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1)

- **Food**
  Fungi are also important directly as food for humans. Many mushrooms are edible and different species are cultivated for sale worldwide. While this is a very small proportion of the actual food that we eat, fungi are also widely used in the production of many foods and drinks. These include cheeses, beer and wine, bread, some cakes, and some soya bean products.
- **Medicines**
  Penicillin, perhaps the most famous of all antibiotic drugs, is derived from a common fungus called *Penicillium*. Many other fungi also produce antibiotic substances, which are now widely used to control diseases in human and animal populations. The discovery of antibiotics revolutionized health care worldwide.

  Some fungi which parasitize caterpillars have also been traditionally used as medicines. The Chinese have used a particular caterpillar fungus as a tonic for hundreds of years. Certain chemical compounds isolated from the fungus may prove to be useful treatments for certain types of cancer.
- **Biocontrol in farms**
  Fungi such as the Chinese caterpillar fungus, which parasitize insects, can be extremely useful for controlling insect pests of crops. The spores of the fungi are sprayed on the crop pests. Fungi have been used to control Colorado potato beetles, which can devastate potato crops. Spittlebugs, leaf hoppers and citrus rust mites are some of the other insect pests which have been controlled using fungi. This method is generally cheaper and less damaging to the environment than using chemical pesticides.

2)

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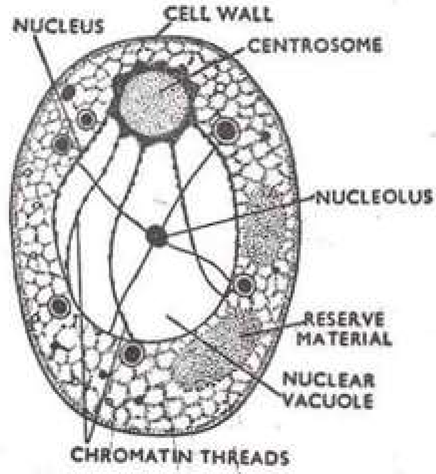

Fig. 214. Diagrammatic representation of parts of a yeast cell.

THE CELL STRUCTURE OF A UNICELLULAR FUNGUS(YEAST)

3) **Sexual reproduction**

Sexual reproduction, an important source of genetic variability, allows the fungus to adapt to new environments. The process of sexual reproduction among the fungi is in many ways unique. Whereas nuclear division in other eukaryotes, such as animals, plants, and protists, involves the dissolution and re-formation of the nuclear membrane, in fungi the nuclear membrane remains intact throughout the process, although gaps in its integrity are found in some species. The nucleus of the fungus becomes pinched at its midpoint, and the diploid chromosomes are pulled apart by spindle fibres formed within the intact nucleus. The nucleolus is usually also retained and divided between the daughter cells, although it may be expelled from the nucleus, or it may be dispersed within the nucleus but detectable.

Sexual reproduction in the fungi consists of three sequential stages: plasmogamy, karyogamy, and meiosis. The diploid chromosomes are pulled apart into two daughter cells, each containing a single set of chromosomes (a haploid state). Plasmogamy, the fusion of two protoplasts (the contents of the two cells), brings together two compatible haploid nuclei. At this point, two nuclear types are present in the same cell, but the nuclei have not yet fused. Karyogamy results in the fusion of these haploid nuclei and the formation of a diploid nucleus (i.e., a nucleus containing two sets of chromosomes, one from each parent). The cell formed by karyogamy is called the zygote. In most fungi the zygote is the only cell in the entire life cycle that is diploid. The dikaryotic state that results from plasmogamy is often a prominent condition in fungi and may be prolonged over several generations. In the lower fungi, karyogamy usually follows plasmogamy almost immediately. In the more evolved fungi, however, karyogamy is separated from

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plasmogamy. Once karyogamy has occurred, meiosis (cell division that reduces the chromosome number to one set per cell) generally follows and restores the haploid phase. The haploid nuclei that result from meiosis are generally incorporated in spores called meiospores.

Fungi employ a variety of methods to bring together two compatible haploid nuclei (plasmogamy). Some produce specialized sex cells (gametes) that are released from differentiated sex organs called gametangia. In other fungi two gametangia come in contact, and nuclei pass from the male gametangium into the female, thus assuming the function of gametes. In still other fungi the gametangia themselves may fuse in order to bring their nuclei together. Finally, some of the most advanced fungi produce no gametangia at all; the somatic (vegetative) hyphae take over the sexual function, come in contact, fuse, and exchange nuclei.

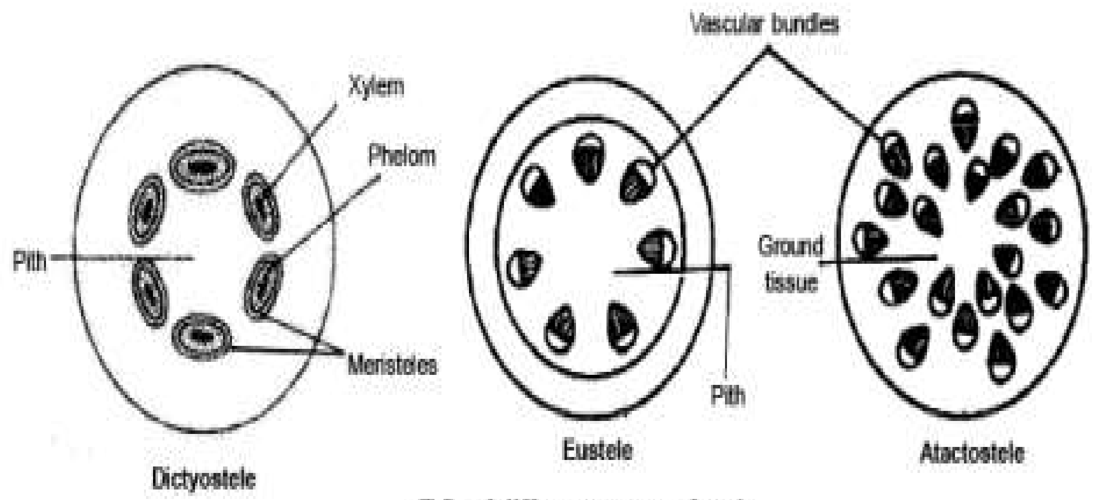
Fungi in which a single individual bears both male and female gametangia are hermaphroditic fungi. Rarely, gametangia of different sexes are produced by separate individuals, one a male, the other a female. Such species are termed dioecious. Dioecious species usually produce sex organs only in the presence of an individual of the opposite sex.

4) Bryophytes to adapt to their environment due to the possession of: a waxy cuticle and gametangia. The waxy cuticle helped to protect the plants tissue from drying out and the gametangia provided further protection against drying out specifically for the plants gametes. Bryophytes also show embryonic development which is a significant adaptation that links them to the vascular land plants.

5) a) EUSTELE: Most seed plant stems possess a vascular arrangement which has been interpreted as a derived siphonostele, and is called a **eustele**. In this arrangement, the primary vascular tissue consists of vascular bundles, usually in one or two rings around the pith. In addition to being found in stems, the eustele appears in the roots of monocot flowering plants. The vascular bundles in a eustele can be collateral (with the phloem on only one side of the xylem) or bicollateral (with phloem on both sides of the xylem, as in some Solanaceae).

b) ATACTOSTELE: Is a type of eustele, found in monocots like maize and rye, in which the vascular tissue in the stem exists as scattered bundles. Most seed plant stems possess a vascular arrangement, which has been interpreted as a derived siphonostele and is called as eustele. There is also a variant on the eustele found in monocots, like maize and rye. The variation has numerous scattered bundles in the stem and is called as an atactostele.

C) DICTYOSTELE – An amphiphloic siphonostele can be called a dictyostele. If multiple gaps in the vascular cylinder exist in any one transverse section. The numerous leaf gaps and leaf traces give a dictyostele the appearance of many isolated islands of xylem surrounded by phloem. Each of the apparently isolated units of a dictyostele can be called a meristele. Among living plants, this type of stele is found only in the stems of ferns.



T.S. of different types of stele

D) SIPHONOSTELE: It is one of the two types of stellar organization on plants. Siphonosteles have a region of ground tissue called the pith internal to xylem. The vascular strand comprises a cylinder surrounding the pith. Siphonosteles often have interruptions in the vascular strand where leaves (typically megaphylls) originate (called leaf gaps).

Siphonosteles can be ectophloic (phloem present only external to the xylem) or they can be amphiphloic (with phloem both external and internal to the xylem). Among living plants, many ferns and some Asterid flowering plants have an amphiphloic stele.

An amphiphloic siphonostele can be called a solenostele or a dictyostele. Most seed plant stems possess a vascular arrangement which has been interpreted as a derived siphonostele, and is called a eustele.

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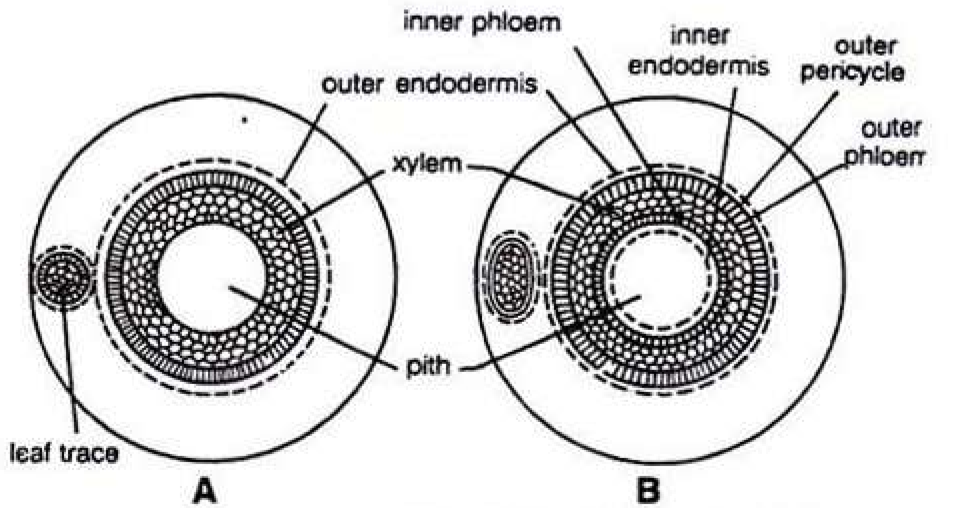
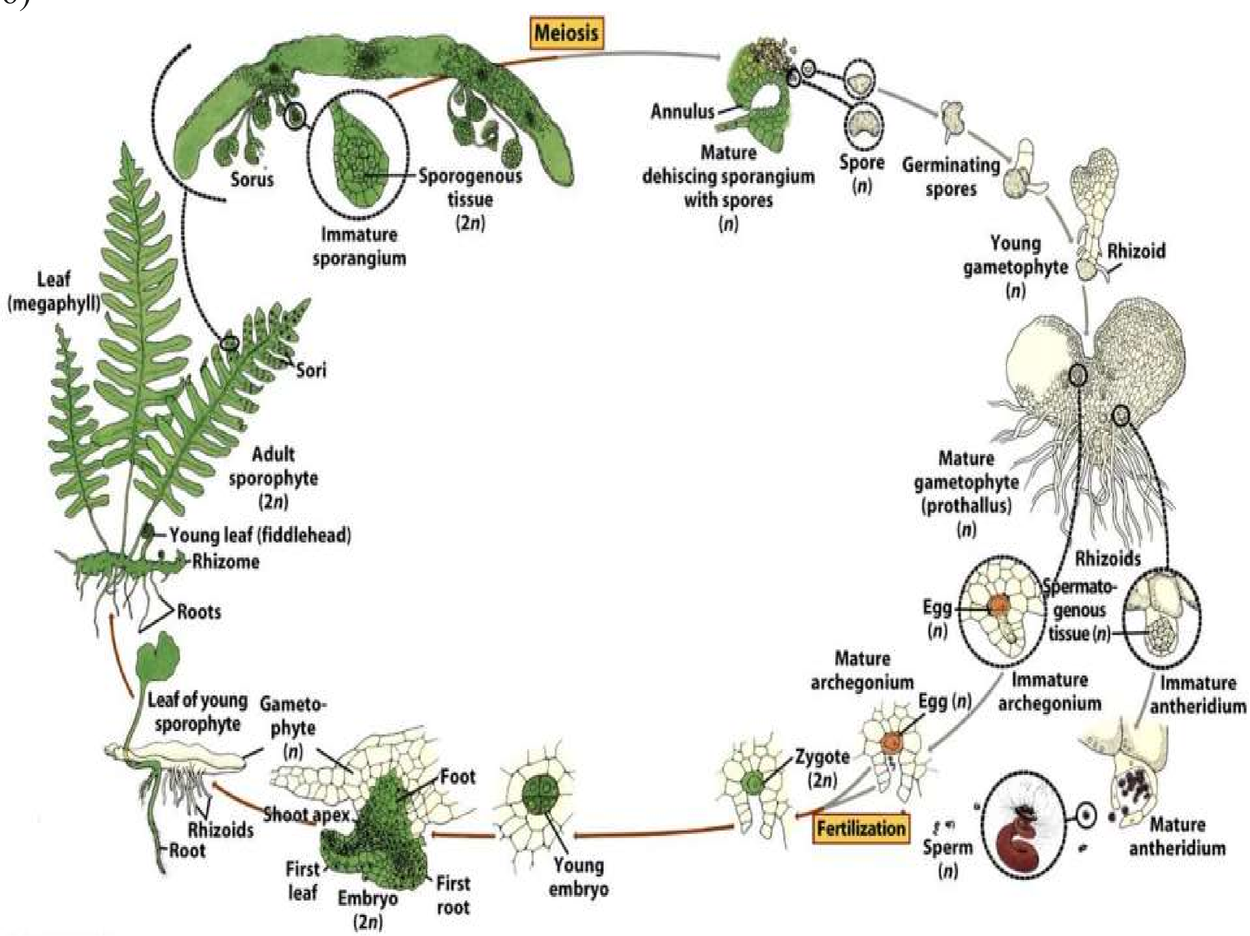


Fig. 3 (A–B). Stelar System : A. Ectophloic siphonostele, B. Amphiphiloic siphonostele

6)



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LIFE CYCLE OF A PRIMITIVE VASCULAR PLANT(PTERIDOPHYTE)