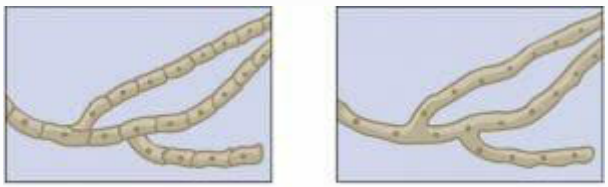
Lab 3= **Septa**

Septa

Septate Hyphae

Septate hyphae have dividers between the cells, called septa (singular septum). The septa have openings called pores between the cells, to allow the flow of cytoplasm and nutrients throughout the mycelium. Although the septa separate the cells, in some hyphae the cellular components, including the nucleus, can fit through the pores. When new cells bud at the apex of the hypha, a septum does not form immediately. As the new cell matures, the cell wall grows down into the cytoplasm, forming the septum. Members of the classes Basiodiomycetes and Ascomycetes form septate hyphae.

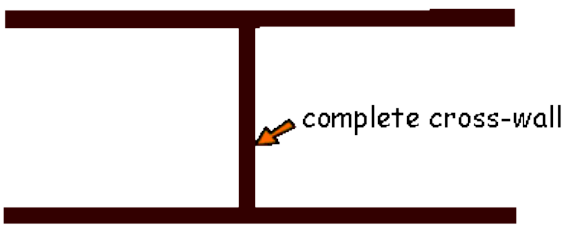
Non-septate hyphae, also known as aseptate or coenocytic hyphae, form one long cell with many nuclei. They are the more primitive form of hyphae; species with septate hyphae diverged from a common ancestor with coenocytic hyphae. Most fungi with coenocytic hyphae belong to the class Zygomycetes. While they do not form septa between nuclei, they do form a septum at branch points that connect one filament to another, preventing the entire network from being compromised if one hypha is injured.



septate hypha **non septate**

Septa (cross-walls) can be seen by light microscopy, . But electron microscopy has revealed that several different types of septa exist among the major taxonomic groups of fungi.

- Oomycota and Zygomycota:

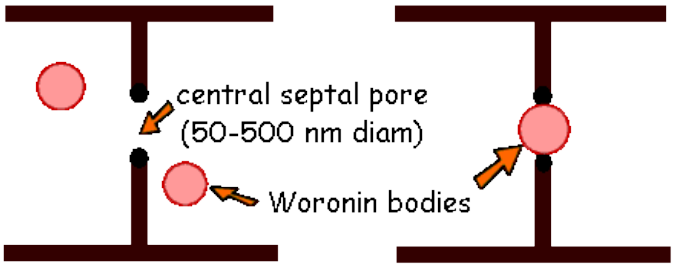


- In general, the hyphae of fungi belonging to these groups are not regularly septate (although there are some exceptions).

Lab 3= **Septa**

- 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.

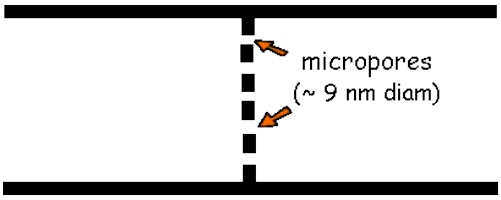
Ascomycota and some mitosporic fungi:



- Hyphae of fungi belonging to these groups (and the Basidiomycota) 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.
- Cytoplasmic streaming enables sub-apical and intercalary (central) compartments of young hyphae to contribute towards growth of the hyphal tip - transporting nutrients and essential enzymes to the apex - so maximizing the capacity for somatic growth.
- Associated with each septum are spherical, membrane-bound organelles called WORONIN BODIES that .....
    - 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.
- Not all fungi belonging to the Acomycota possess Woronin bodies - those that don't often possess LARGE HEXAGONAL CRYSTALS OF PROTEIN in the cytoplasm that are capable of serving the same function, i.e. they can seal the septal pores of damaged or ageing hyphae.

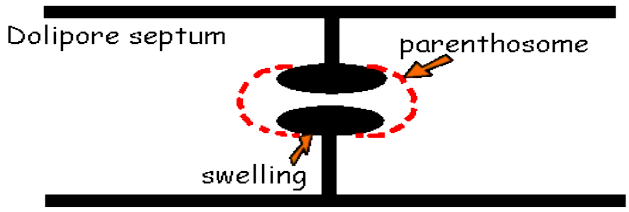
Some other mitosporic fungi:

Lab 3= **Septa**



- A number of mitosporic fungi possess septa with a single central pore, similar to that observed in the Ascomycota.
- But 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.

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 - illustrated above.
- 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
  - The addition of plate-like cross-walls to what is essentially a long tube-like structure (hypha) will help stabilize it.
- Act as the FIRST LINE OF DEFENCE when part of a hypha is damaged
  - Large-pored septa that have Woronin bodies or large proteinaceous crystals associated with them have the

advantage that cytoplasmic streaming can occur between adjacent compartments.
    - But at the same time 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.
    - It's unlikely to be coincidental that the most complex and highly differentiated sporulating structures we see are those produced by fungi possessing the most complex types of septa, i.e. fungi belonging to the Basidiomycota