

# The Fungus

- **Eukaryotic**
- **Spore bearing**
- **Achlorophyllous organism**
- **Generally reproduce sexually and asexually**
- **Usually filamentous or branched somatic structure**
- **Typically surrounded by cell walls**
- **Containing chitin or cellulose or both together**
- **With many other complex organic molecules**

# What Do Fungi Look Like?

- **Mycelial (filamentous)**
- **Unicellular and primitively branched (Chytrids)**
- **Yeasts (unicellular)**
- **Dimorphism (Two morphological forms)**

# Thallus organization

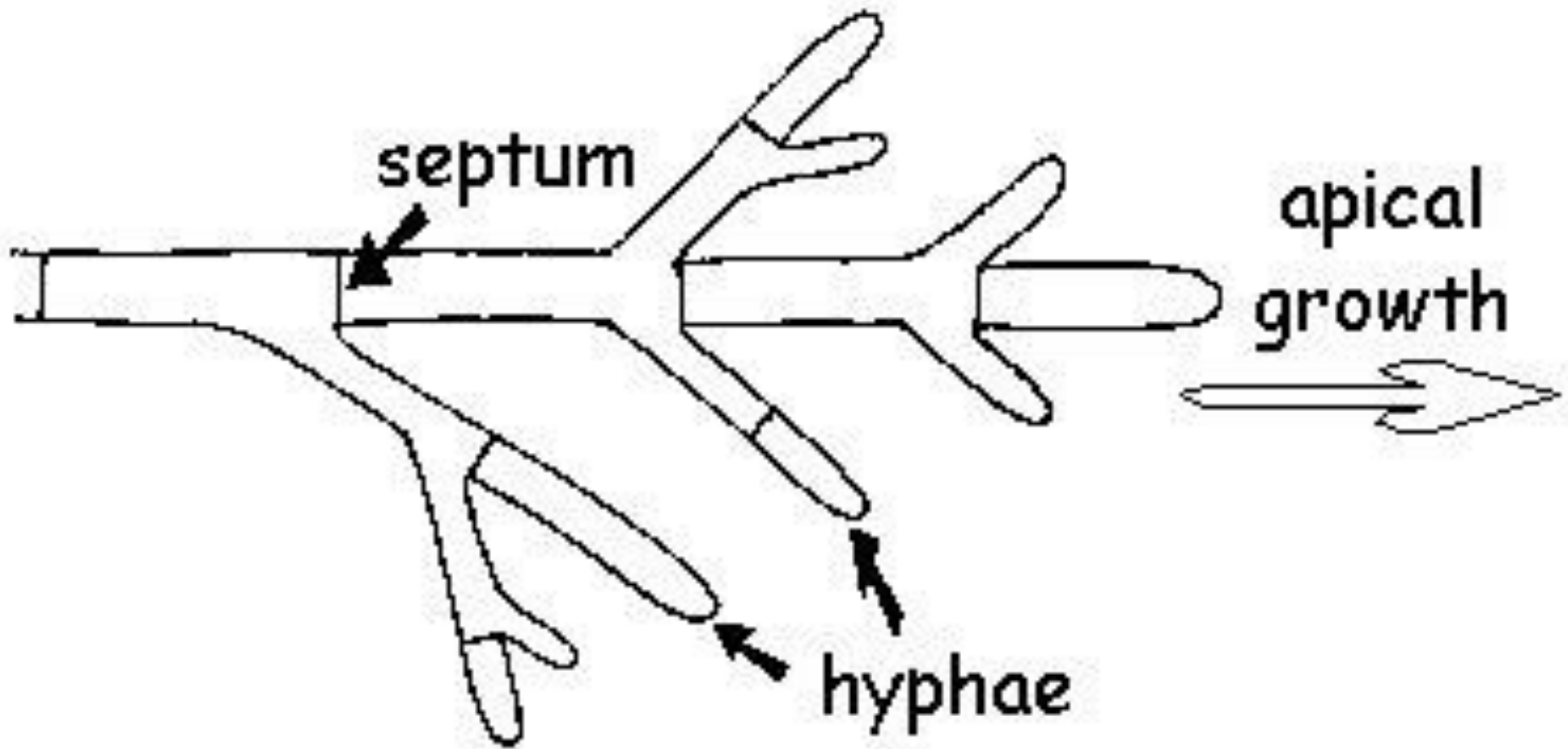
- **Unicellular**
- **Thread like filaments**
  - ✓ **Simple Hypha/hyphae or mycelium (net work)**
    - **Holocarpic – no differentiation**
    - **Eucarpic– differentiated in vegetative and reproductive parts**
    - **Coenocytic or nonseptate – with homokaryotic or heterokaryotic condition**
  - ✓ **Septate with simple solid septum or perforated and dolipore septum**

# Hyphal modifications and aggregates

- **Rhizomorph** – around root
- **Appressoria** – during early stage of infection
- **Haustoria** – for absorption of nutrition from host
- **Prosenchyma**
- **Pseudoparenchyma**
- **Stroma**
- **Sclerotium**

# General Characteristics of True Fungi (Mycota or Eumycota)

- All are eukaryotic Possess membrane-bound nuclei and a range of membrane-bound cytoplasmic organelles
- Most are filamentous Composed of individual microscopic filaments called hyphae, and which branch to form a network of hyphae called a mycelium
- Some are unicellular e.g. yeasts
- Protoplasm of a hypha or cell is surrounded by a rigid wall Composed primarily of chitin and glucans, some species contain cellulose.
- Many reproduce both sexually and asexually both sexual and asexual reproduction often result in the production of spores.

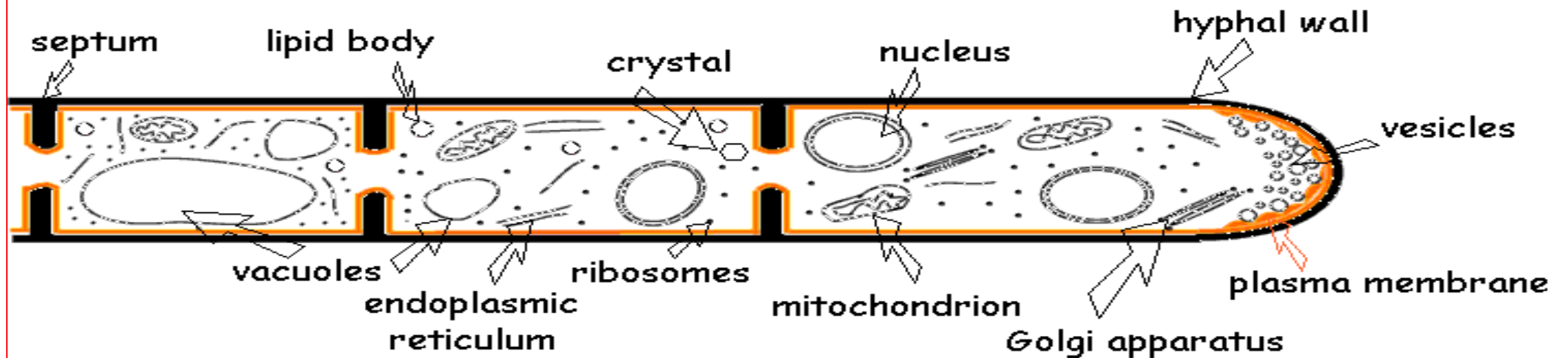


- **Each HYPHA is:**
  - **essentially a tube - consisting of a rigid wall and containing protoplasm**
  - **tapered at its tip - this is the region of active growth (i.e. the extension zone)**

- **SEPTA (cross-walls), if present, can usually be observed down a light microscope**
  - some fungi possess septa at regular intervals along the lengths of their hyphae
  - in others, cross-walls form only to isolate old or damaged regions of a hypha or to isolate reproductive structures
  - some septa possess one or more PORES - such septa divide up the hyphae into a series of interconnected **HYPHAL COMPARTMENTS**, rather than separate, discrete cells



# Diagrammatic cell structure



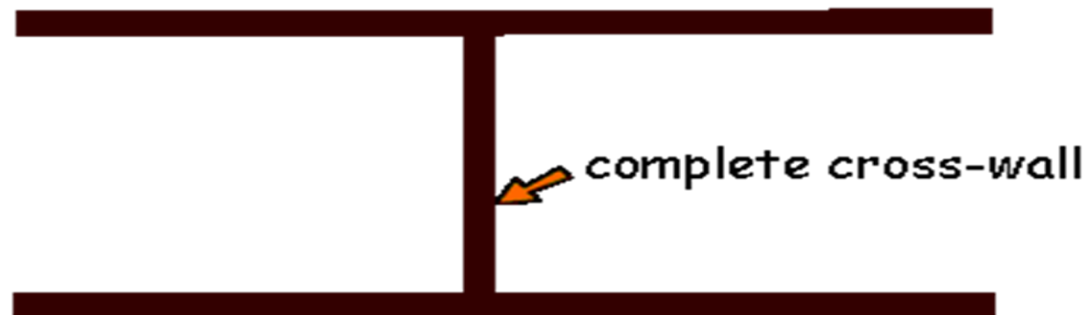
# Septation in fungal mycelium

**Electron microscopy has revealed that several different types of septa exist among the major taxonomic groups of fungi**

- Oomycota and Zygomycota**
- Ascomycota**
- Some other mitosporic fungi**
- Basidiomycota**

# Septation in Oomycota and Zygomycota

- In general, the hyphae of fungi belonging to these groups are not regularly septate
- But septa in the form of **COMPLETE CROSS-WALLS** are formed to isolate old or damaged regions of the mycelium or to separate reproductive structures from somatic hyphae.



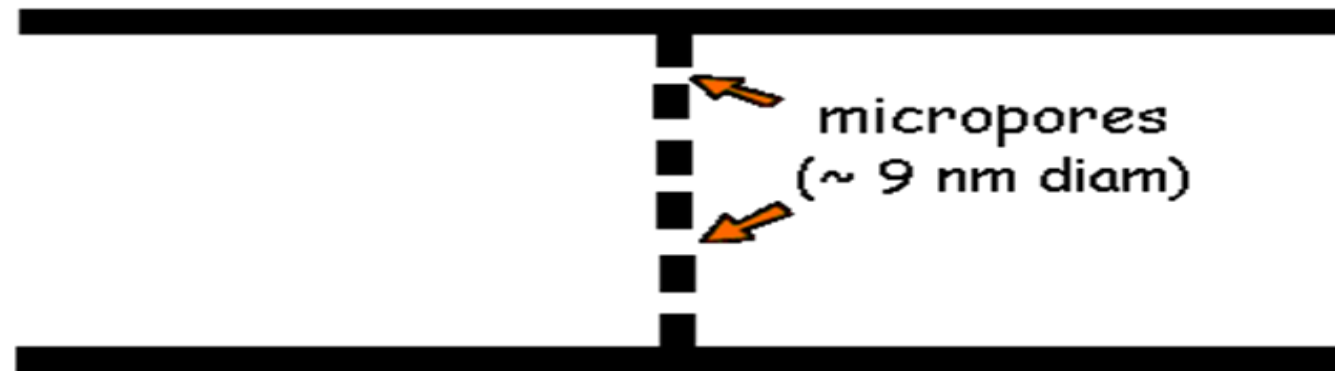
# Septation in Ascomycota

- Hyphae of fungi belonging to these groups possess perforated septa at regular intervals along their length.
- The septum consists of a simple plate with a relatively **LARGE CENTRAL PORE** (50-500 nm diameter) - this allows cytoplasmic streaming (the movement of organelles, incl. nuclei) between adjacent hyphal compartments.
- Associated with each septum are spherical, membrane-bound organelles called **WORONIN BODIES**

- The WORONIN BODIES are composed of protein;
- Remain close to the septal pore and tend not to be disturbed by the cytoplasmic streaming taking place;
- Tend to be of the same or larger diameter than the septal pore and are, therefore, capable of blocking the pore;
- Will block the septal pore if the adjacent hyphal compartment is damaged or ageing and becoming highly vacuolated.

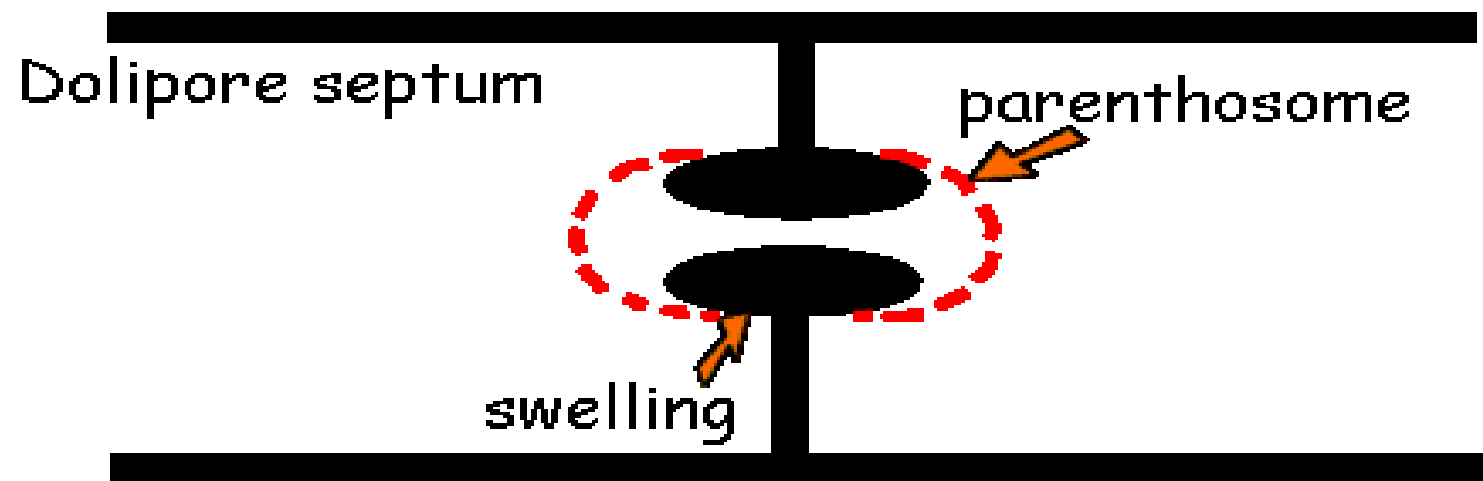


- Some other mitosporic fungi may possess **MULTIPERFORATE SEPTA**
- E.g. the septa of *Geotrichum candidum* (illustrated above) possess characteristic **MICROPORES** (approx. 9 nm diameter)
- The number of pores in each septum can vary up to a maximum of approx. 50
- These micropores allow cytoplasmic continuity between adjacent hyphal compartments, but are too small to allow cytoplasmic streaming to occur to the extent observed in fungi possessing larger septal pores



# Septation in Basidiomycota

- The most complex type of septum is found in fungi belonging to the Basidiomycota
- Each septum is characterized by a swelling around the central pore (DOLIPORE) and a hemispherical perforated cap (PARENTHOSOME) on either side of the pore
- The perforated parenthosome allows cytoplasmic continuity but prevents the movement of major organelles
- The plasma membrane lines both sides of the septum and the dolipore swelling, but the membrane of the parenthosome is derived from endoplasmic reticulum





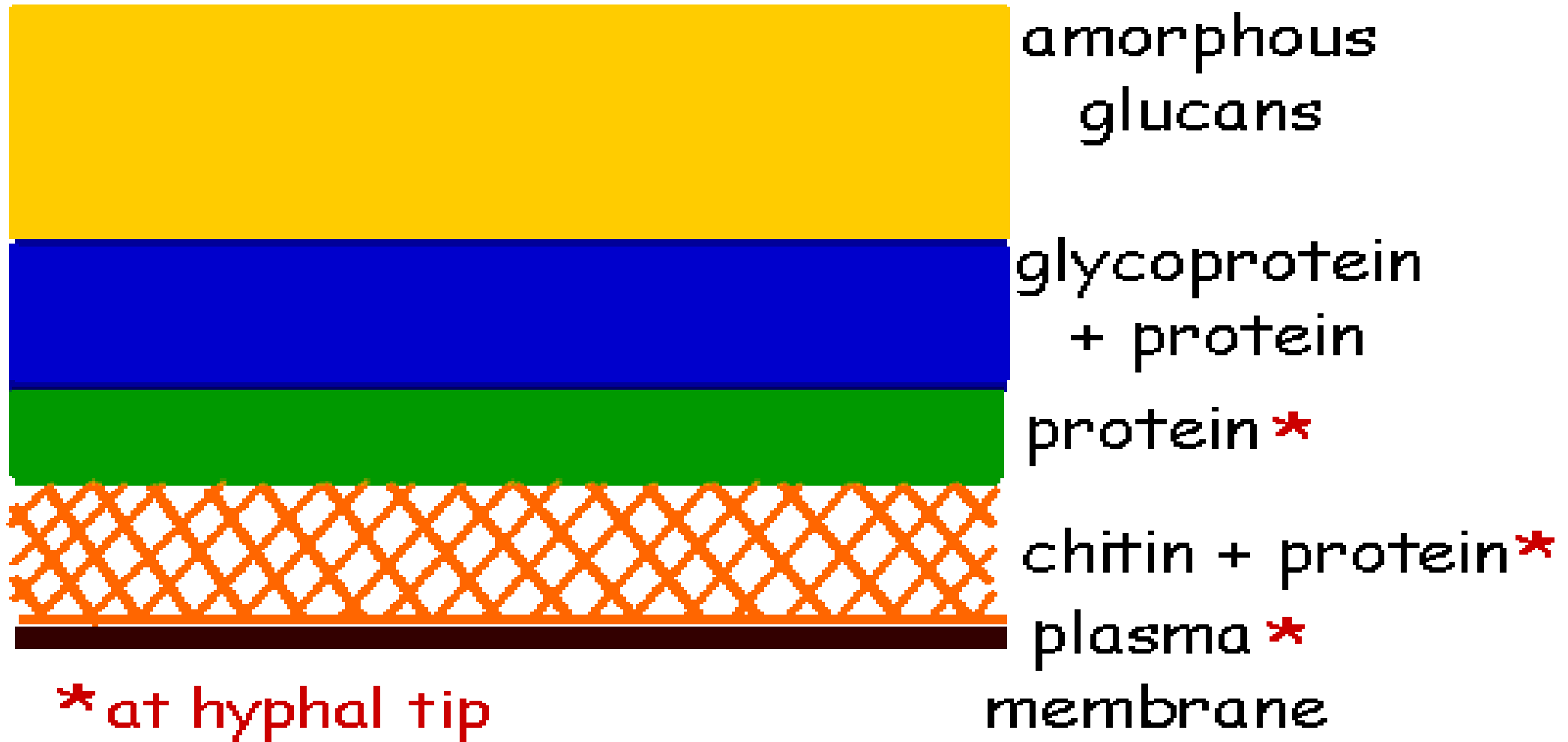
# Functions of septa

- Act as **STRUCTURAL SUPPORTS**
- Act as the **FIRST LINE OF DEFENCE** when part of a hypha is damaged
  - a mechanism exists for rapidly sealing the septal pore under conditions of stress (e.g. if the hypha is damaged) thereby helping protect the mycelium.
- Facilitate **DIFFERENTIATION** in fungi
  - Septa can isolate adjacent compartments from one another so that different biochemical and physiological processes can occur within them - these may result in differentiation of the hyphae into specialized structures, such as those associated with sporulation

# The Fungal Wall

## Functions :

- **PROTECTS** the underlying protoplasm;
- determines and **MAINTAINS THE SHAPE** of the fungal cell or hypha; if you remove the wall the resulting protoplast will always assume a spherical shape;
- acts as an **INTERFACE** between the fungus and its environment;
- acts as a **BINDING SITE** for some enzymes;
- possesses **ANTIGENIC** properties - which allow interactions with other organisms.



# Chemical composition of the wall

- **POLYMERIC FIBRILS**
  - chitin
  - cellulose (in the Oomycota)
- **AMORPHOUS MATRIX COMPONENTS**
  - glucans
  - proteins
  - lipids
  - heteropolymers (mixed polymers) of mannose, galactose, fucose and xylose
- **The types and amounts of these various components vary amongst different groups of fungi and may even vary during the life cycle of a single species.**