FUNGI

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VEGETATIVE STRUCTURE OF FUNGI:

- Vegetative body of fungi is typically thalloid and filamentous type except *Synchytrium* and *Saccharomyces*, which are unicellular.
- The long, tubular, branched filaments are called **hyphae** and the mass of hyphae is called **mycelium**.
- Hyphae may be hyaline or coloured, simple or branched, septate (cellular) or aseptate.
- In some lower fungi, the cytoplasm is continuous in the entire mycelium and the cross walls are not formed. Such a condition of mycelium is called aseptate. It is usually multinucleate. Such a condition where the mycelium is aseptate and multinucleate is called coenocytic.
- On the other hand, hypha that has partition walls dividing the hypha into many cells is called septate.
- The septate mycelium may contain one nucleus (monokaryotic), two (dikaryotic) or many nuclei (multinucleate) with vacuolated protoplasm.

VEGETATIVE STRUCTURE OF FUNGI CONTD...

❖ Usually, the septa between the cells may have different types of pores:

1) If small pores are present on the wall, it is called **micropore**. Eg: *Geotrichum*
2) When only one bigger sized pore is present on the wall, it is called **simple pore**. It is found in most of **Ascomycotina** and **Deuteromycotina**.
3) In **Trichomycetes** and **Mucorales**, the pore is surrounded by an overarching bifurcation of the margin of partition wall which looks like a bordered pit of tracheid. A biumbonate, electron dense plug of material is present between the two bifurcations.
4) In **Basidiomycotina** (except rust and smuts), a centrally located barrel shaped pore with open ends is present which is called **dolipore**. The edges of septa around the pore are swollen. The openings of pore on both the sides are guarded by cap-like thickenings called **parenthosome**.

** **Lomasomes:** A membranous structure found in between the plasmalemma and cell wall or at the surface of plasmalemma of fungal cells.

VEGETATIVE STRUCTURE OF FUNGI CONTD...

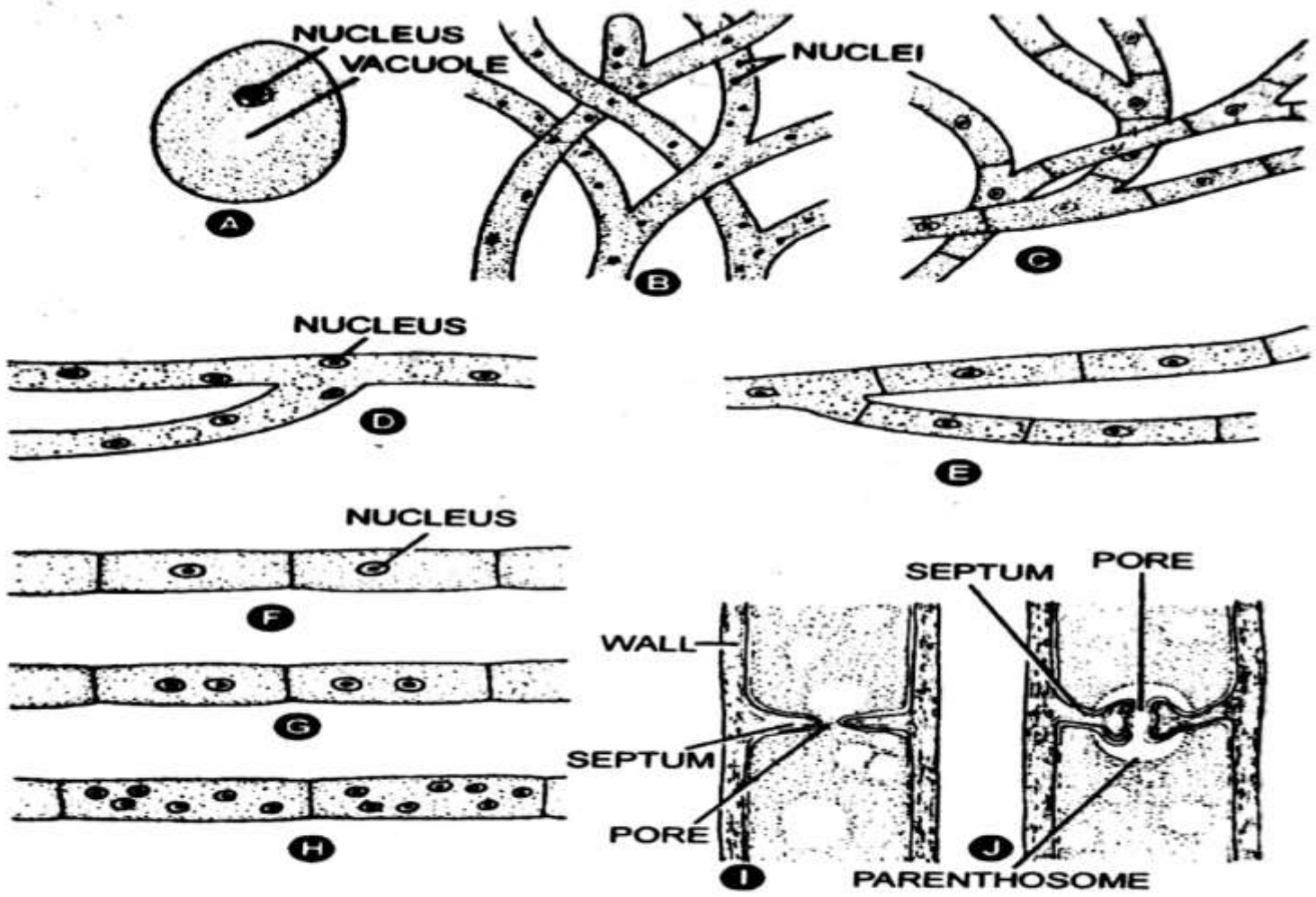


FIGURE 1.2. Different forms of fungal thalli. **A.** Unicellular form ; **B.** Coenocytic hyphae ; **C.** Multicellular septate hyphae ; **F.** Hyphae with uninucleate cells ; **G.** Dikaryotic hypha ; **H.** Multinucleate cells ; **I.** Septum with simple pore ; **J.** Septum with dolipore.

FUNGAL CELL WALL:

The composition of the hyphal wall i.e, cell wall varies in different classes of fungi.

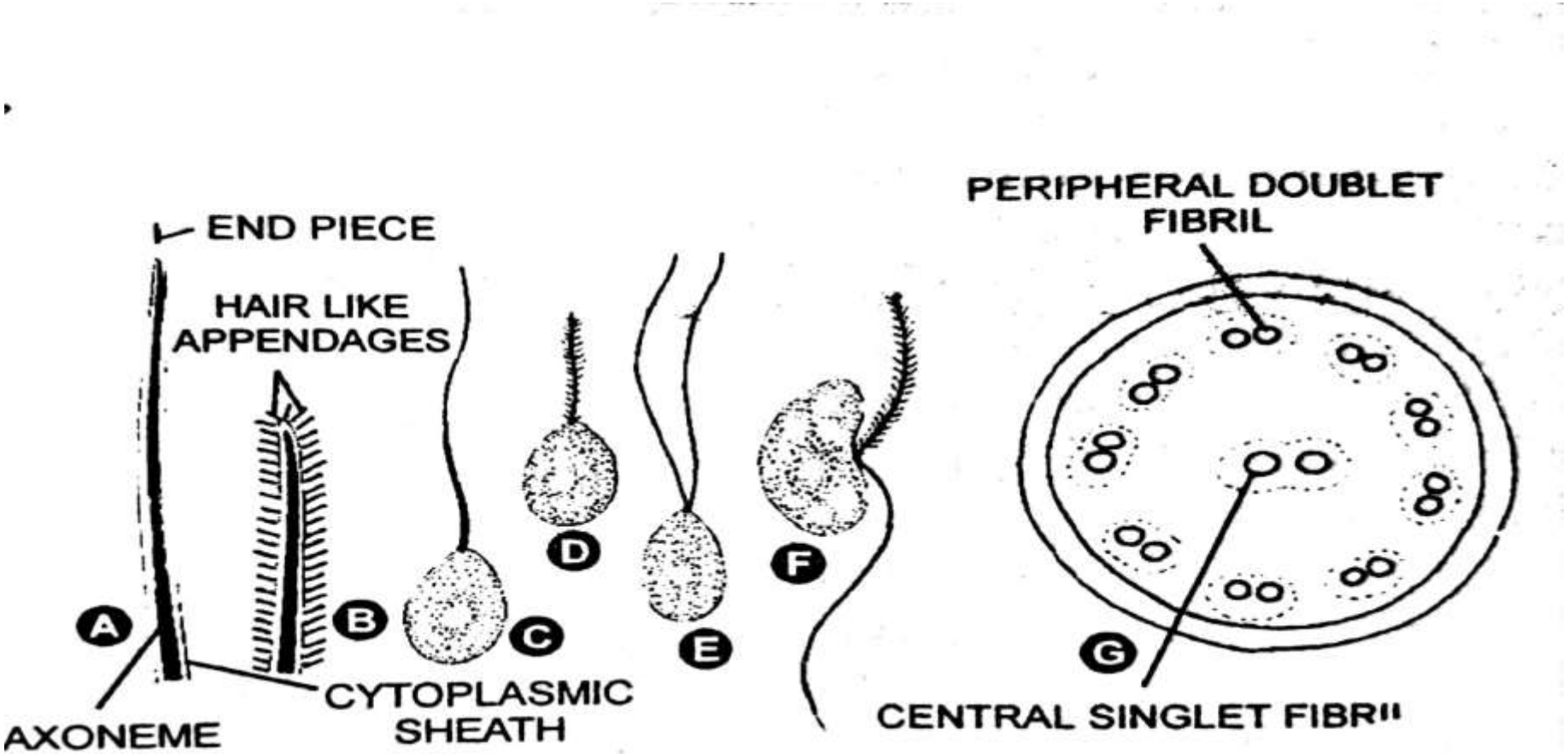
- The cell wall is mainly composed of chitin with formula $C_{22}H_{54}N_4O_{21}$
- Chitin is a polymer composed of N-acetyl-2-glucosamine units, often impregnated with some salts and similar other substances.
- Bartnicki-Garcia (1968), reported the variation of composition of cell wall in different groups of fungi-

- Cellulose-glycogen: Acrasiomycetes
- Cellulose-glucan: Oomycetes
- Cellulose-chitin: Hyphochytridiomycetes
- Chitin-chitosan: Zygomycetes
- Chitin-glucan: Chitridomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes
- Mannan-glucan: Saccharomycetaceae and Cryptococcaceae
- Mannan-chitin: Sporobolomycetaceae
- Polygalactosamine-galactan: Trichomycetaceae

FLAGELLA IN FUNGI:

- Presence of flagella in motile bodies is the characteristic feature of some lower fungi.
- These are thin, hair-like extensions of cell cytoplasm.
- Each flagellum has a central core known as **Axoneme**, composed of 11 fibrils.
- The typical **9+2 arrangement of fibrils** is the characteristic of all eukaryotic flagella.
- The motile bodies of fungi are either uniflagellate or biflagellate. There are 2 kinds of flagella- **a) Whiplash and b) Tinsel**
- The **whiplash** type of flagellum is flexible and long ending into a narrow end piece. It has smooth surface. It is also called **acronematic flagellum**.
- The **tinsel** type of flagellum is usually small and bears fine hair-like appendages (hairy) called **flimmer hairs** or **mastigoneme**. This type of flagellum is also called **pantonematic**.
- If a biflagellate body bears 2 flagella of equal length, it is called **isokontae**. If they are not equal; it is called **heterokontae**.

FLAGELLA IN FUNGI:

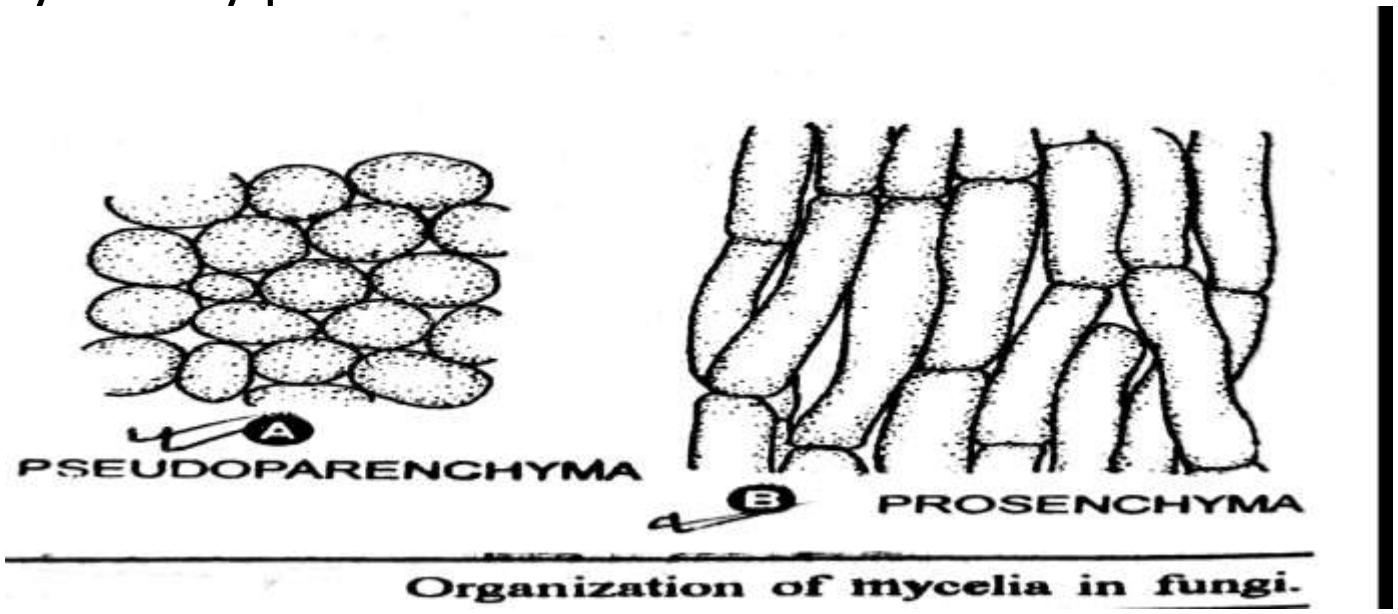


Flagella in fungi. **A.** Whiplash (acronematic) type ; **B.** Tinsel (pantonematic) type. **C–F.** Different types of flagellation ; **G.** Diagrammatic representation of t.s. of flagellum showing 9 + 2 arrangement of fibrils.

Modification of mycelium in fungi:

- In some fungi, the mycelium becomes organized and appear just like a thalloid body. It consists of loosely or compactly woven tissue-like structure, called **plectenchyma**. There are 2 types of plectenchyma:

1. **Prosenchyma:** consist of loosely woven hyphae which lie almost parallel to each other and the cells and hyphae are clearly distinguishable.
2. **Pseudoparenchyma:** consists of compact mass of parenchyma-like tissue where the hyphae are very closely packed and interwoven.



Organization of mycelia in fungi.

Modification of mycelium in fungi contd:

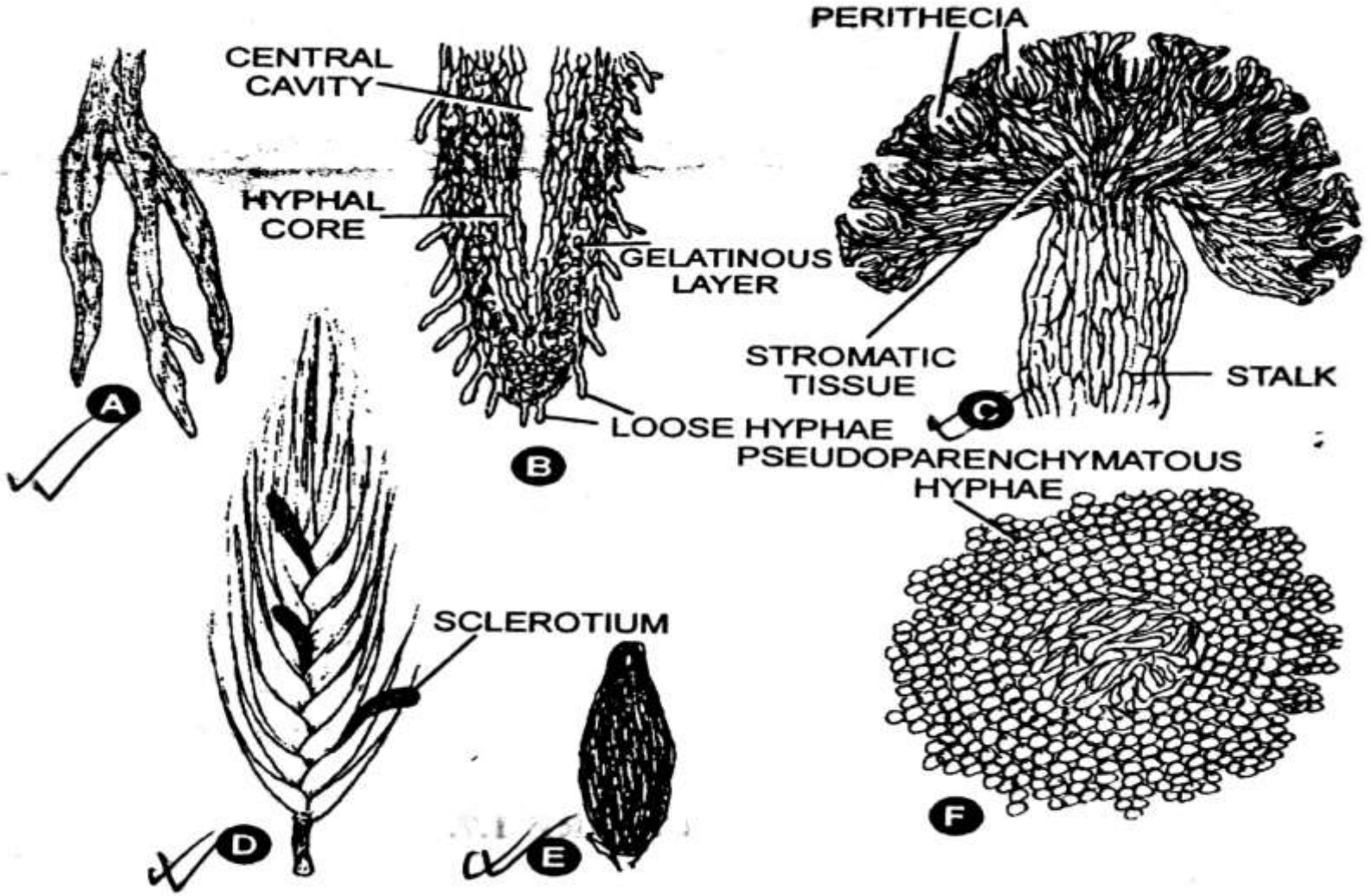
Besides plectenchyma, there are other modifications of mycelium such as:

i. **Rhizomorph:** Several hyphae become interwoven with each other forming cord-like, string-like or root-like elongated mycelial strands called rhizomorph.

ii. **Sclerotia:** It consist of a compact mass of interwoven hyphae forming pseudoparenchyma. The outer hyphae become hard and form a protective covering or rind. These bodies remain dormant under unfavourable conditions and germinate at the onset of favourable conditions.

iii. **Stroma:** It is a thick mycelial mat on, or, in which a large no. of fruit bodies develops.

Modification of mycelium in fungi contd:



A. Rhizomorph ; **B.** L.S. of rhizomorph tip ; **C.** L.S. of stroma ; **D.** Sclerotia in rye grains ; **E.** Single sclerotium ; **F.** T.S. of sclerotium.

SEXUALITY IN FUNGI:

- The sex cells are called gametes which are usually produced in sex organs called **gametangia**.
- Gametangia may be morphologically similar (**isogametangia**) or may be dissimilar (**heterogametangia**).
- The male gametangia is called **antheridia** and the female gametangia is called **oogonium**.
- When antheridia and oogonia are developed on different hyphal branches, they are called **diclinous**. When both the sex organs are developed on the same hyphal branch, they are called **androgynous**.
- In fungi, gametes may be flagellate **(planogametes)** or non-flagellate **(aplanogametes).**

SEXUALITY IN FUNGI:

- On the basis of sex, Alexopoulos (1962) has classified most fungi into 3 categories as follows-

1. **Hermaphrodite/Monoecious:** Here, each thallus bears both male and female sex organs
2. **Dioecious/dimorphic:** Here, some thalli bear only male sex organ while some other thalli bear only female sex organs.
3. **Sexually undifferentiated:** Here, sex organs are produced but they are not morphologically distinguishable into male and female.

- On the basis of compatibility, fungi in the above sex categories may belong to any one of the following 3 groups:

1) **Homothallic Fungi:** They are those fungi where both distinguishable male and female sex organs occur on the same thallus.

SEXUALITY IN FUNGI CONTD:

2) Heterothallic Fungi: They are those fungi in which male and female sex organs occurs on different thalli and therefore requires the help of another compatible thallus of a different mating type for sexual reproduction.

Heterothallic fungi again belong to any one of the following 2 categories:

i. **Bipolar heterothallic:** Fungi in this group consist of 2 mating types of individuals which differ in their genetic make up for the compatibility factor. For eg, one mating type carries the gene ‘A’ in each nucleus and the other mating type carries the gene ‘a’ in each nucleus. Only thalli whose nuclei carry opposite genes are compatible.

ii. **Tetrapolar heterothallic:** Fungi in this group consist of 4 mating types of individuals. Here compatibility is governed by 2 pairs of factors such as ‘Aa’ and ‘Bb’ located on different chromosomes. Only thalli whose nuclei carry opposite genes of both are compatible. The resulting zygote has the genotype AaBb.

SEXUALITY IN FUNGI CONTD:

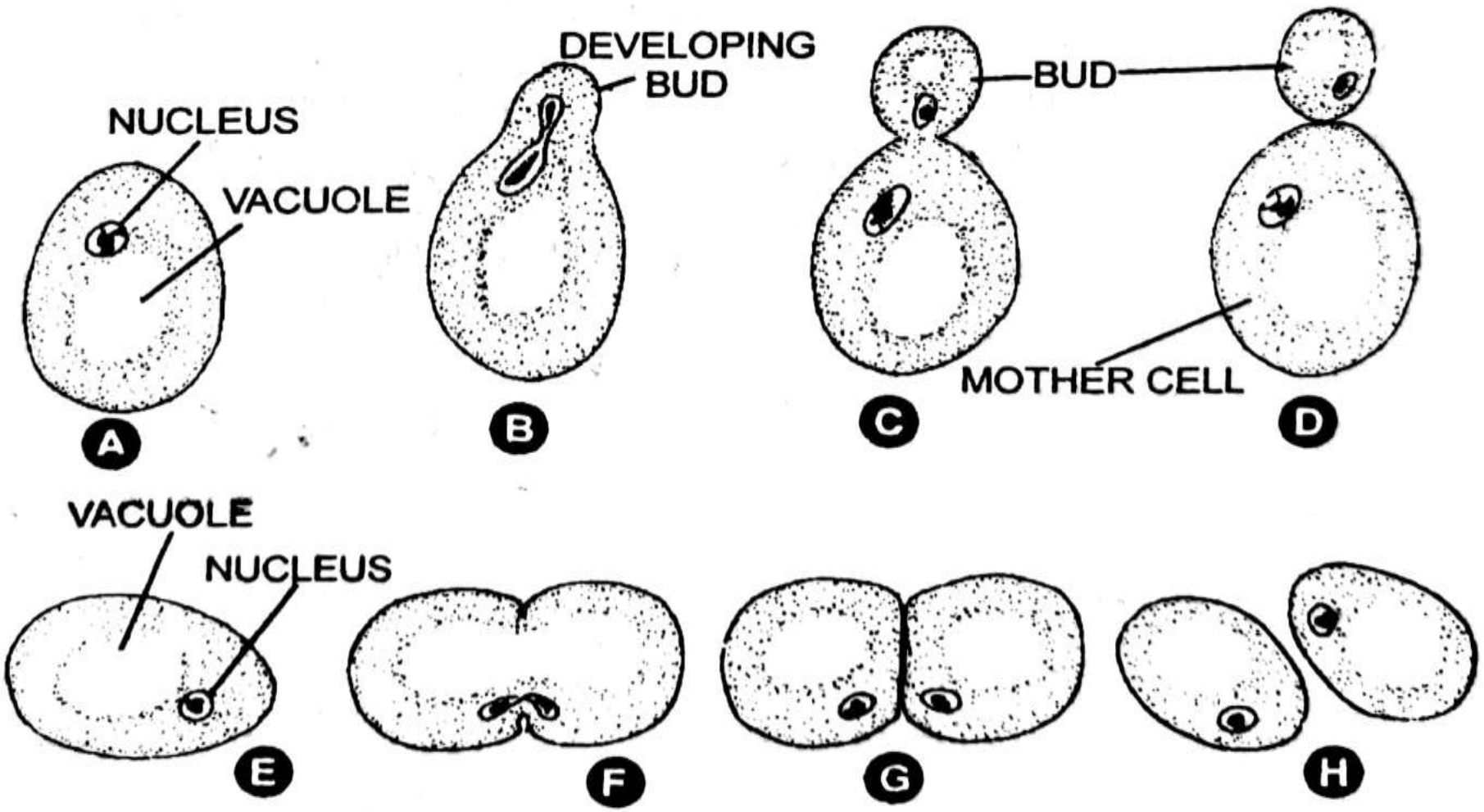
3) Secondary homothallic Fungi: In some bipolar heterothallic fungi, during spore formation, 2 nuclei of opposite mating type are regularly incorporated in each spore. Each spore on germination therefore produces a thallus which contains both 'A' and 'a' nuclei and naturally behaves as though it was homothallic. This condition is called secondary homothallism.

- **Parasexuality:** Some fungi do not go through a normal sexual cycle. In them, plasmogamy, karyogamy and meiosis takes place but not at specified time in the life cycle. Such a cycle is known as parasexual cycle and the process is called parasexuality.
- Parasexuality was first discovered by **Pontecarvo** in *Aspergillus nidulans* and *Emericella nidulans*

Reproduction in Fungi:

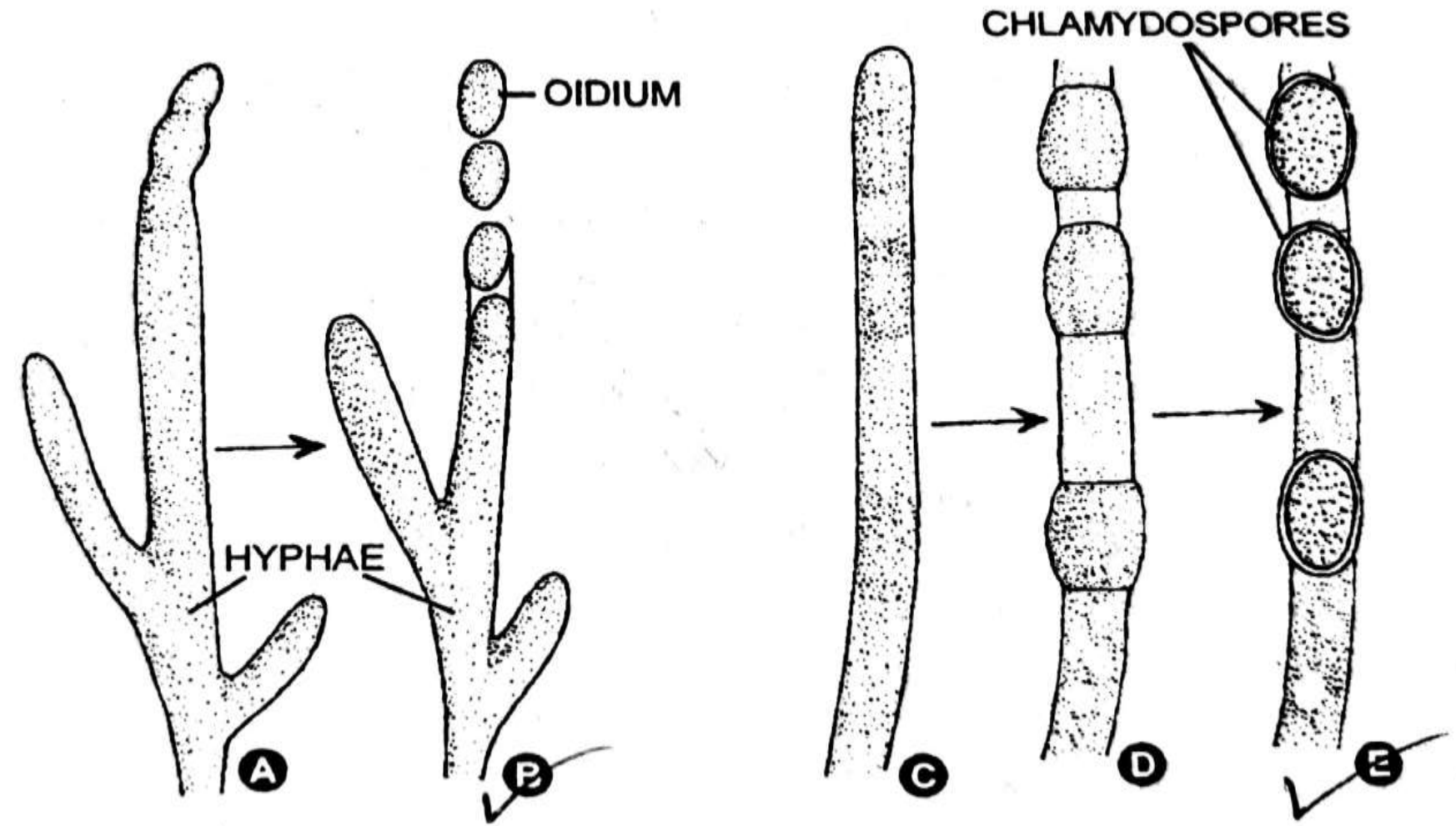
- In fungi, if the plant body (thallus) is unicellular, the complete vegetative cell may be transformed into reproductive body. This condition is called holocarpic.
- If a portion of vegetative thallus is transformed into reproductive structure, this condition is called eucarpic.

Reproduction in Fungi:



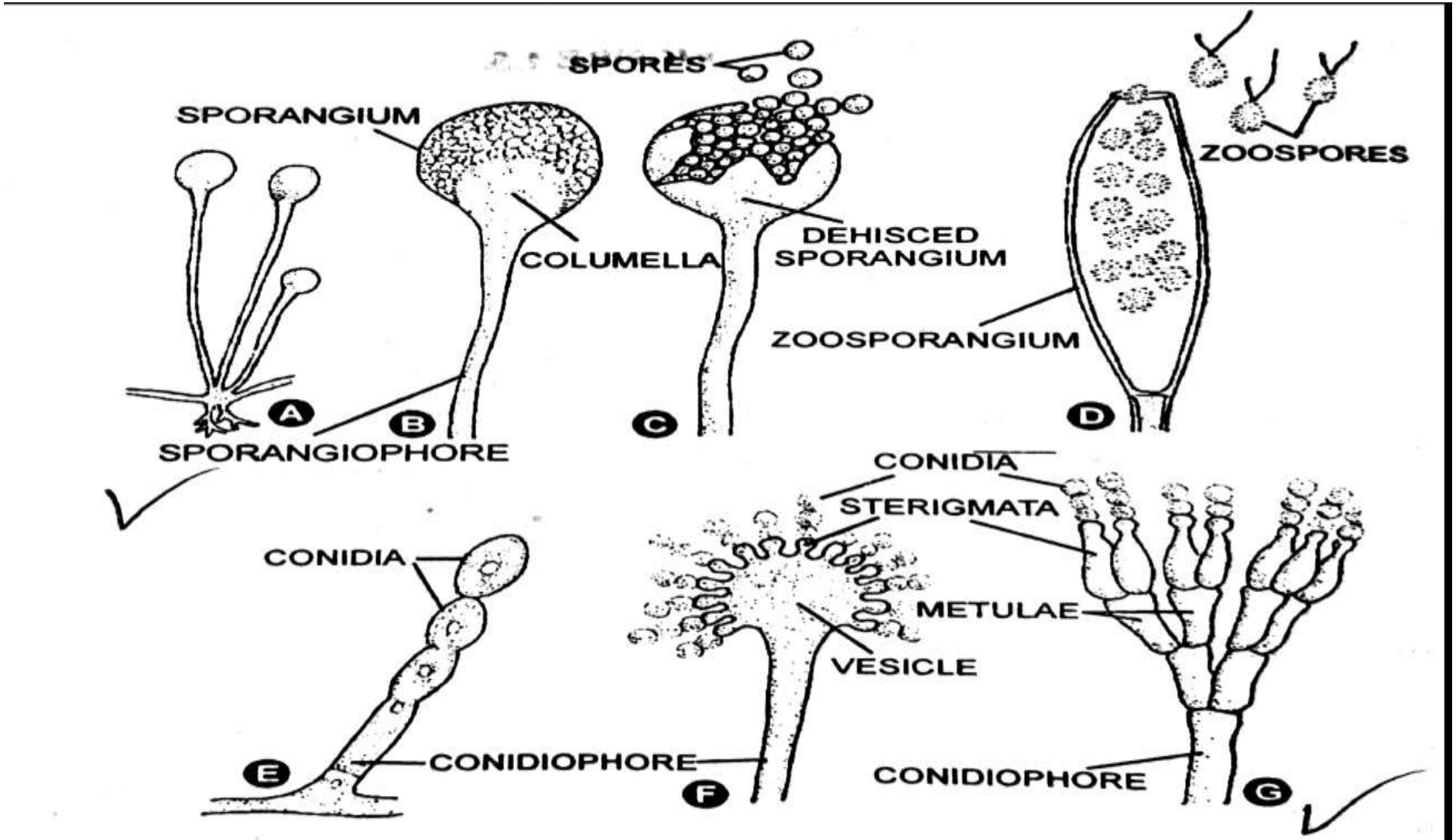
A-D. Budding ; E-H. Fission.

Reproduction in Fungi:



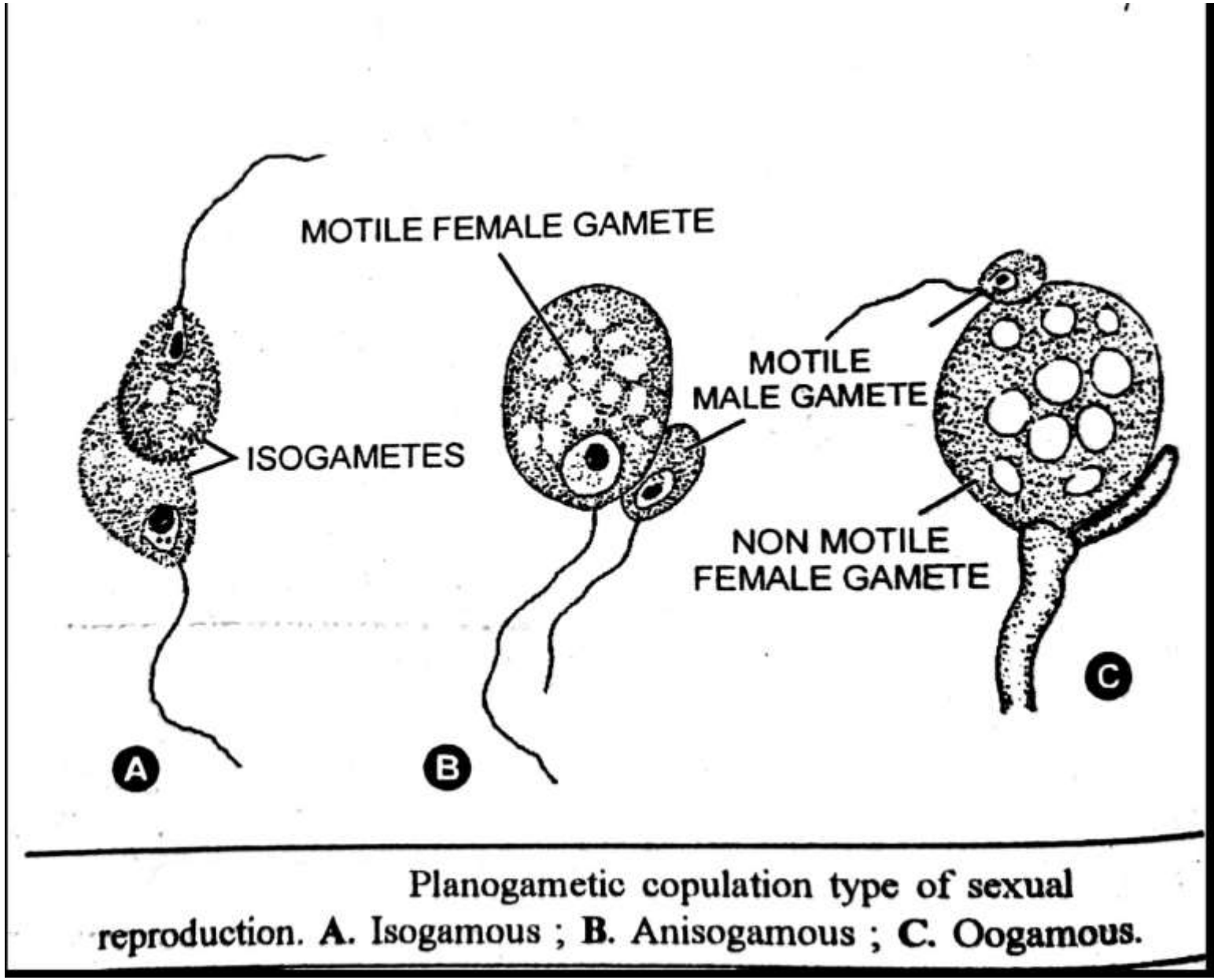
A–B. Oidia formation ; C–E. Formation of Chlamydospores.

Reproduction in Fungi:



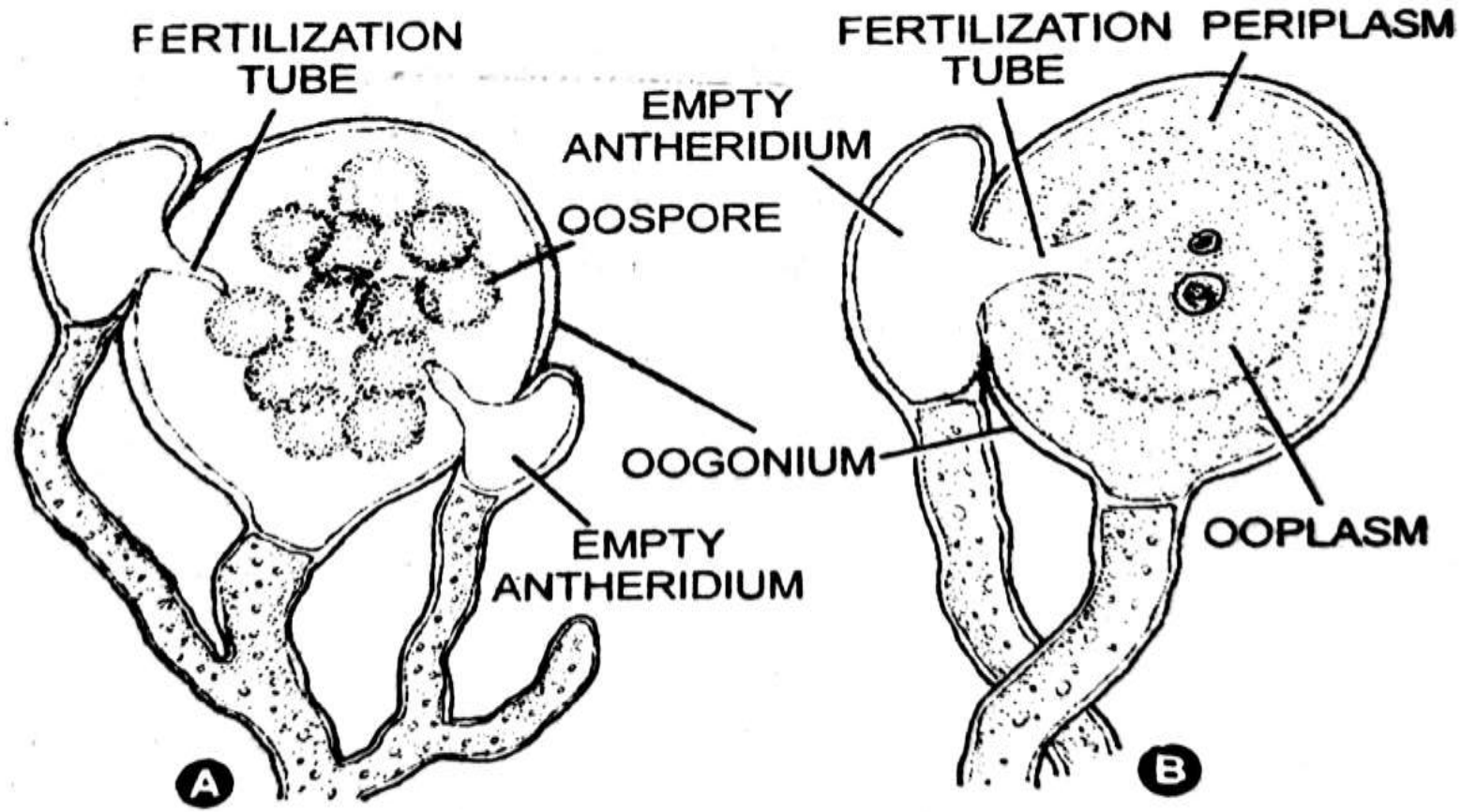
Common types of asexual reproduction. **A – C.** Spores ; **D.** Zoospores ; **E – G.** Conidia.

Reproduction in Fungi:



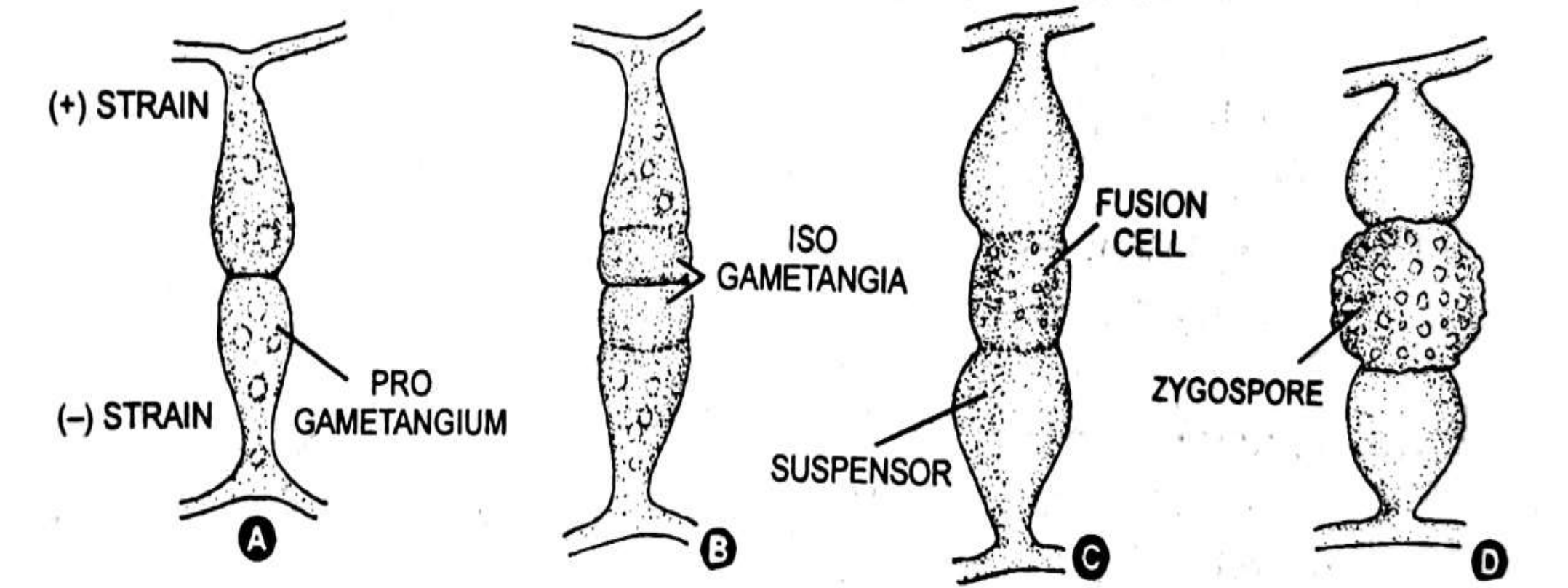
Planogametic copulation type of sexual reproduction. **A.** Isogamous ; **B.** Anisogamous ; **C.** Oogamous.

Reproduction in Fungi:



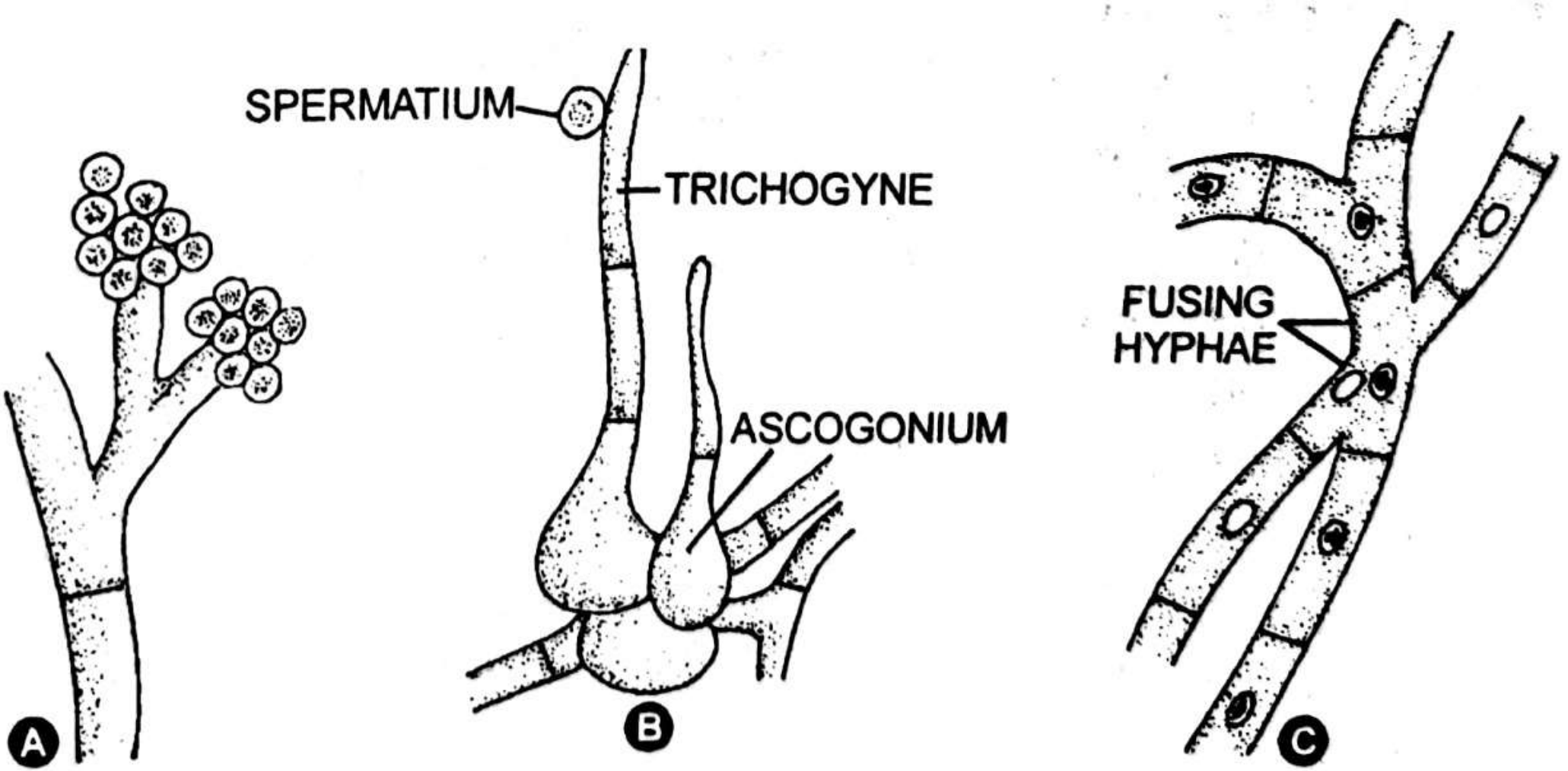
A – B. Gametangial contact type of sexual fusion.

Reproduction in Fungi:



A – D. Gametangial copulation type of sexual fusion.

Reproduction in Fungi:



A – B. Spermatisation ; C. Somatogamy.

Thank You