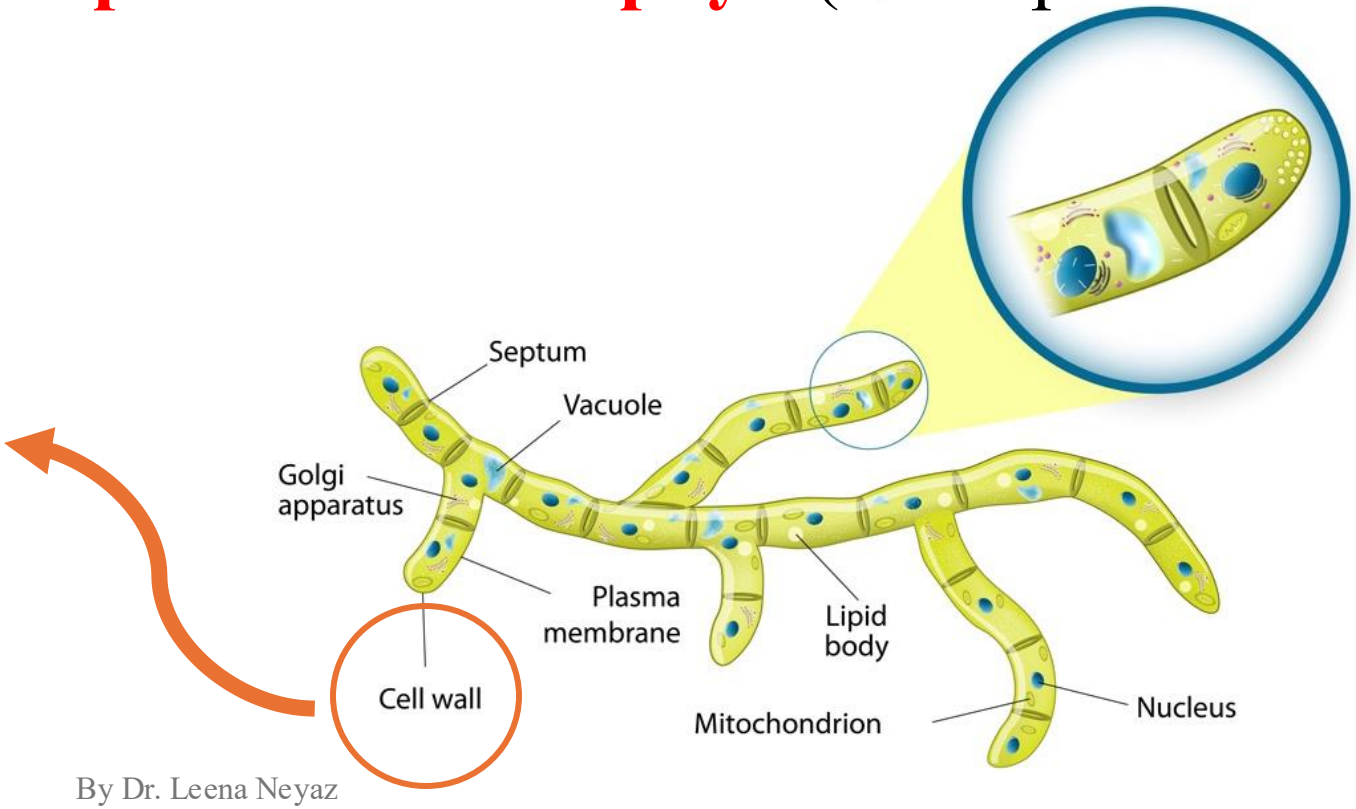


The yeast *Saccharomyces cerevisiae*

Body Shape and Structure

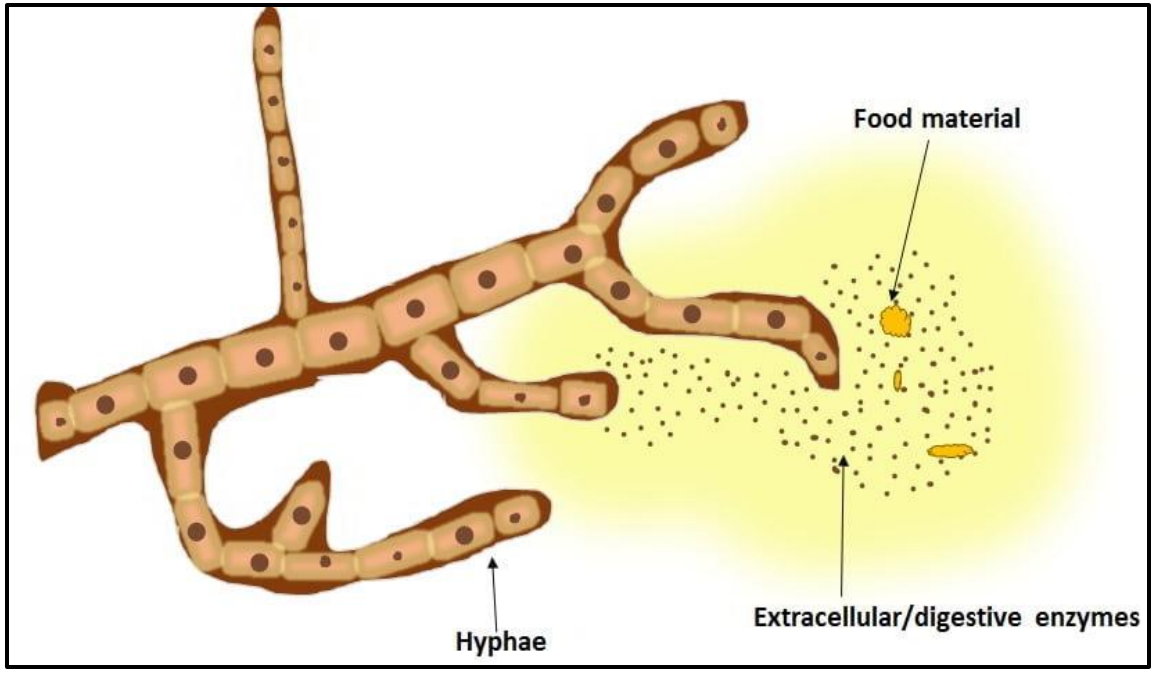
- They have a **thick cell wall made of mainly chitin** (a strong but flexible polysaccharide) to provide important **structural stability** to fungal cell walls
- Fungal cells **do not have chloroplasts or chlorophyll** (not capable of photosynthesis)
- Fungi are **non-motile**





Nutrition in Fungi

- All fungi are **heterotrophs** (not capable of photosynthesis because they lack chlorophyll)
- Fungi use **enzymes** to break down a large variety of complex molecules. The **versatility of these enzymes** contributes to **fungi's ecological success**
- They **feed by absorption (extracellular digestion);** Means they **absorb** nutrients from outside of their body



Classification of Fungi According to Nutrition

Fungi exhibit **diverse lifestyles with diverse food sources:**

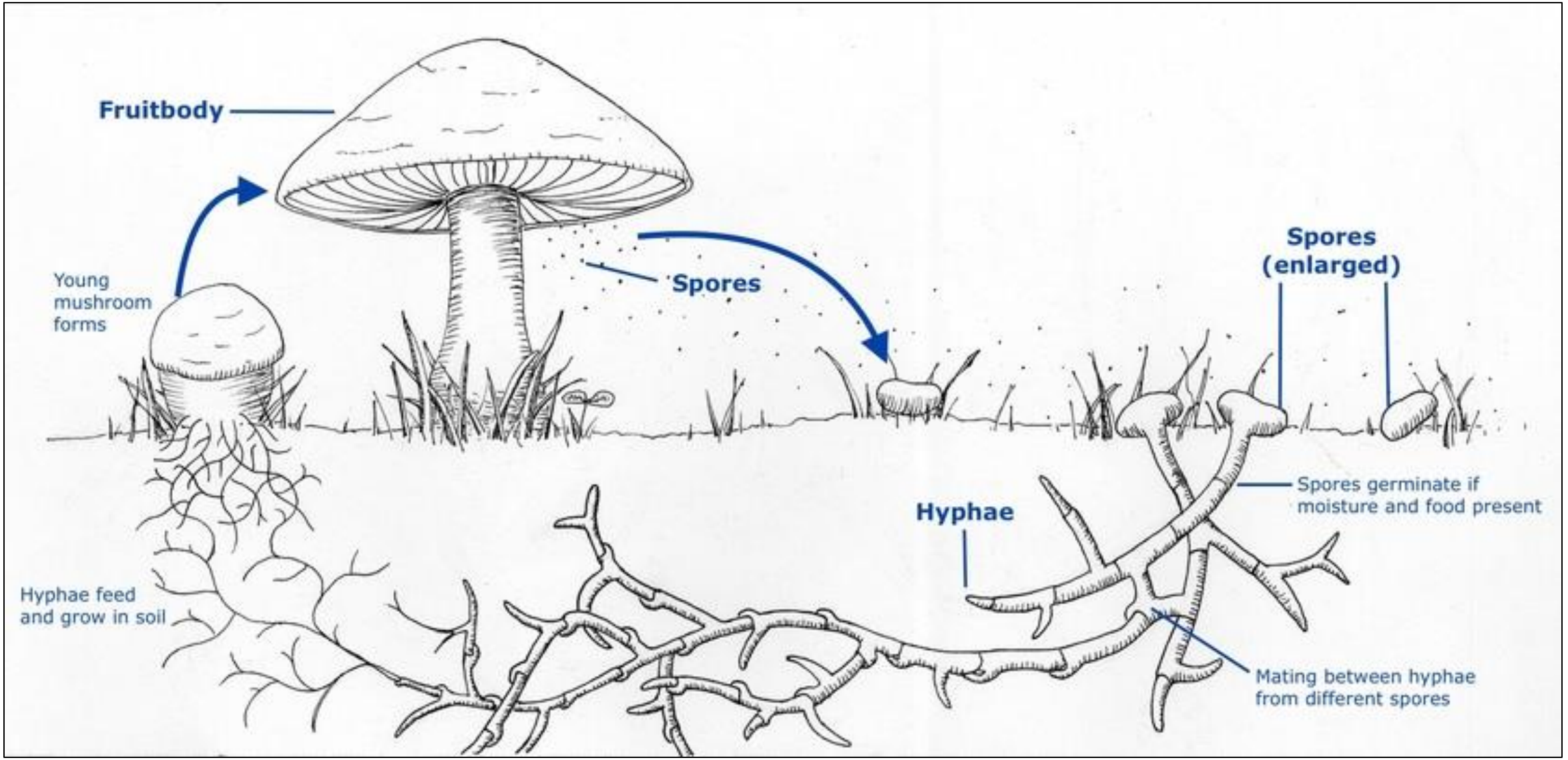
1. **Decomposers/saprophytes:** feed on **nonliving dead organic material**, such as fallen logs, animal corpses, and the wastes of organisms
2. **Parasites:** feed on **living cells of a host**. Parasites that cause disease are called **pathogens**
3. **Mutualists/ Symbionts:** fungi **live harmlessly** with other living organisms, and both **get mutually benefited**





Reproduction in Fungi

- Most fungi propagate themselves **by producing vast numbers of spores**
- Spores can be **carried long distances** by wind or water. If they land in a moist place where there is food, **they germinate producing a new mycelium**
- Some fungi form **reproductive (fruiting) structures** which can **contain spores**
- **Most fungi** can reproduce **both sexually and asexually;** others **reproduce only sexually or only asexually**
- In **both sexual and asexual** reproduction, **most fungi** produce **spores.** Fungi exhibit several types of spores, and these can be **important in classification**


Fruitbody
Young mushroom forms
Spores
Spores (enlarged)
Spores germinate if moisture and food present
Hyphae
Hyphae feed and grow in soil
Mating between hyphae from different spores

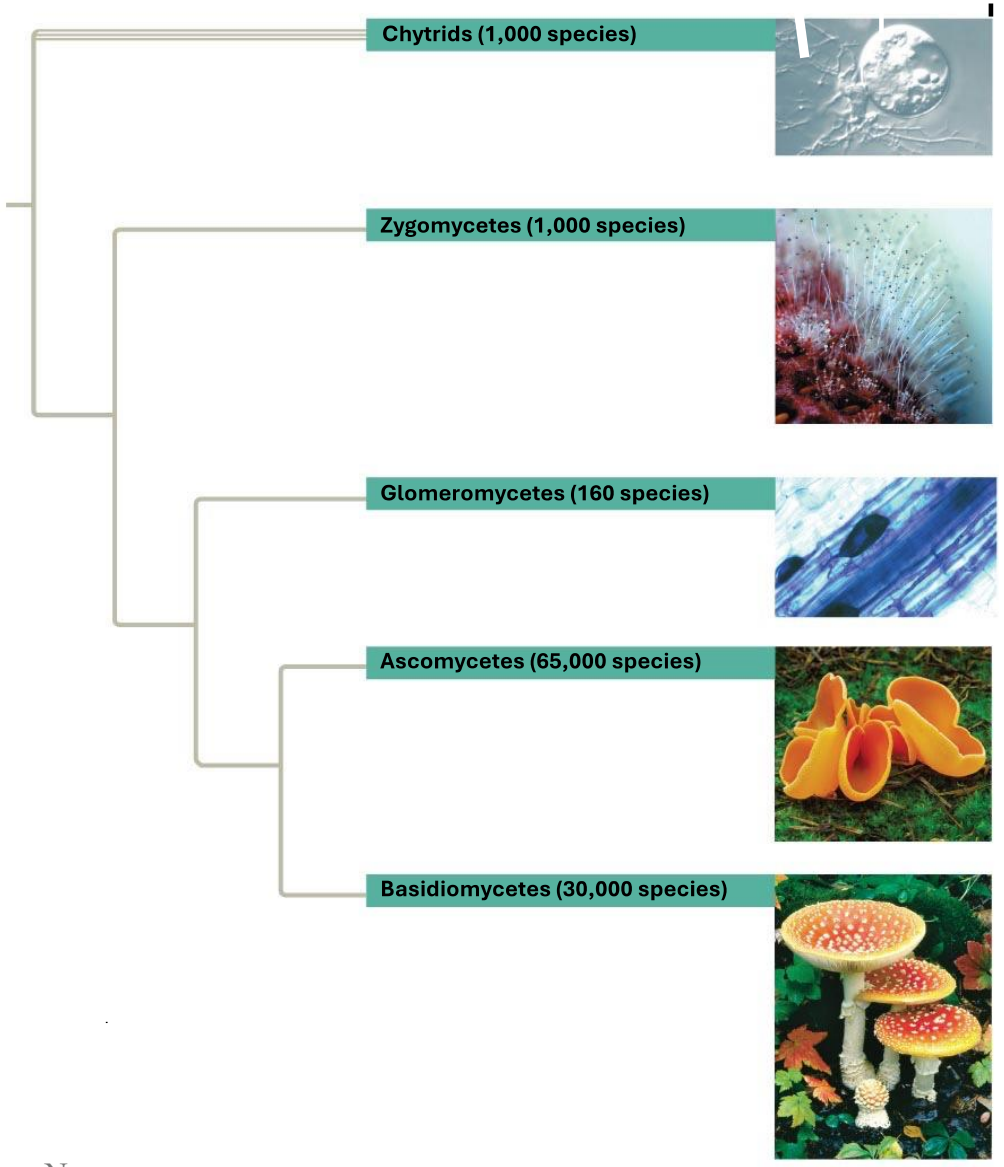




Puffballs and mushroom, the reproductive (fruiting) structures of certain fungal species, may release trillions of spores

Diversity of Fungi

Fungal Phylum	Distinguishing Features of Morphology and Life Cycles	
Chytridiomycota (chytrids)	Flagellated spores	
Zygomycota (zygote fungi)	Resistant zygosporangium as sexual stage	
Glomeromycota (arbuscular mycorrhizal fungi)	Form arbuscular mycorrhizae with plants	
Ascomycota (sac fungi)	Sexual spores (ascospores) borne internally in sacs called asci; ascomycetes also produce vast numbers of asexual spores (conidia)	
Basidiomycota (club fungi)	Elaborate fruiting body (basidiocarp) containing many basidia that produce sexual spores (basidiospores)	



Fungi play key roles in nutrient cycling

- Fungi are efficient **decomposers of organic material**, including the **cellulose and lignin of plant cell walls**. In fact, **almost any carbon-containing substrate**—even jet fuel and house paint—can be consumed by fungi
- As a result, fungi are **primarily responsible for recycling chemical elements** such as carbon, nitrogen, and other elements in the ecosystems



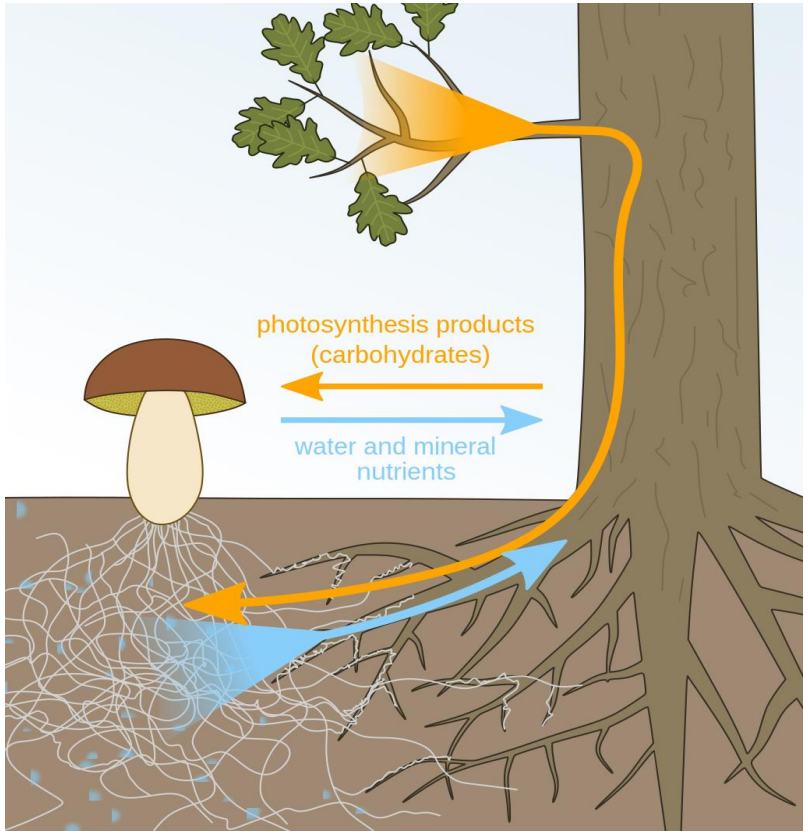


Many fungi are important decomposers of dead wood

Fungi Play Key Roles in Ecological Interactions

Fungi form **mutualistic relationships** with plants, algae, cyanobacteria, and animals. All these relationships have profound ecological effects

1. Fungus-Plant Mutualisms:
fungi & plant roots (Mycorrhizae)



2. Fungus-photosynthetic microorganism Mutualisms: fungi and algae (lichens)



Fungi Play Key Roles in Human Welfare

- About 30% of known fungal species are parasites or pathogens, **mostly on or in plants.** Some fungi that attack food crops are **toxic to humans**
- **Animals are much less susceptible** to parasitic fungi than are plants
- The general term for a fungal infection in animals (including human) is **mycosis**



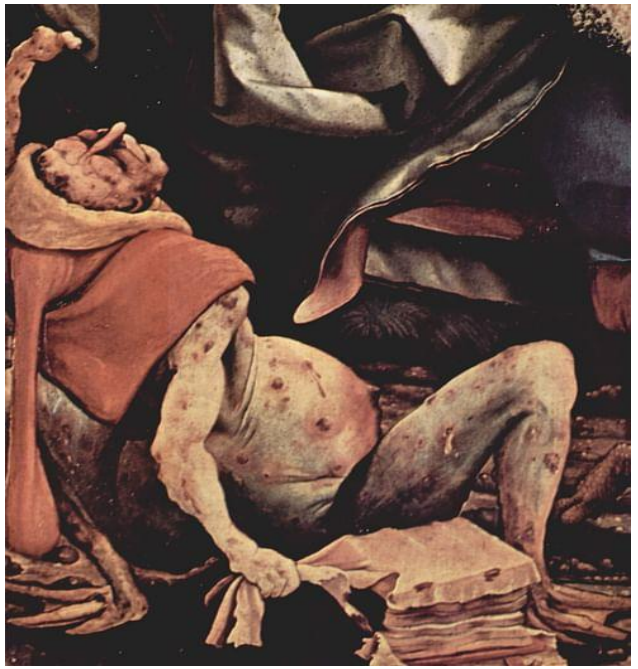
(a) Corn smut on corn



(b) Tar spot fungus on maple leaves



(c) Ergots on rye



An epidemic of ergotism (944 CE) killed up to 40,000 people in France

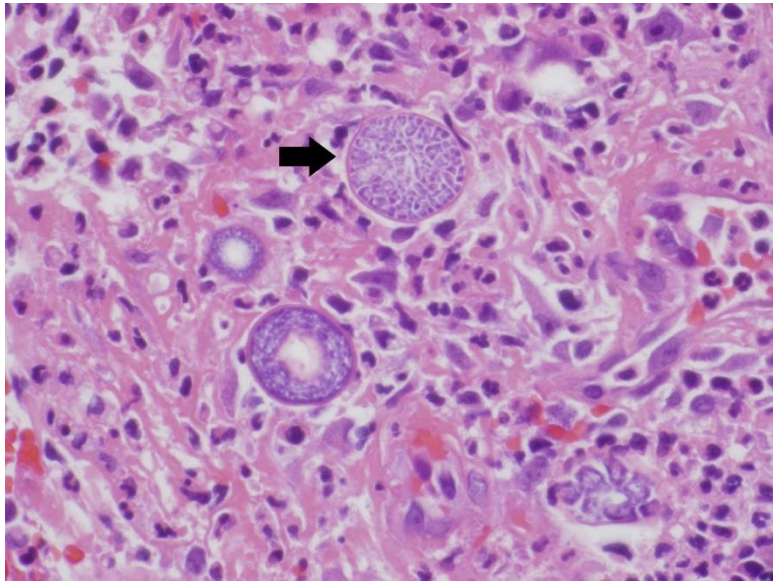




Nearly 100 species of frogs and **other amphibians** wiped out by fungal **chytrids**




Athlete's foot (left) and ringworm infections (right)



Coccidioidomycosis produces tuberculosis-like symptoms in the lungs

Practical Uses of Fungi

In Food Industry

Humans **eat** many fungi and use others to **make** cheeses, alcoholic beverages, and bread.

In Medicine

Some fungi are used to **produce antibiotics** for the treatment of bacterial infections, for example the fungi *Penicillium*.

In Research

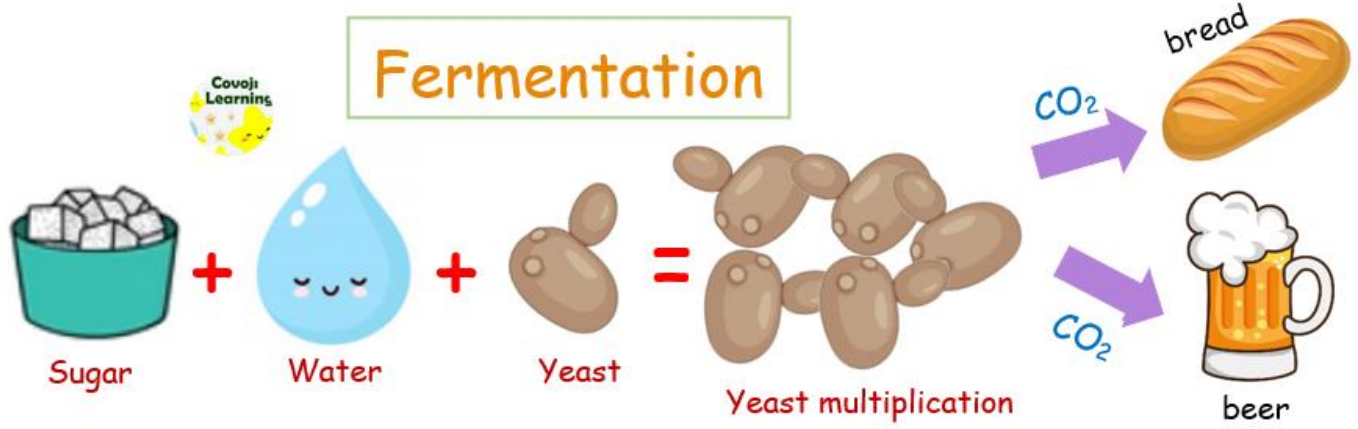
Genetic research on fungi is leading to applications in **biotechnology:** For example, insulin-like growth factor can be produced in the fungus *Saccharomyces cerevisiae*



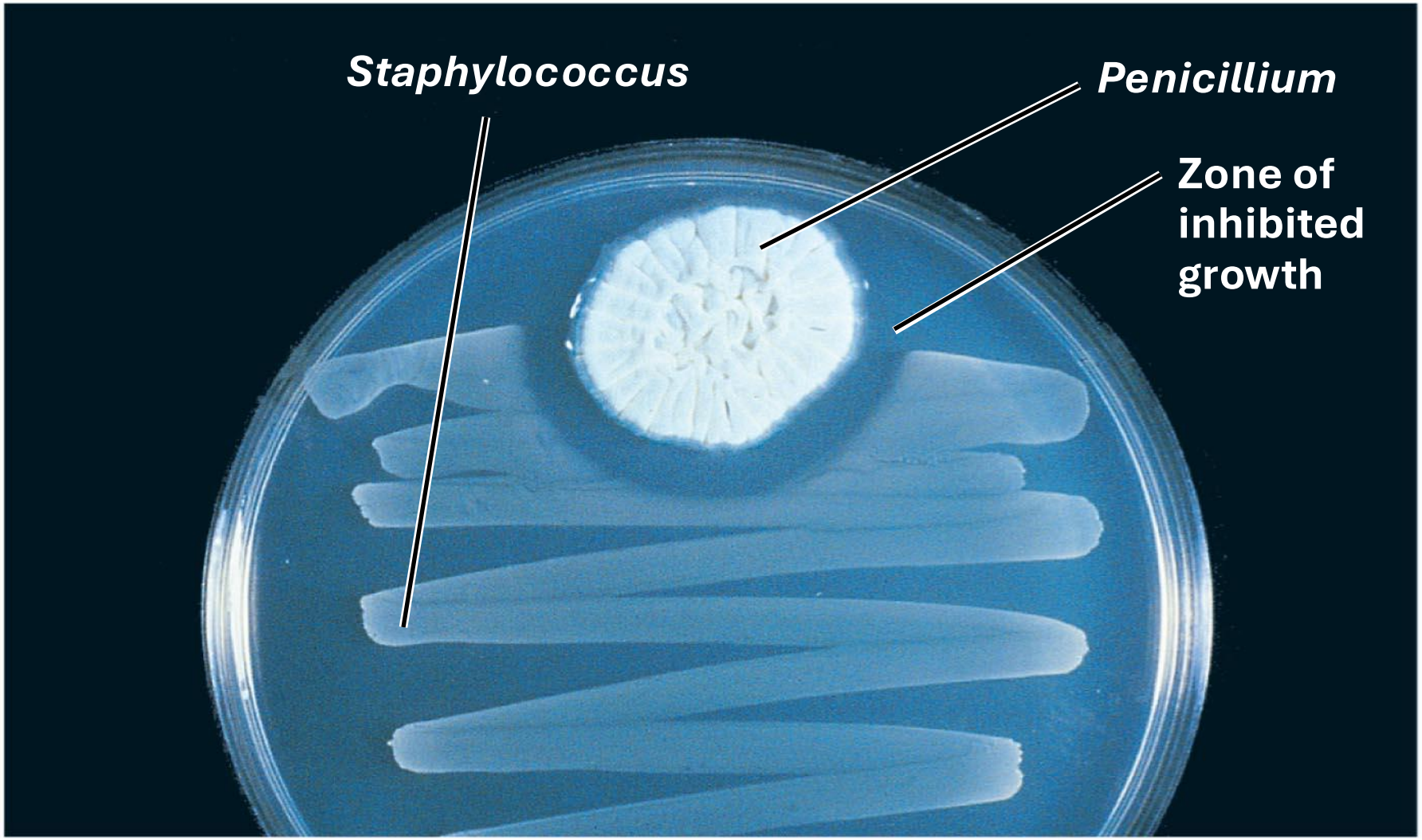





ROQUEFORT
CARLES


Fermentation
Covoji Learning
Sugar
Water
Yeast
Yeast multiplication
CO_2
bread
CO_2
beer

Fungal production of an Antibiotic: The mold penicillium produces an antibiotic that inhibits bacteria growth resulting in a clear area between the mold and the bacteria



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