Fungal hyphae and septation relevant to medical mycology

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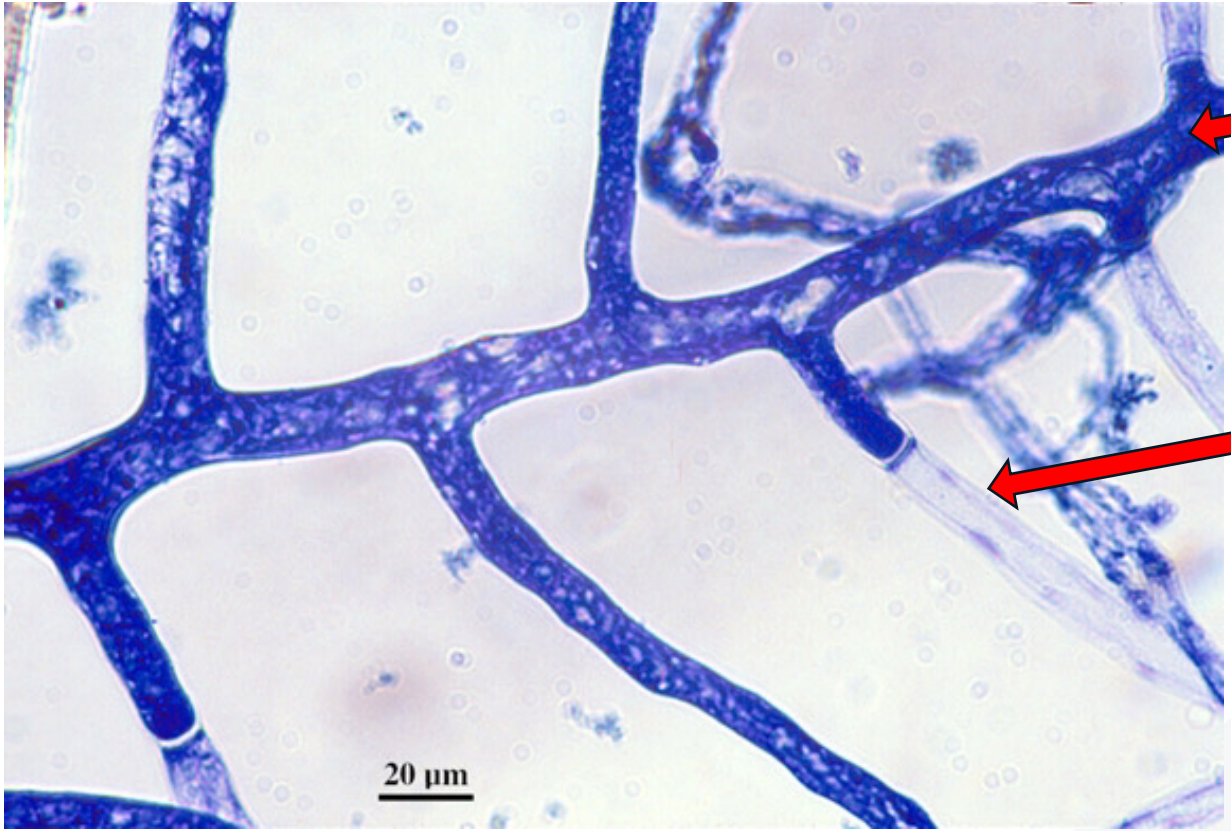
Zygomycetes

- Zygomycetes have characteristic thin-walled, infrequently septate, multi-nucleate coenocytic hyphae.
- Many refer to zygomycete hyphae as non-septate because they don't have true septa with pores, **they are one continuous cell**.
- Cells are separated by solid cross walls with no pores and there is no flow of cytoplasmic material between cells.
- Thus, coenocytic hyphae are **very susceptible to death if damaged**.
- For example, in a biopsy sample there maybe only a few hyphal cells ramifying through the tissue. During the surgical removal and subsequent laboratory processing all may be damaged and therefore become non-viable.

Coenocytic hyphae as in the Zygomycetes are large single cells, thus they are very prone to death if damaged.



viable undamaged cell

damaged non viable cell

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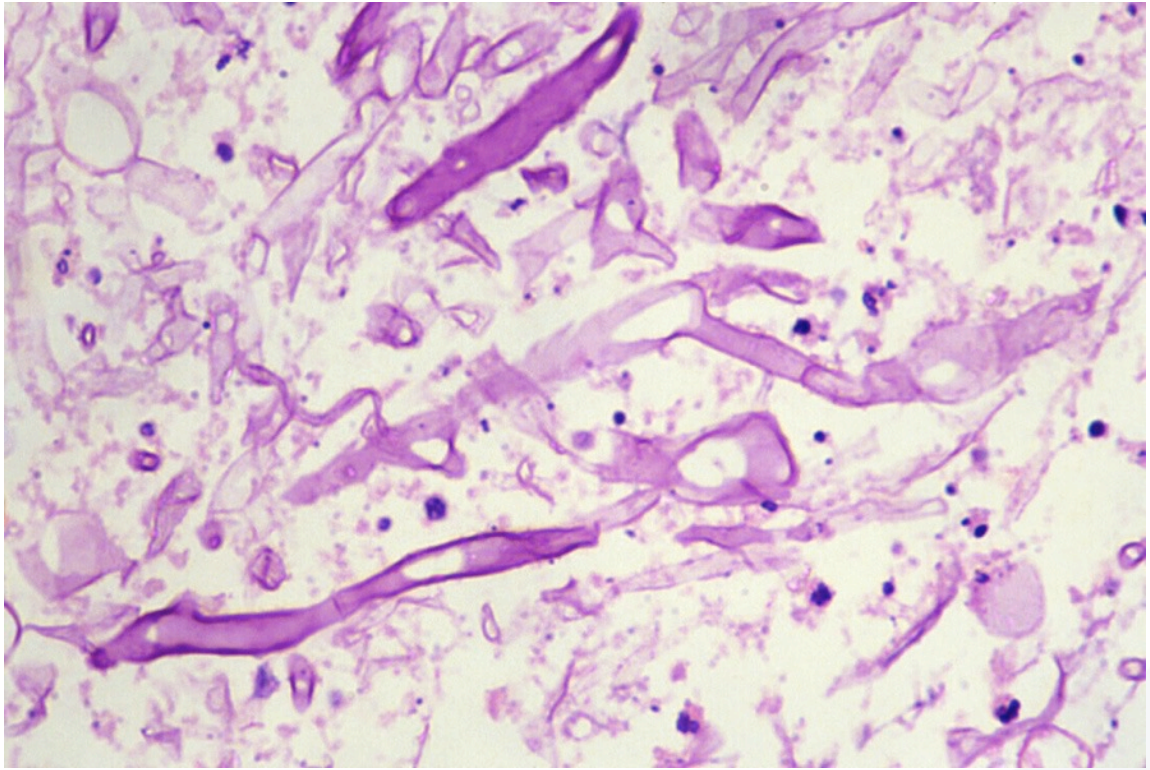
Haematoxylin and eosin (H&E) stained section of lung tissue showing coenocytic hyphae ramifying through the tissue. Thus, all the viable cells could be easily damaged in the laboratory processing.



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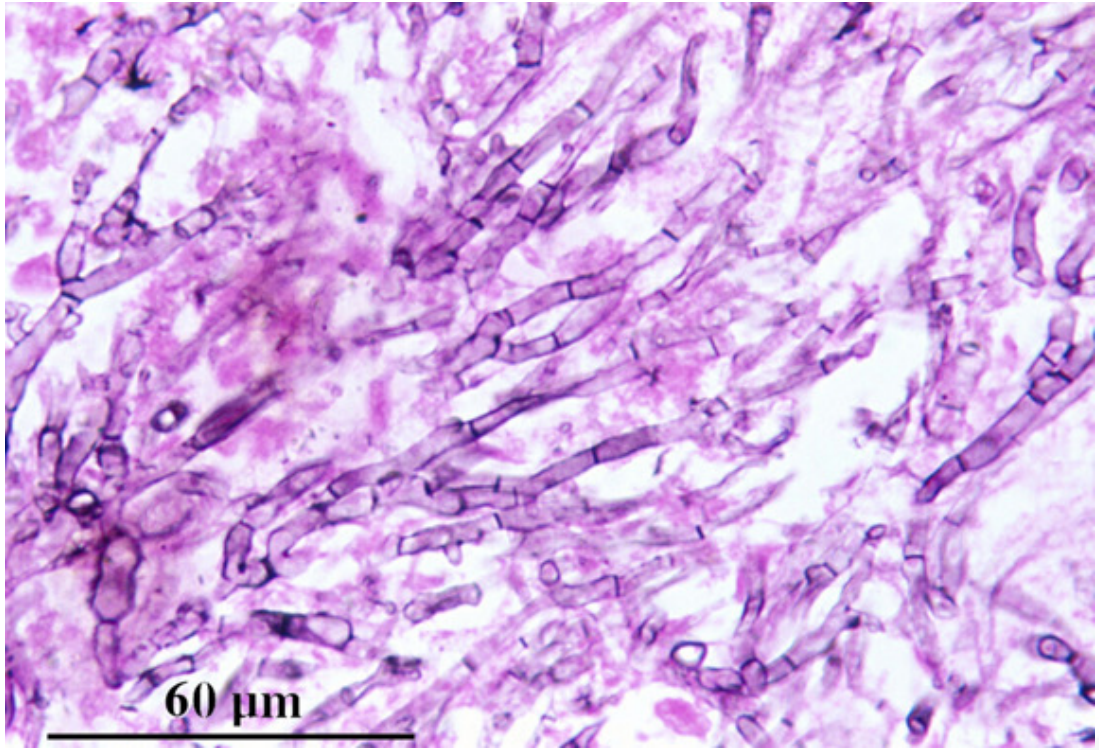
Coenocytic hyphae

- So, the Histopathology laboratory reports numerous non-septate hyphae present consistent with zygomycosis, however the Microbiology laboratory can't grow it.
- Well, the specimen has been chopped up, all the hyphae have been damaged and are non-viable.
- If zygomycosis is suspected, then try not to chop up the specimen too much, rather tease it apart and use bigger pieces to inoculate isolation media. Zygomycetes rely on rapid growth and sporulation for survival, all you need is some viable hyphae to be present.

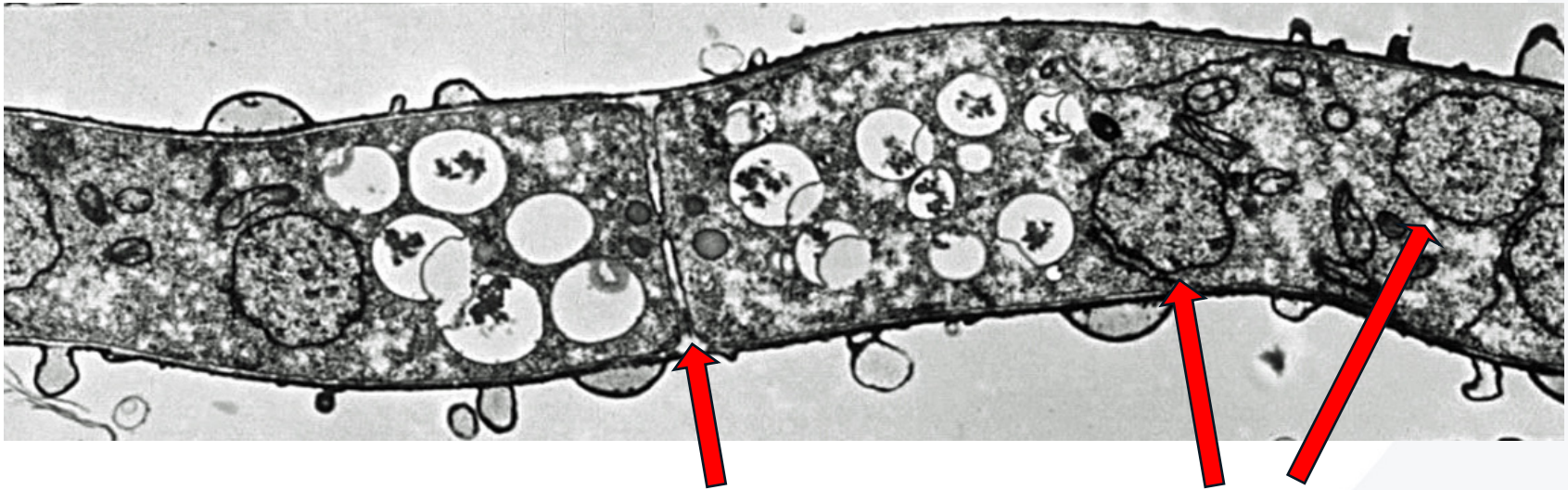
Ascomycetes

- Most common conidial moulds [hyphomycetes], includes *Asperguillus, Fusarium, Scedosporium* etc.
- **Septate hyphae with simple pores where cytoplasmic and nuclear migration is not inhibited**.
- Like in a submarine the hyphae are compartmentalised with a cross wall (septa) with a simple door (pore) that can be closed if one section becomes damaged.
- This is a major survival mechanism for these fungi.

Septate hyphae of *Aspergillus* in lung tissue. Note the hyphae are compartmentalized by cross walls or septa.



Ascomycete hyphae are multi-nucleate and compartmentalized by septa with simple pores, i.e., all cytoplasmic contents including nuclei may flow up and down the hyphal strand.



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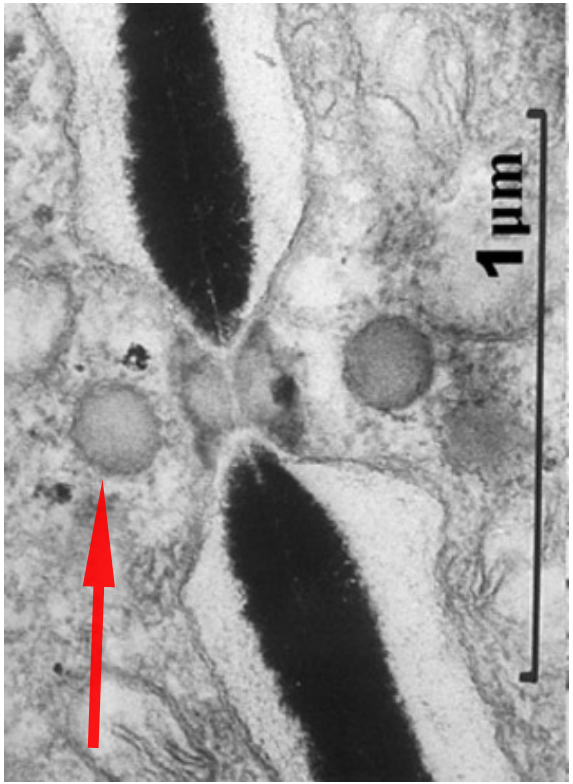
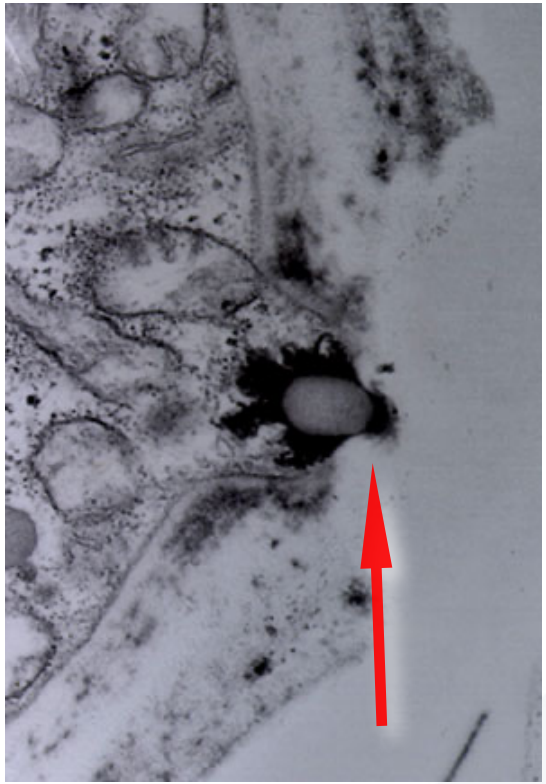
Simple septal pores with Woronin bodies that can block the pore if a hyphal compartment becomes damaged.



Woronin bodies



plugged pore

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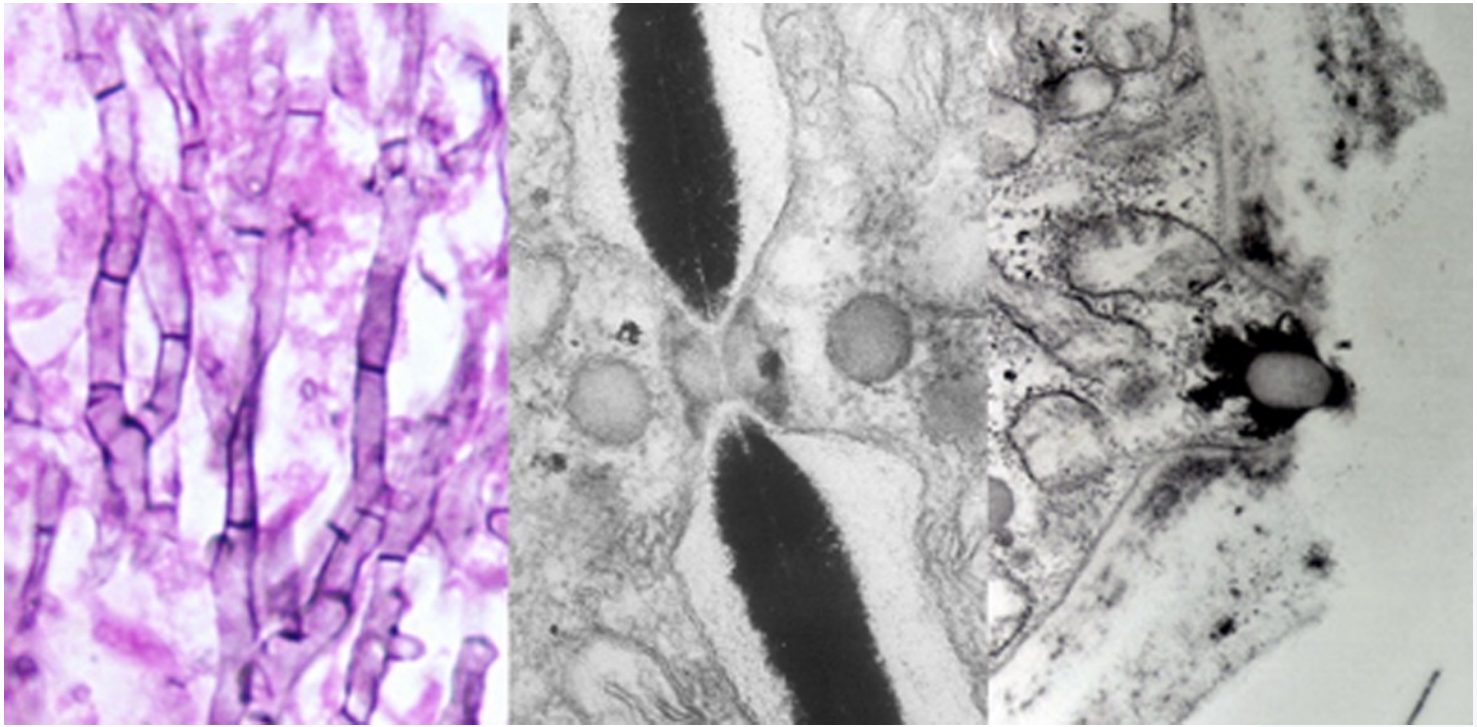
So, you can chop up a mould like *Aspergillus*, and enough hyphal compartments will remain viable for culture.



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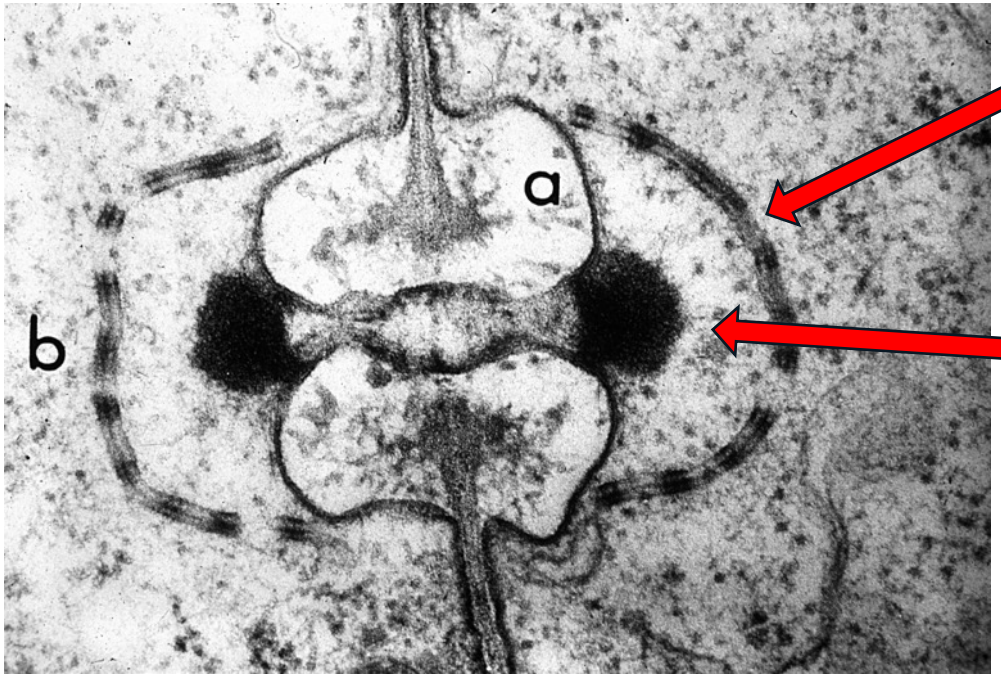
Basidiomycetes

- Septate hyphae with **complex septal pores called dolipores**, which allow cytoplasmic but **not nuclear migration**.
- Hyphae are dikaryotic (two nuclei per hyphal compartment - one from each parent cell).
- Basidiomycetous fungi can often be recognized by the presence of characteristic **hyphal clamp connections** over the septa. Clamp connections are specialized hyphal bridges that allow the simultaneous mitosis of two nuclei to occur in such a position that the dikaryons of compatible nuclei are duplicated in the proper relationship to each other.

Hyphal compartments of Basidiomycetes are dikaryotic and "dolipores" have evolved to allow cytoplasmic but not nuclear migration. In this section the swollen lip of the dolipore is clearly seen (a) with the suspended parenthesome adjacent to it (b).



parenthesome or barrier to prevent nuclei migrating through the pore

woronin bodies to block the pore in the event of damage

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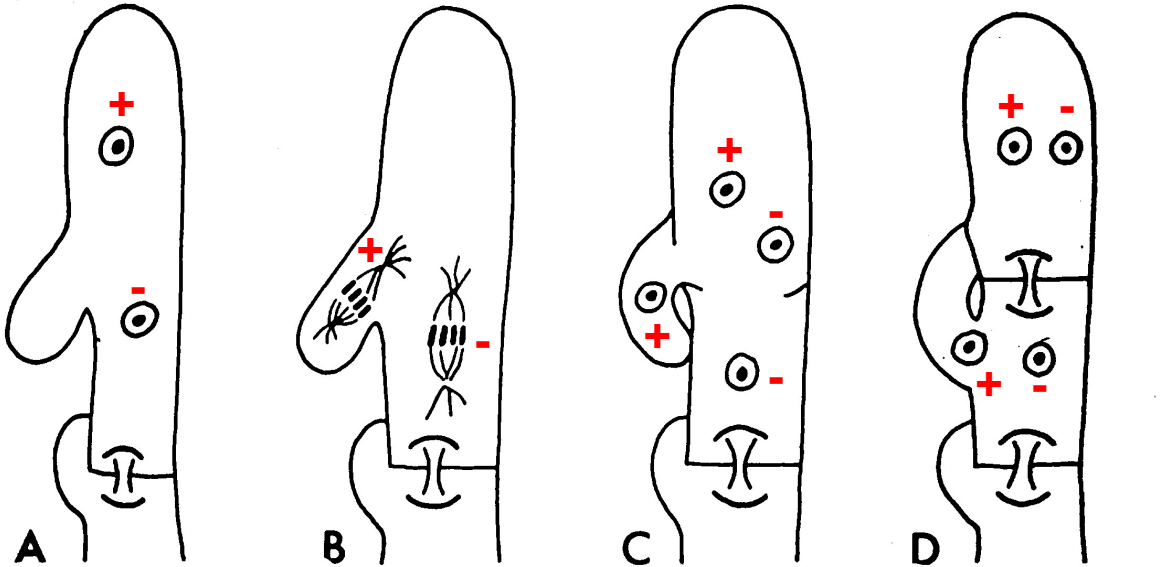
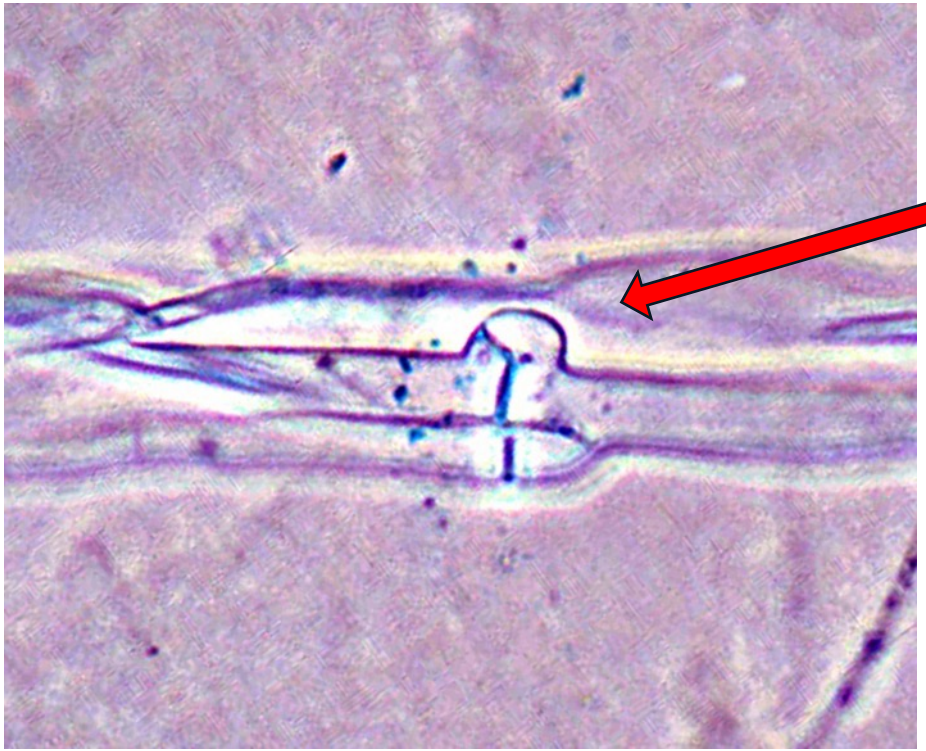
Clamp connections are specialized hyphal bridges that are formed over septa to regulated the movement of nuclei to maintain the dikaryotic state of each hyphal compartment (two nuclei per hyphal compartment - one from each parent cell **+/-**).



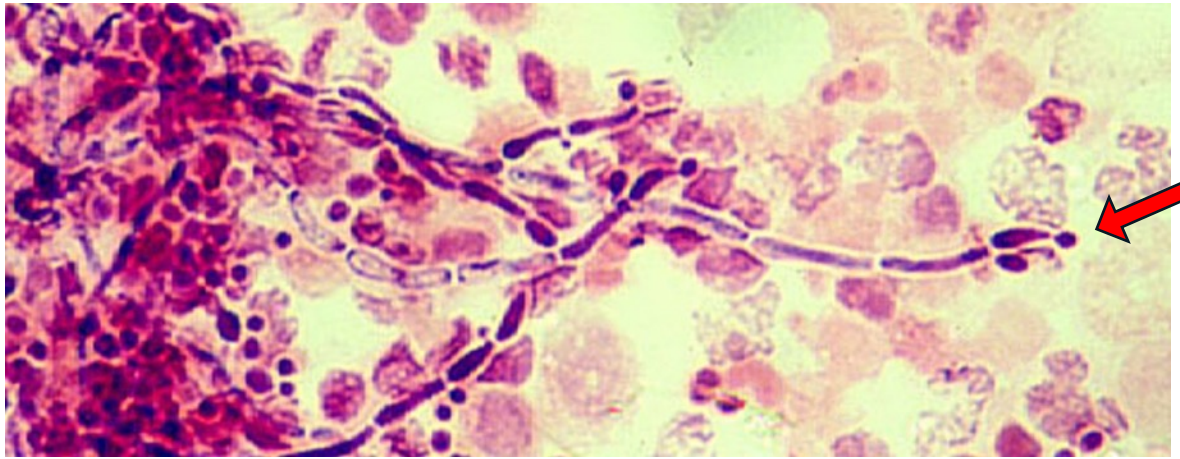
Clamp connections are specialized hyphal bridges that are characteristic of a Basidiomycete.



clamp connection over a septa - careful observation of hyphal septa may determine the presence of a Basidiomycete especially in a non-sporulating culture.

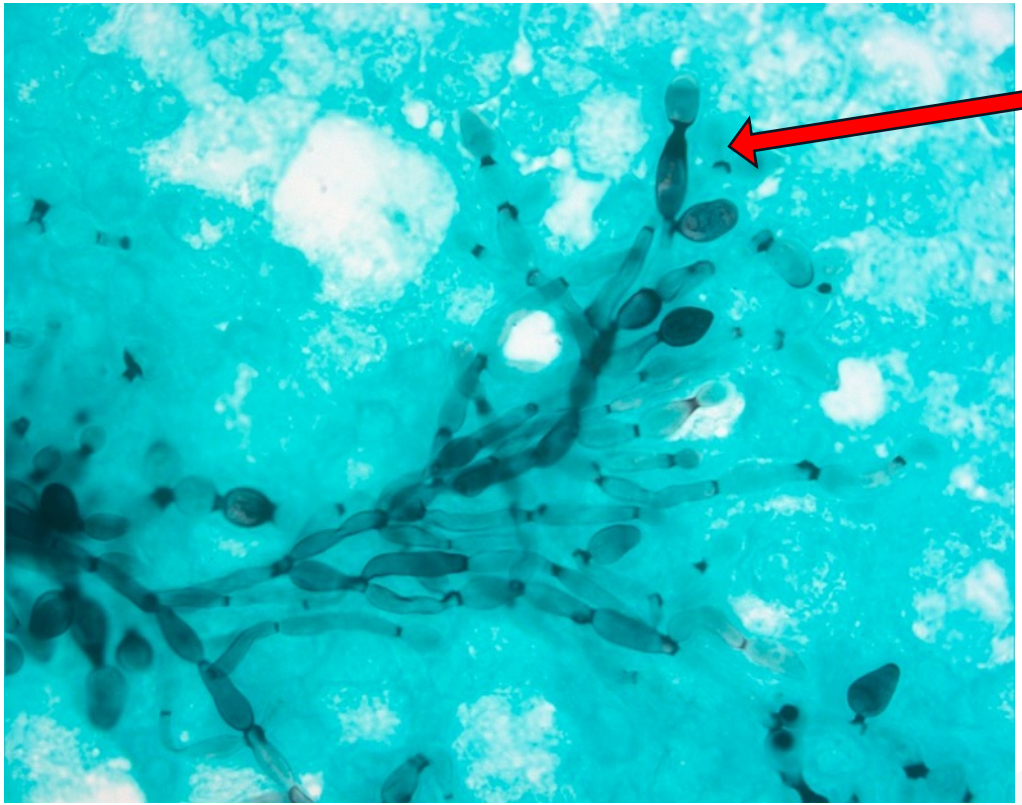
Pseudohyphae

- Pseudohyphae are a **string of elongated blastoconidia** formed by some yeasts that resemble a hypha-like filament.



budding yeast cells elongating to form a filament, each segment or compartment is just a single yeast cell.

GMS – showing pseudohyphae (elongating yeast cells) of *Candida albicans.* Note the slight constriction at the cell junction.



elongating budding yeast cells

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