Introduction to Mycology

The term "mycology" is derived from Greek word "mykes" meaning mushroom فطرTherefore mycology is the study of fungi.

(Fungi)فطريات…… (fungus) فطر

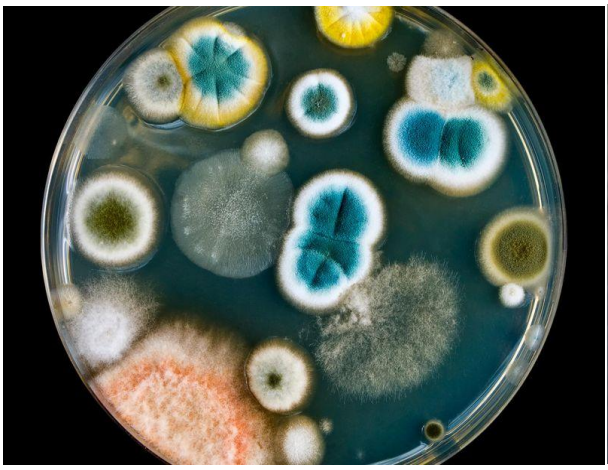
- **Mycologists**: scientists who study fungi.
- **Mycoses**: diseases caused by fungi.
- **Mycotoxin:** is atoxic secondary metabolites produced by fungi such as (Aflatoxin ,Ochratoxin, Trichothecene ,Zeralenone, Patuline, Citrinin, Ergot alkaloids. Fuminosine).

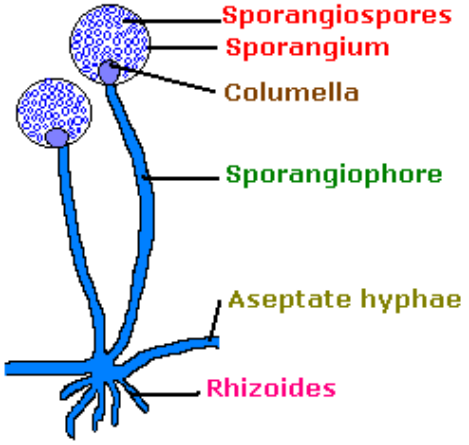
Characteristics of Fungi:

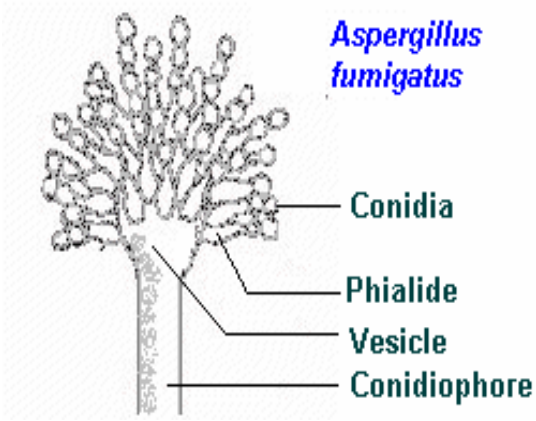
1- Eukaryotic microorganisms, lack of chlorophyll therefore not autotrophic.
2- Larger than bacteria require oxygen to survive.
3- Fungi are containing a nucleus bound by a membrane, an endoplasmic reticulum, and mitochondria.
4- Rigid cell walls: made of chitin, glucans, mannans
5- Plasma membranes: made of ergosterol
6- Food storage is generally in the form of lipids and glycogen.
7- All fungi require water and oxygen and there are no obligate anaerobes.
(هي ليست كائنات مجبرة لاهوائية).

Morphology of Fungi:

Fungi exist in two fundamental forms; the filamentous (hyphal) and single celled budding forms (yeast). But, for the classification they are studied as **moulds, yeasts**, **yeast like fungi and dimorphic fungi.**

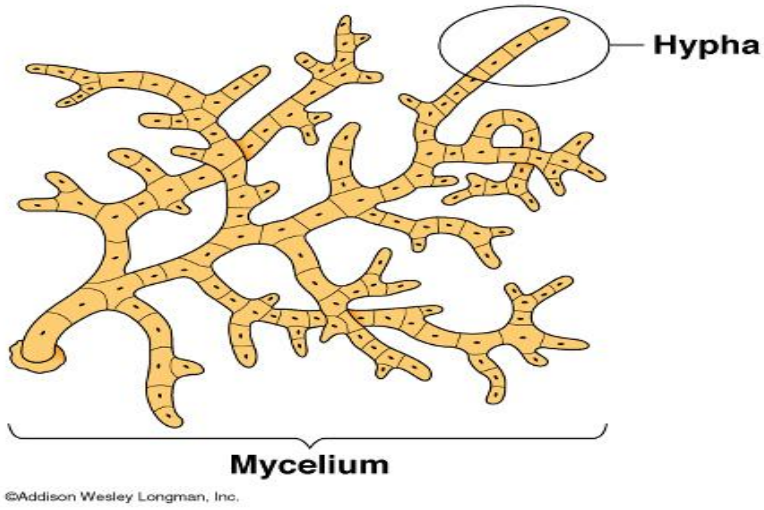


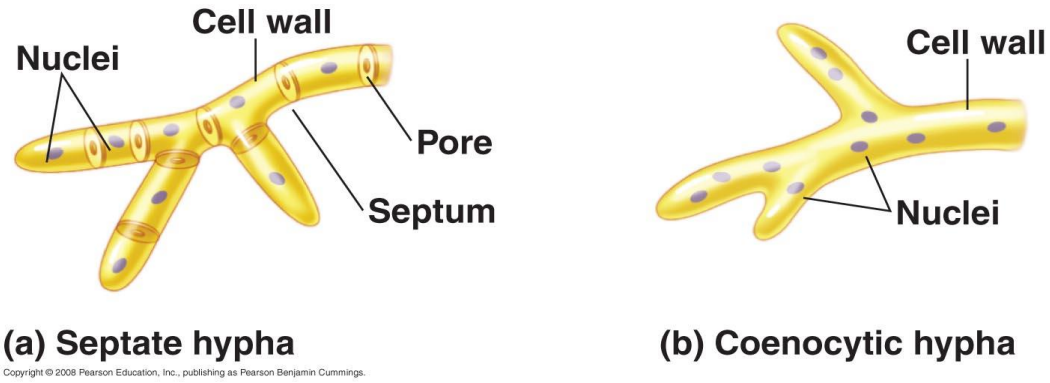




Moulds

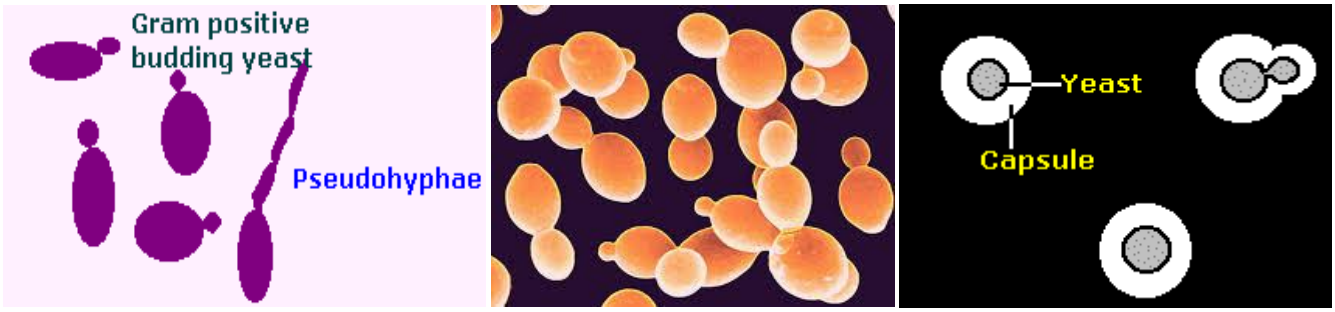
Most fungi have a **thallus** composed of **hyphae** (sing. **hypha**) which are cylindrical tube like structures that elongates by growth at tips. hyphae may be branched or unbranched . Hyphae usually have cross walls that divide them into numerous cells. These cross walls, called **septa** have small pores through which cytoplasm is continuous throughout the hyphae. Fungal hyphae form a network called a **mycelium**غزل فطري (pl. **mycelia**) غزول فطرية





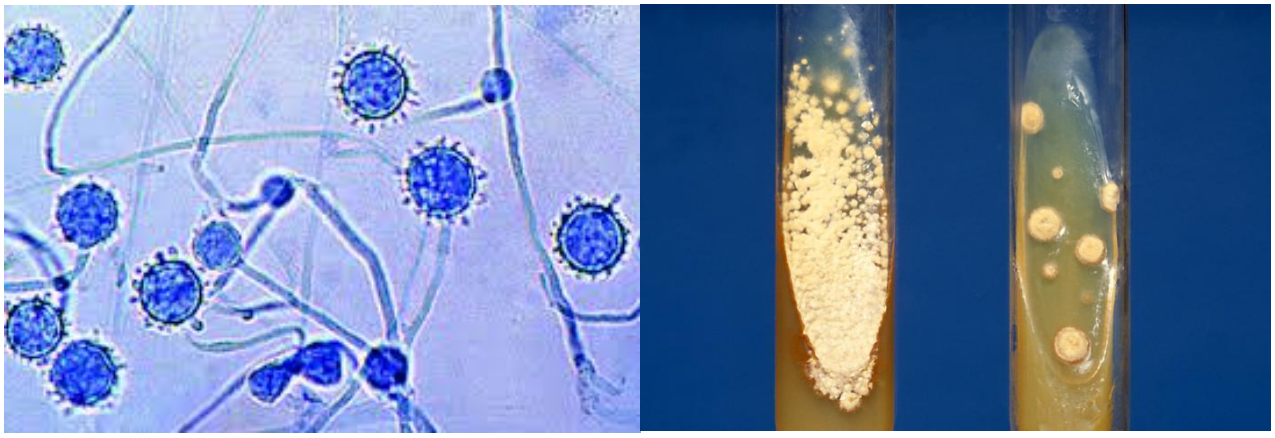
Yeasts and Yeast like Fungi

Yeasts are unicellular spherical to oval shape cells. They reproduce by budding. Yeast like fungi (the buds fail to separate and elongate thus forming a chain of elongated hyphae like filament called pseudohyphae). This property is seen in ***Candia albicans***. The same species also have the ability to produce true hypha, which is seen as germ tube. The difference between the two is that there is a constriction in psueudohyphae at the point of budding, while the germ tube has no constriction. True yeasts such as ***Saccharomyces cerviciae*** don't produce pseudohyphae. **Yeast-like fungi may be** basidiomycetes, such as ***Cryptococcus neoformans*** or ascomycetes such as ***Candida albicans.***

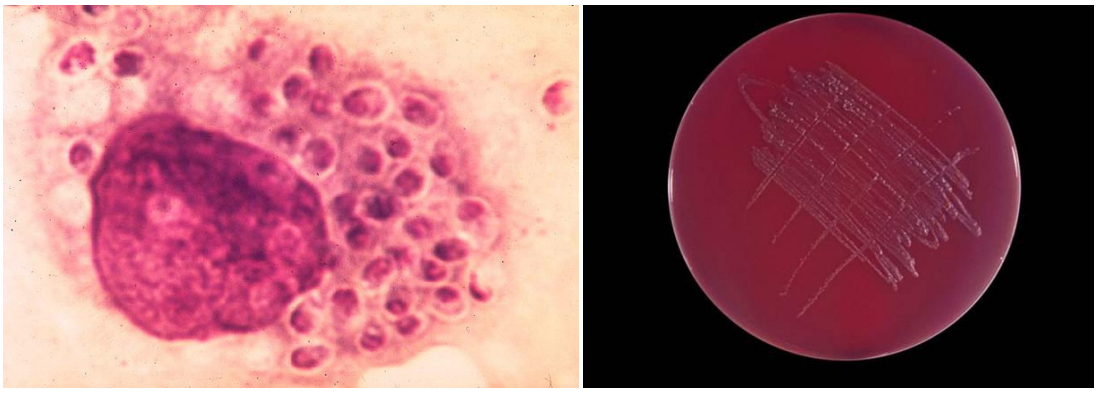


Dimorphic fungi:

These are fungi which exhibit a filamentous mycelial morphology(هيئة خيوط فطرية) (saprophytic phase) when grown at room temperature 27^{o}C, but have a typical yeast morphology (parasitic phase) inside the body when grown at 37^{o}C



Histoplasma capsulatum 27^{o}c



Histoplasma capsulatum 37^{o}C

Fungal Feeding:

1- Are **chemoheterotrophs** (require organic compounds for both carbon and energy sources).

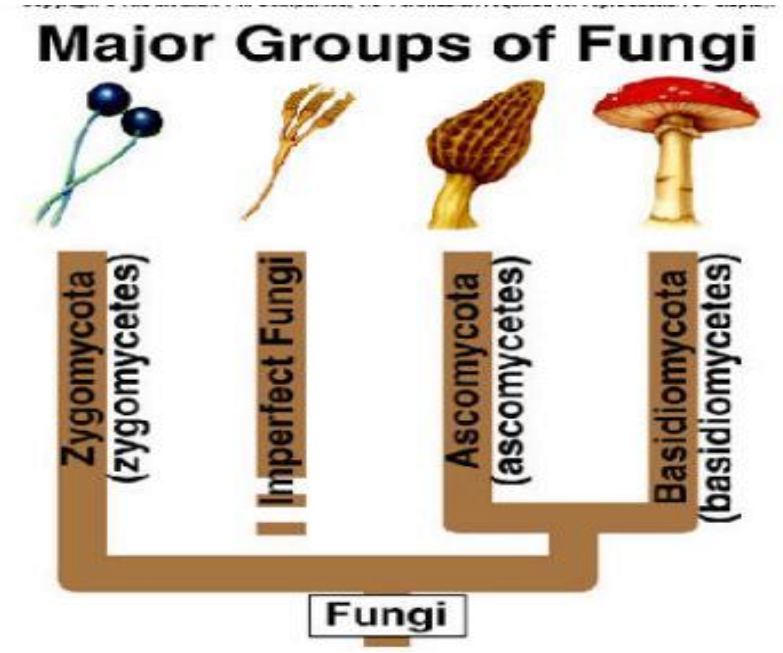
2- Fungi are **osmiotrophic**; they obtain their nutrients by absorption.

3- They obtain nutrients as **saprophytes** (live off of decaying matter) or as **parasites** (live off of living matter).

Saprophytes

Osmiotrophic

Group of fungi: there are 4 major groups of fungi



A. Deuteromycota- no sexual reproduction فطريات ناقصة

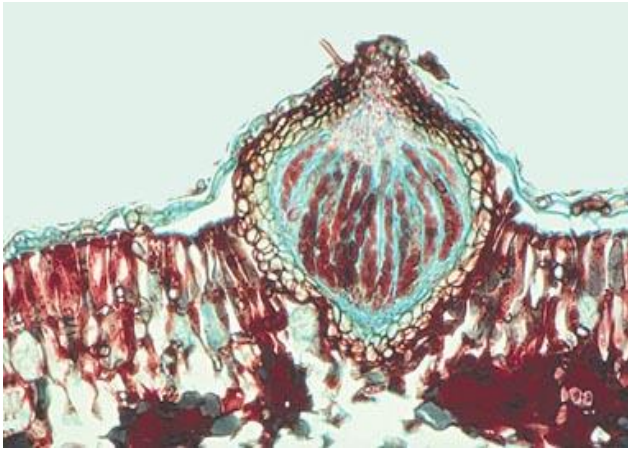
B. Zygomycota- coenocytic fungi فطريات تزاوجية

C. Ascomycota- فطريات كيسية

Septate and have asci(اكياس)contain spores

D. Basidomycota فطريات بازيدية

Septate and fleshy base like a (mushrooms)



Asci اكياس

Ascusكيس

Classification of fungi

Kingdom Fungi

- **Phylum :** Basidio**mycota** الشعبة
- **Class :** Basidio**mycetes** الصنف
- **Order :** Agaric**ales** الرتبة
- **Family :** Agarica**ceae** العائلة

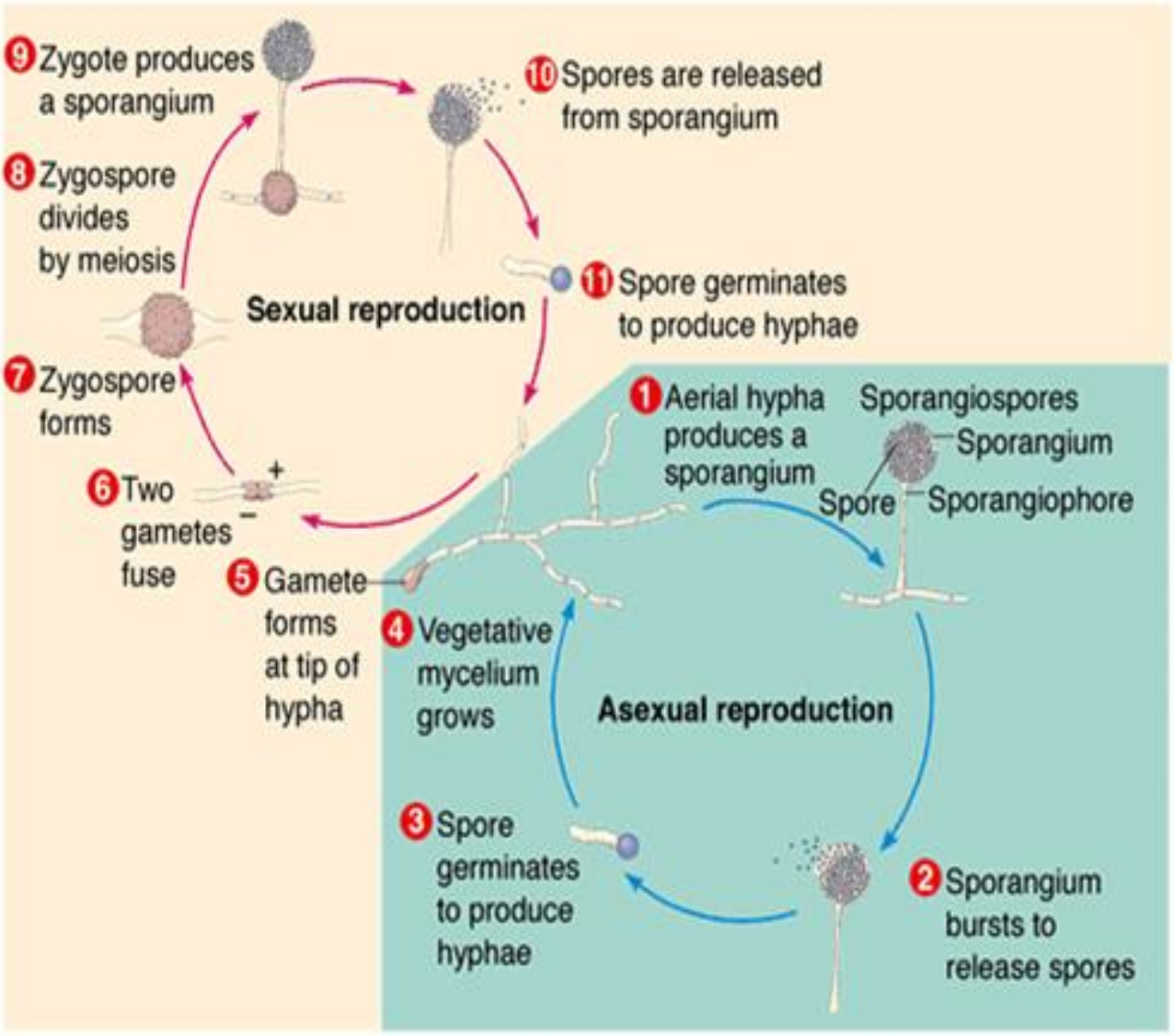
- **Genus : *Agaricus*** الجنس
- **Species : *Agaricus campestris*** النوع

Reproduction in fungi

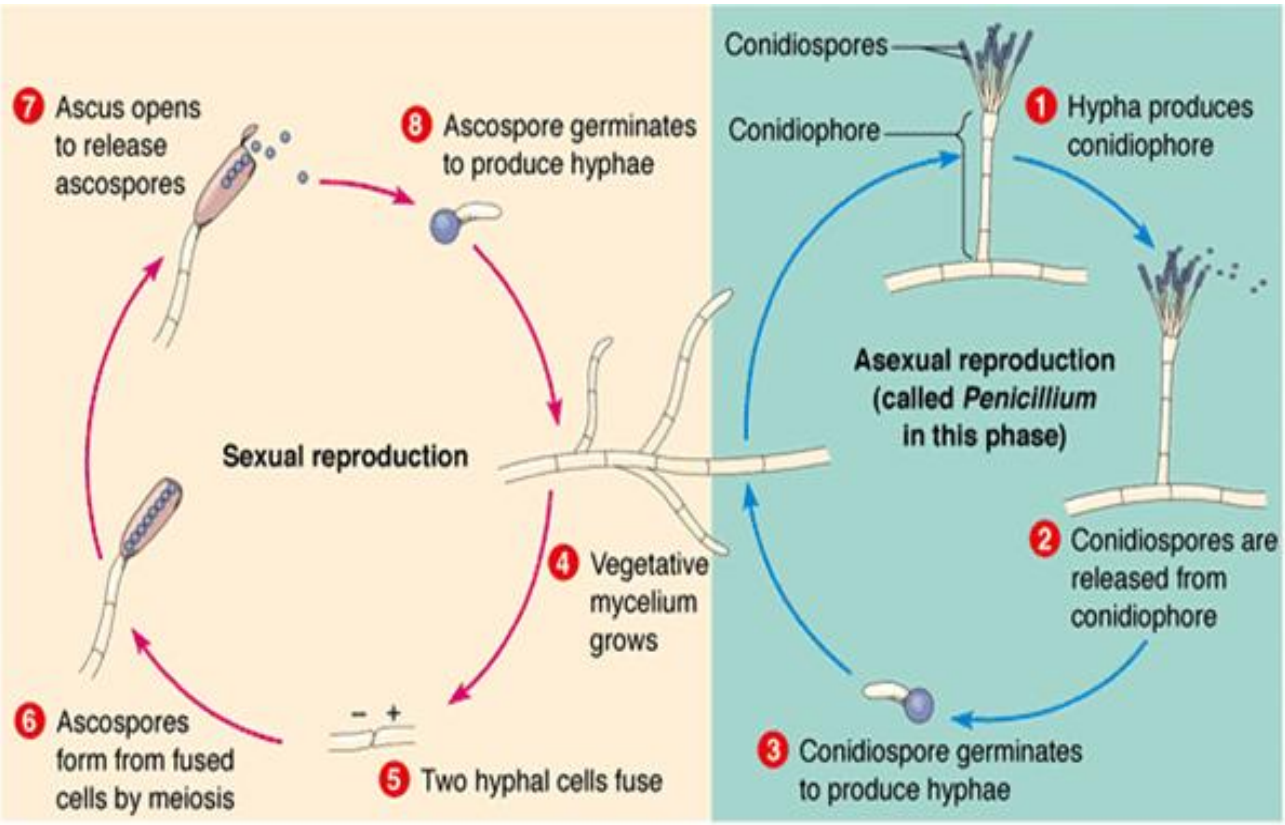
Fungi reproduce by a sexual, sexual and parasexual means شبه جنسي

Asexual reproduction:

Asexual are termed either spores or conidia depending on their mode of production. Asexual spores are produced following mitosis.انقسام خيطي



Asexual and Sexual reproduction in Zygomycetes



Asexual and Sexual reproduction in Ascomycetes

Sexual Reproduction:

Sexual are produced by the fusion of two nuclei that then generally undergo meiosis

انقسام اختزالي

1-The first step in sexual methods of reproduction involves

plasmogamy (cytoplasmic fusion of two cells).

2-The second step is **karyogamy** (fusion of two compatible nuclei), resulting in production of diploid or zygote nucleus. This is followed by genetic recombination and meiosis. The resulting four haploid spores are said to be sexual spores, e.g.

zygospores, ascospores and basidiospores.

Parasexual reproduction:

Parasexual reproduction, first seen in *Aspergillus* is known to occur in basidiomycetes, ascomycetes and deuteromycetes. The process involves genetic recombination اعادة التركيب الجيني without the requirement of specific sexual structures.

Importance of Fungi:

1. Decomposition - nutrient and carbon recycling.
2. Used for the industrial production of alcohols, fats, citric, oxalic.
3. Important sources of antibiotics, such as Penicillin.
4. Model organisms for biochemical and genetic studies. Eg: *Neurospora crassa*
5. *Saccharomyces cerviciae* is extensively used in recombinant DNA technology.
6. Some fungi are edible (mushrooms).
7. Yeasts provide nutritional supplements such as vitamins and cofactors.
8. *Penicillium* is used to flavor some types of cheeses.
9. Ergot produced by *Claviceps purpurea* contains medically important alkaloids that help in inducing uterine contractions, controlling bleeding and treating migraine.

Harmful Effects of Fungi

1. Destruction of food, wood, paper, and cloth.
2. Plant, Animal and human diseases, including allergies.
3. Toxins produced by poisonous mushrooms and within food (Mycetism and Mycotoxicosis).
4. Spoilage of agriculture produce such as vegetables and cereals.
5. Damage the products such as magnetic tapes and disks, glass lenses, bones and wax.