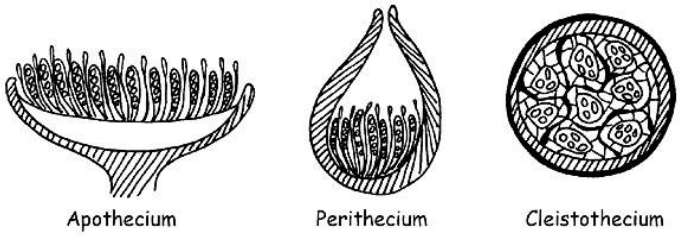
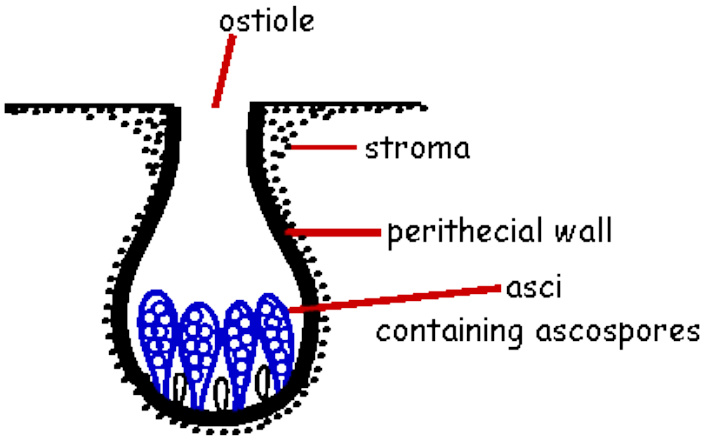
The Ascomycota

- This phylum contains 75% of all fungi described to date
- Most diverse phylum being significant:
  - Decomposers
  - Agricultural pests (e.g., Dutch elm disease, powdery mildews of crops)
  - Pathogens of humans and animals

- Asexual spores (mitospores), Variety of types, Usually not used for taxonomic purposes
- Generally referred to as conidia
- Tend to be haploid and dormant
- Key feature is the ascus (pl., asci) - sexual reproductive cell containing meiotic products termed ascospores
- Another significant structural feature - a simple septum with a central pore surrounded by Woronin bodies
- The fruiting body of these fungi, termed an ascocarp, takes on diverse forms

  - Flasked shaped - perithecium
  - Cup-shaped – apothecium
  - Closed structure – cleistothecium
  - Embedded structure – pseudothecium





- Some ascospores are borne singly or not enclosed in a fruiting structure
- Asci also vary in structure:

    - **Unitunicate-operculate** - single wall with lid/opening (operculum); found only in apothecial ascomata (fruiting body tissue)
    - **Unituicate-inoperculate** - operculum replaced with an elastic ring; found in perithecial and some apothecial
    - **Protunicate** - no active spore shooting mechanism; ascus dissolves to release spores; characteristically produced by fungi that form cleistothecia
    - **Bitunicate** - double-walled ascus in which outer wall breaks down, inner wall swells through water uptake, then expels spores
- Ascomycetes differ from zygomycetes in both their basic anamorphic and teleomorphic characteristics:

- Anamorph - mitospores (conidia) of ascomyetes are typically derived from modified bits of hyphae, whereas zygospores result from the cleavage of a multinucleated cytoplasm within a sporangium
- Teleomorph - in zygomycetes, the anamorph and teleomorph often occur together and share the same nomenclature; in ascomycetes, anamorphs can be completely separated from the teleopmorph and are often given different binomials

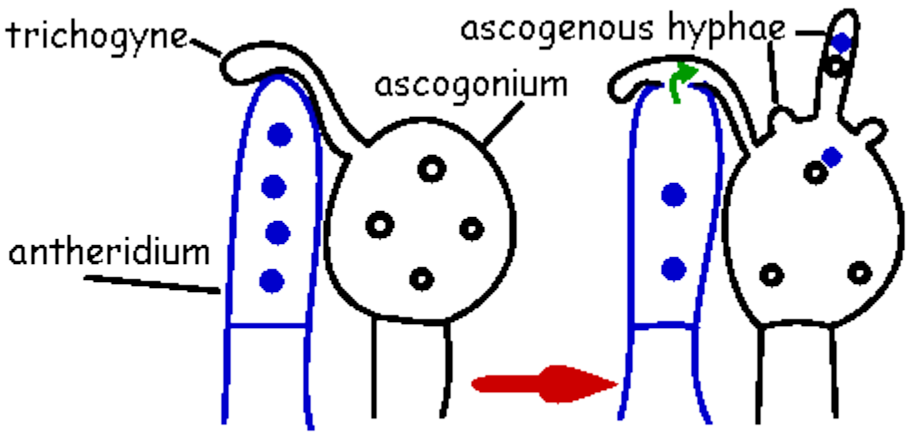
- For the Ascomycota, anamorph + teleomorph = holomorph
- Life cycle of most ascomycetes typified by *Neurospora*

Conidia/ascospores give rise to hyphae

Hyphae may continue to grow and produce conidia

Sexual reproduction begins with the differentiation of female hyphae into a trichogyne
Trichogyne is fertilized by a conidium or by an antheridium (male reproductive structure)

Plasmogamy occurs without karyogamy, i.e., cytoplasmic fusion without nuclear fusion, producing heterokaryotic hyphae (presence of two different nuclei in the same cytoplasm)



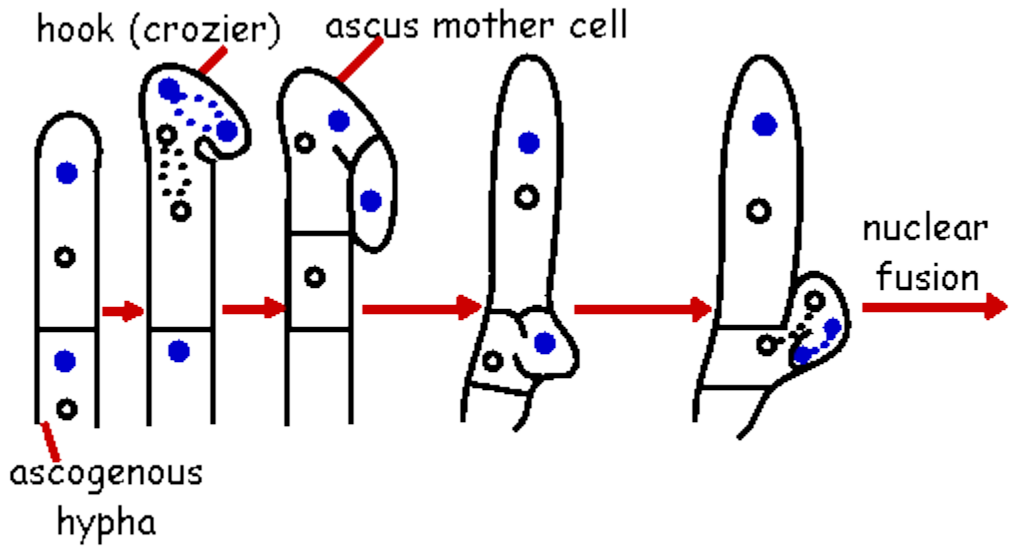
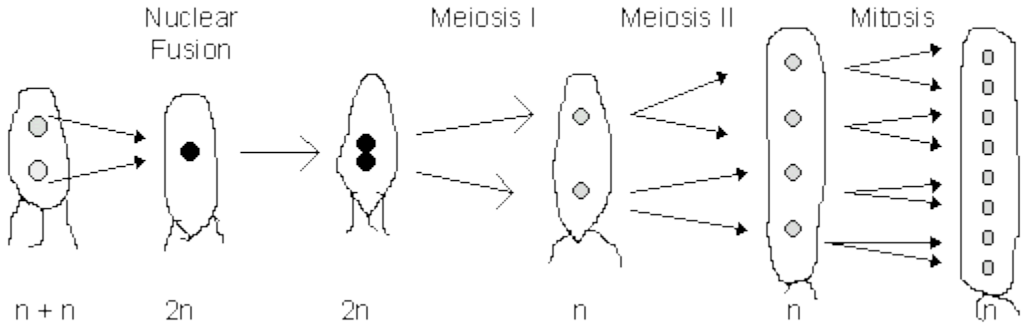


Figure 1

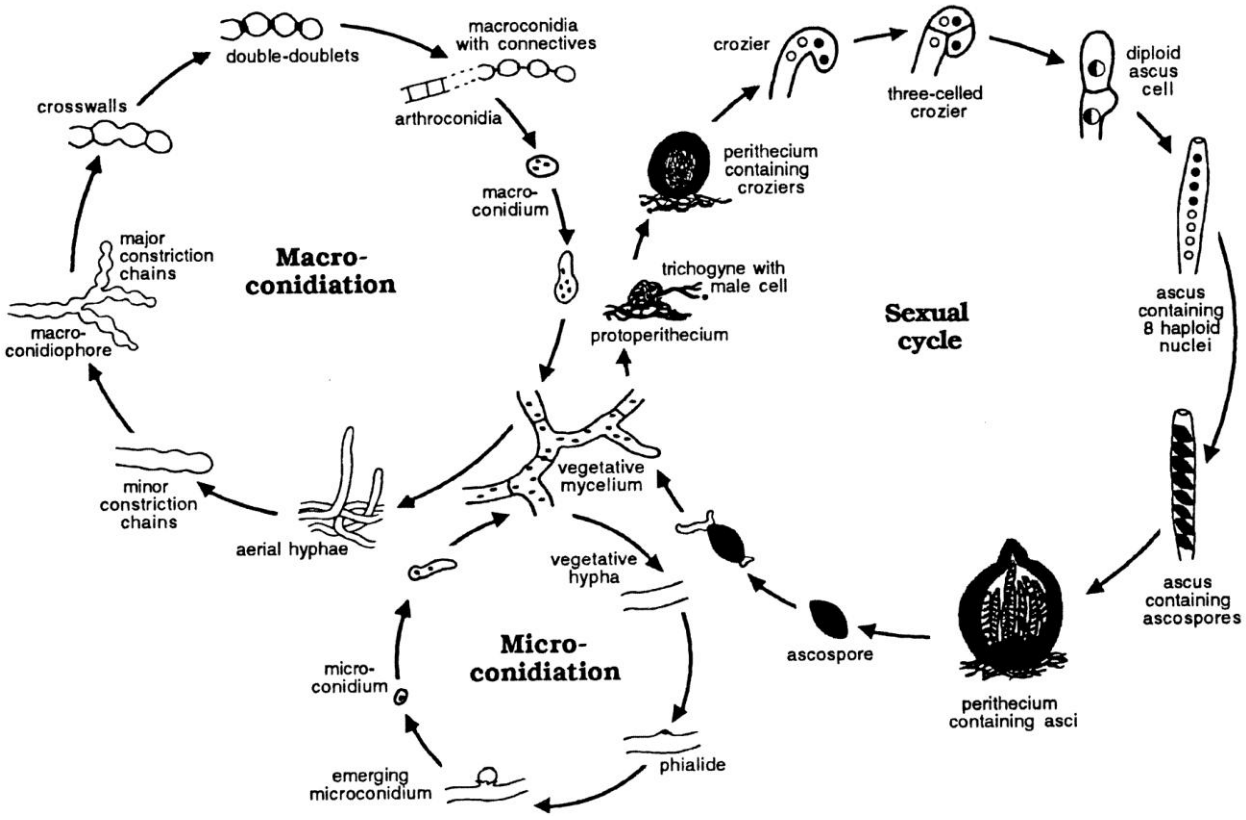


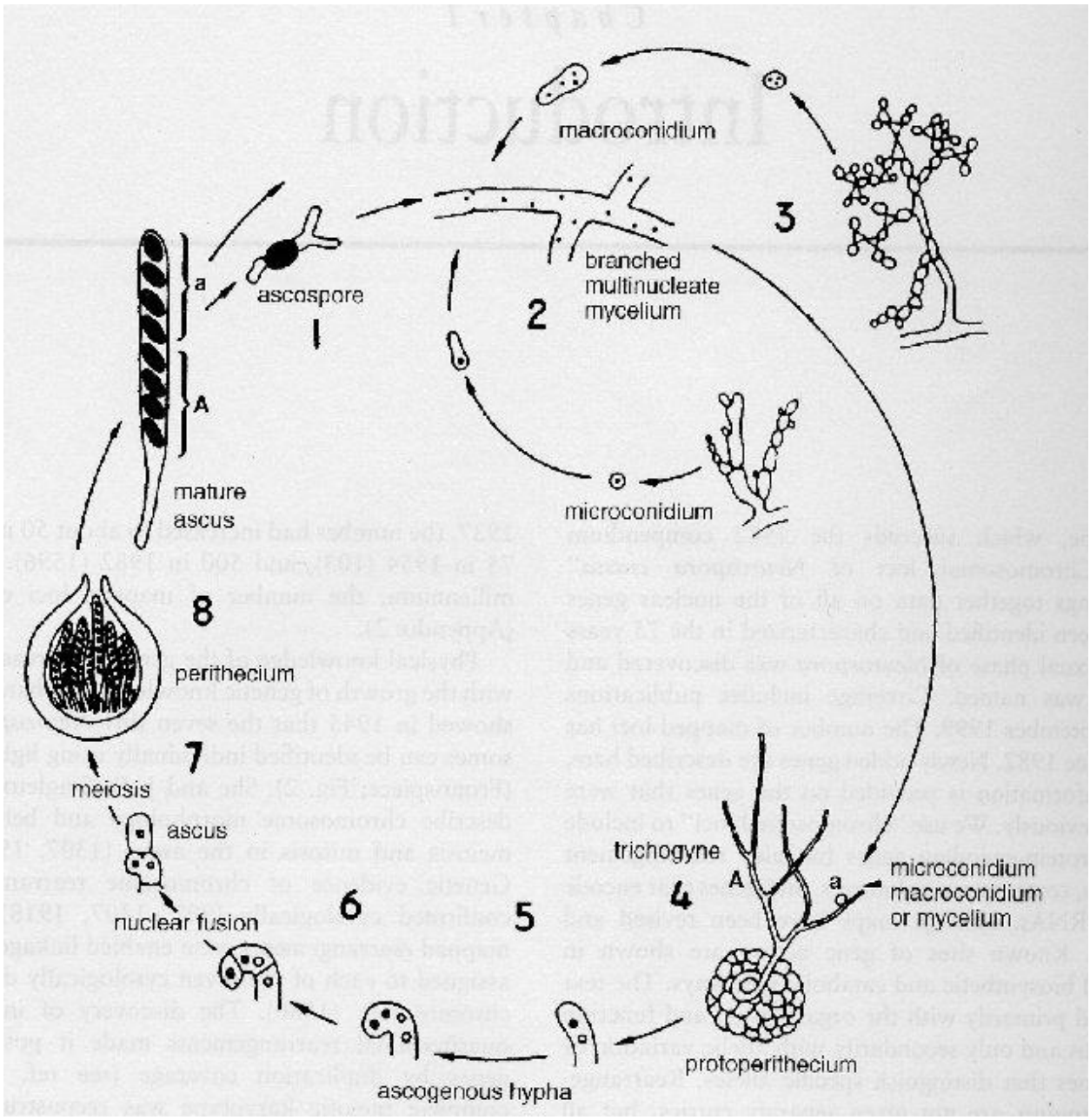
The heterokaryotic hyphae undergo crozier formation

Nuclear division continues followed by septation of the crozier to produce an ascus initial cell that contains one nucleus of each mating type, i.e., a dikaryotic state

Karyogamy occurs to form a diploid nucleus that then undergoes meiosis

Haploid nuclei are then walled off to form ascospores - typically there are 4-8 meiotic products


double-doublets
macroconidia with connectives
crosswalls
arthroconidia
macro-conidium
major constriction chains
Macro-conidiation
macro-conidiophore
minor constriction chains
aerial hyphae
vegetative mycelium
vegetative hypha
Micro-conidiation
micro-conidium
emerging microconidium
phialide
crozier
three-celled crozier
diploid ascus cell
perithecium containing croziers
trichogyne with male cell
protoperithecium
Sexual cycle
ascus containing 8 haploid nuclei
ascus containing ascospores
ascospore
perithecium containing asci


macroconidium
3
branched
multinucleate
mycelium
2
ascospore
1
a
A
mature
ascus
microconidium
8
perithecium
7
meiosis
ascus
nuclear fusion
6
5
trichogyne
4
A
a
microconidium
macroconidium
or mycelium
protoperithecium
ascogenous hypha

CLASSES OF ASCOMYCOTA

1. **Hemiascomycetes**-no ascocarp; asci come from diploid cells

2. **Plectomycetes**-ascocarp is a cleistothecium which does not have an opening through which ascospores escape; these ascomycetes rely on physical disruption of the ascocarp.

3. **Pyrenomycetes**-ascocarp is a perithecium which have an opening called an ostiole.

4. **Discomycetes**-ascocarp is an apothecium on which asci are exposed upon maturity; the apothecium is an open or cup-like structure upon which asci are formed.

5. **Loculoascomycetes**-ascocarp a pseudothecium which is similar to a perithecium; bitunicate asci.

6. **Laboulbeniomycetes**-ascocarp a perithecium, lack true mycelium, obligate parasites of insects.