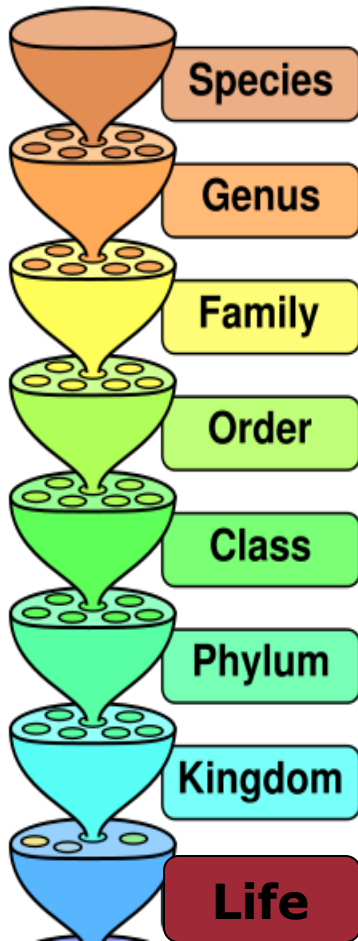


**Classification and
Reproduction
of
lower fungi
(Phycomycetes)**

History of Classification

<u>Linnaeus</u> 1735 2 kingdoms <i>(not treated)</i>	<u>Haeckel</u> 1866 3 kingdoms	<u>Copeland</u> 1956 <u>4 kingdoms</u>	<u>Whittaker</u> 1969 <u>5 kingdoms</u>	<u>Woese et al.</u> 1977 <u>6 kingdoms</u>	<u>Woese et al.</u> 1990 <u>3 domains</u>
	<u>Protista</u>	Monera	Monera	<u>Eubacteria</u>	<u>Bacteria</u>
				<u>Archaeobacteria</u>	<u>Archaea</u>
		<u>Protista</u>	<u>Protista</u>	<u>Protista</u>	<u>Eukarya</u>
<u>Vegetabilia</u>	<u>Plantae</u>		<u>Fungi</u>	<u>Fungi</u>	
		<u>Plantae</u>	<u>Plantae</u>		
<u>Animalia</u>	<u>Animalia</u>	<u>Animalia</u>	<u>Animalia</u>	<u>Animalia</u>	

A Biological organizational Hierarchy



Biological Organization

Kingdom (one or more phyla)

Phylum (one or more classes)

Class (one or more orders)

Order (one or more families)

Family (one or more genera)

Genus (one or more species)

Species (a distinct kind or unit)



Three Domains

Six Kingdoms

Common Ancestor

Bacteria

Eubacteria



Archaea

Archaeobacteria



Eukaryotes

Protista



Plantae



Fungi



Animalia



Oomycetes

Zygomycetes

Classification of Fungi (Eumycota)

Deutromycetes

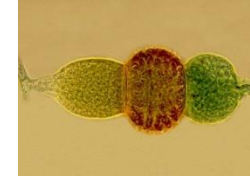
Basidiomycetes

Ascomycetes

Kingdom Fungi (5 Major Phyla)

1. Phylum **Zygomycota** (Bread molds) :

Rhizopus – black bread mold.



2. Phylum **Chytridiomycota** (Water molds) :

Water mold, potato blight, mildew.



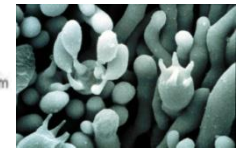
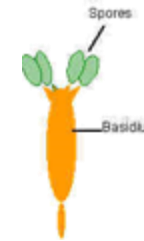
3. Phylum **Ascomycota** (Sac fungi) :

Yeast and true fungi .



4. Phylum **Basidiomycota** (Club fungi) :

Mushrooms , rusts and smuts fungi.



5. Phylum **Deuteromycota** (Imperfect fungi):

***Curvularia* , *Fuzarium*.**



Classification of fungi

Sparrow divided the true fungi into five classes namely

Plasmodiophoromycetes

Phycomycetes

Ascomycetes

Basidiomycetes

Deautromycetes

Sparrow classified class phycomycetes on the basis of **presence or absence** of **motile cells** in the life cycle and the **kind, number and arrangement** of **flagellae** on the motile cells, as follows:

**Phycomycetes
(lower fungi)**

Sporangiospores
motile

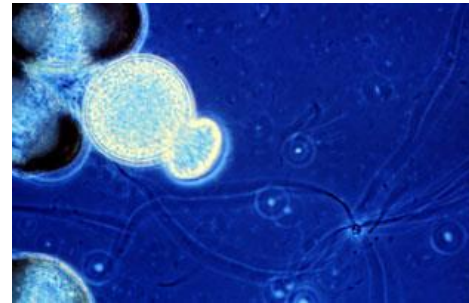
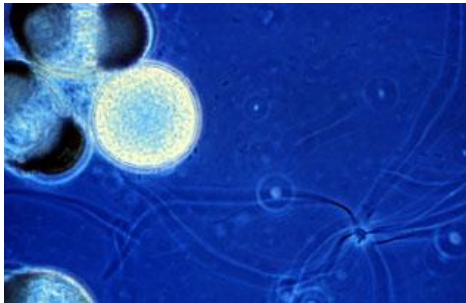
Sporangiospores
immotile
Order 1: Mucorales
Order 2: Entomophthorales

Motile
Sporangiospores
Uniflagellate
Sub-class 1: Uniflagellatae
Order 1: Chytridiales
Order 2: Blastocladales
Order 3: Monoblepharidales

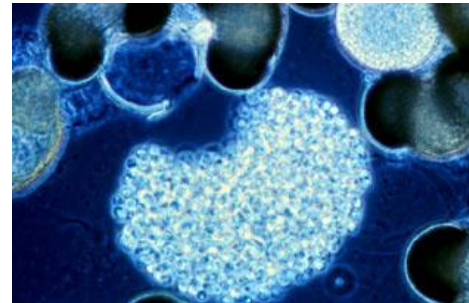
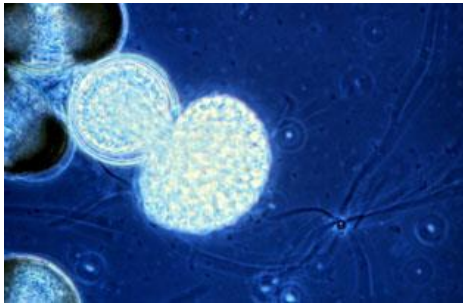
Motile
Sporangiospores
Biflagellate
Sub-class 2: Biflagellatae
Order 1: Saprolegniales
Order 2: Leptomitales
Order 3: Lagenidiales
Order 4: Peronosporales

Asexual reproduction

- Initiates with **zoosporangium** filled with **protoplasm** and **many nuclei**.

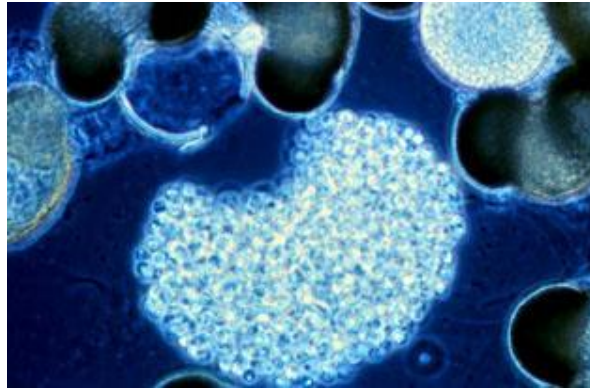


- Protoplasm of zoosporangium is **incorporated into numerous zoospores** may involve vesicle formation.

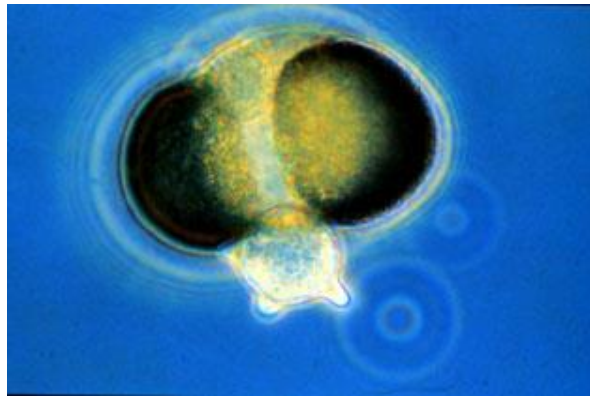


- zoospores are **released**, **swim**, **encyst**, then germinate to produce a thallus.

- Operculate zoosporangia form a **well-defined circular cap**, **operculum**, through which the **zoospores emerge**.



- Inoperculate zoosporangia **discharge zoospores** through a **discharge tube**, formed when **papilla dissolves**.



- Most known species **possess inoperculate zoosporangia**.

Sexual reproduction

Modes of sexual reproduction:

1- Planogametic copulation: three forms

A- Isogamous

B- Anisogamous

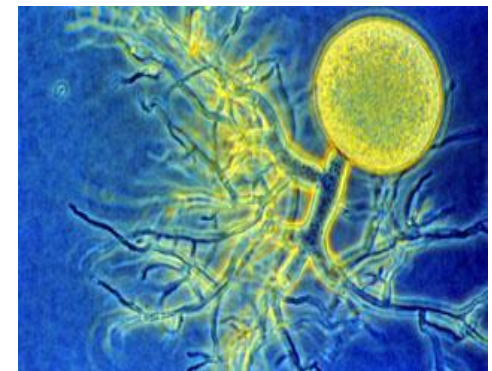
C- Non motile egg fertilized by a motile antherzoid .

2- Gametangial copulation:

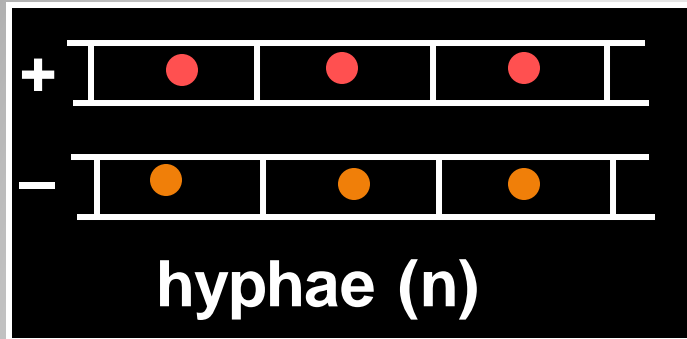
Transfer of protoplast from one gametangium to another.

3- Somatogamy:

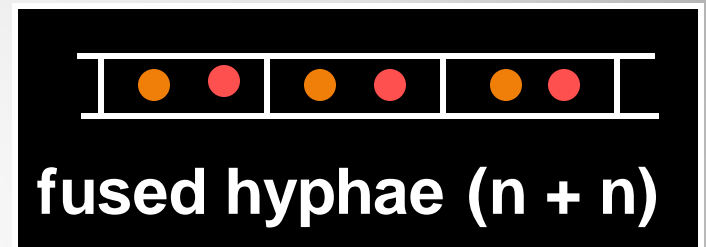
Fusion between rhizoidal filaments.



Sexual reproduction in fungi



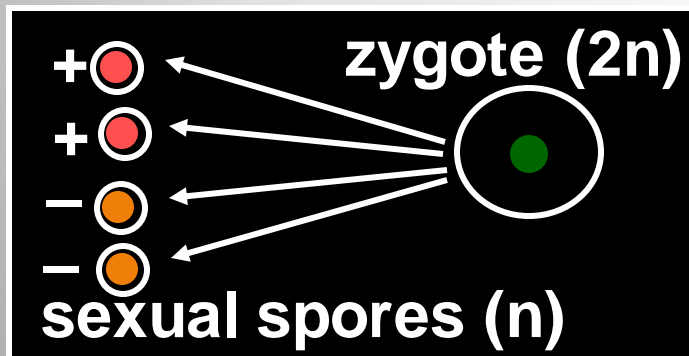
fusion of compatible hyphae
(**plasmogamy**)



fusion of nuclei
(**karyogamy**)



meiosis of
“zygote-like”
structures



dispersal of spores



There is a great diversity in the sexual process of **the lower fungi** (**Phycomycetes**).

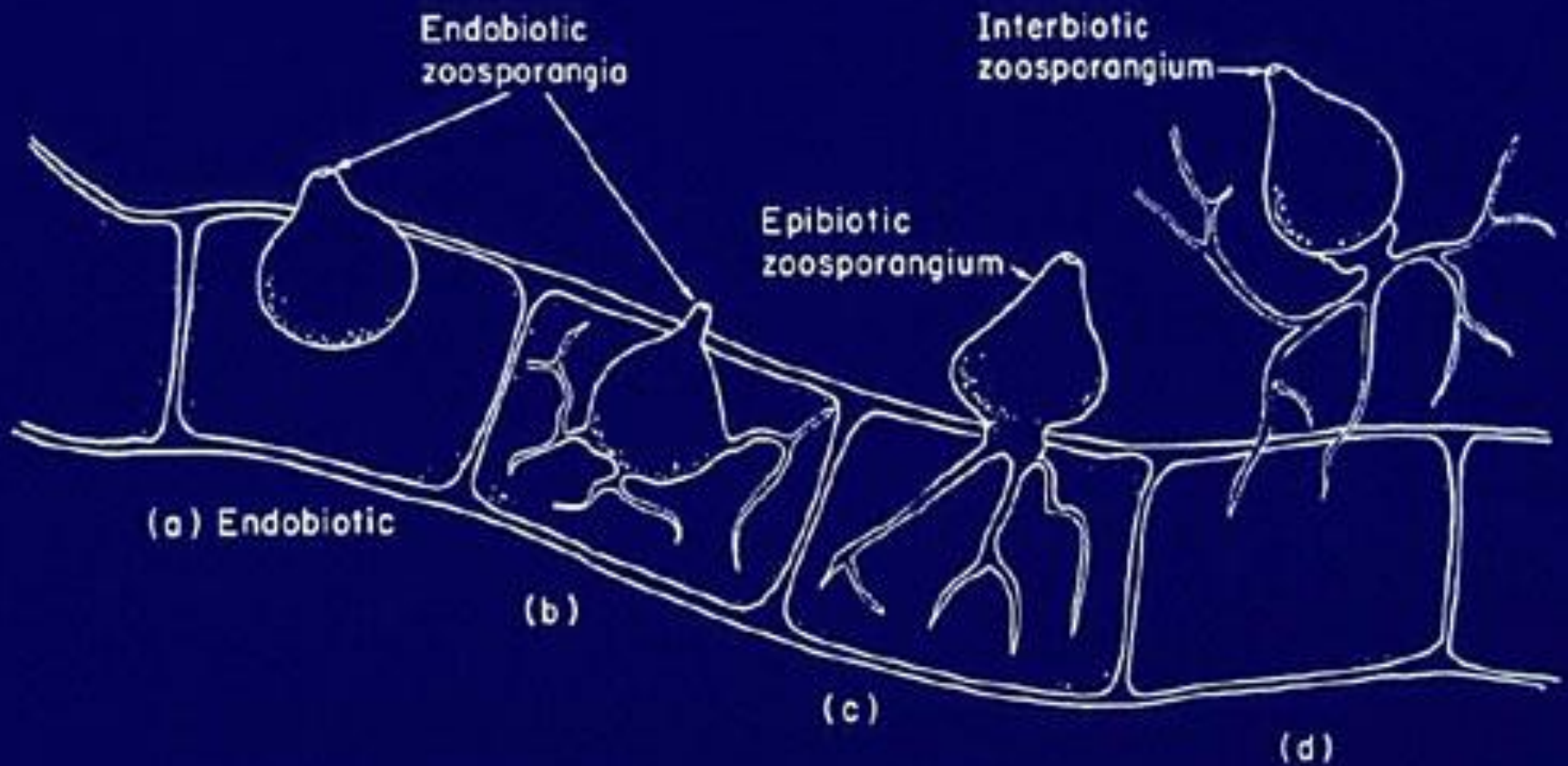
It ranges from **isogamy** to **oogamy** through **anisogamy**.

Most of the species are **homothallic** , which **both kinds of gametes** are produced on the **same thallus**.

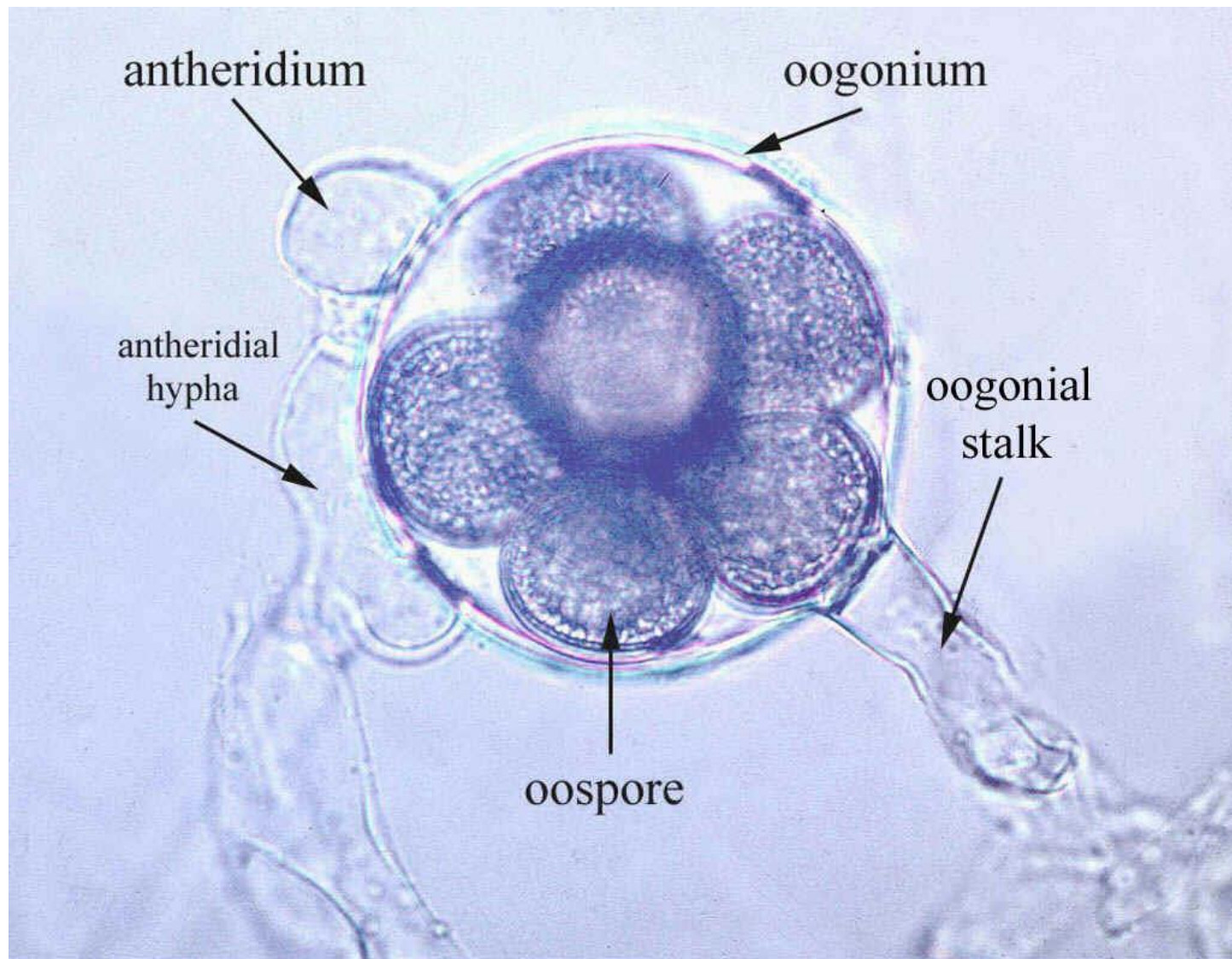
Many species are **heterothallic**. The single fungal thallus produces **only one kind of gametes** either **male** or **female** so that there are **separate male and female organisms**.

Thallus and life history diversity :

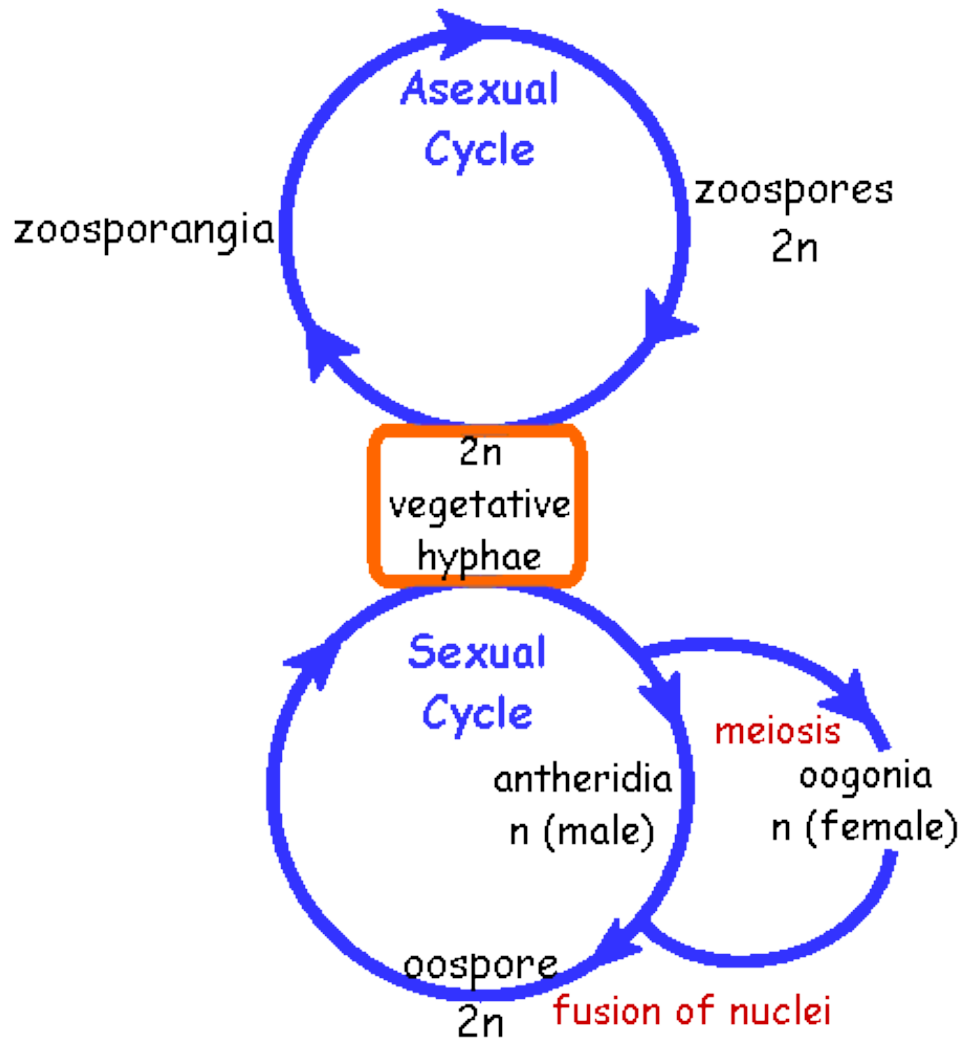
- **Holocarpic** : entire thallus converted into a sporangium.
- **Eucarpic** : portions of thallus converted into sporangia , development of vegetative thallus.
- **Endobiotic** : living entirely within the cells of their hosts.
- **Epibiotic** : producing sporangia on the surface of either a living host or dead organic material.



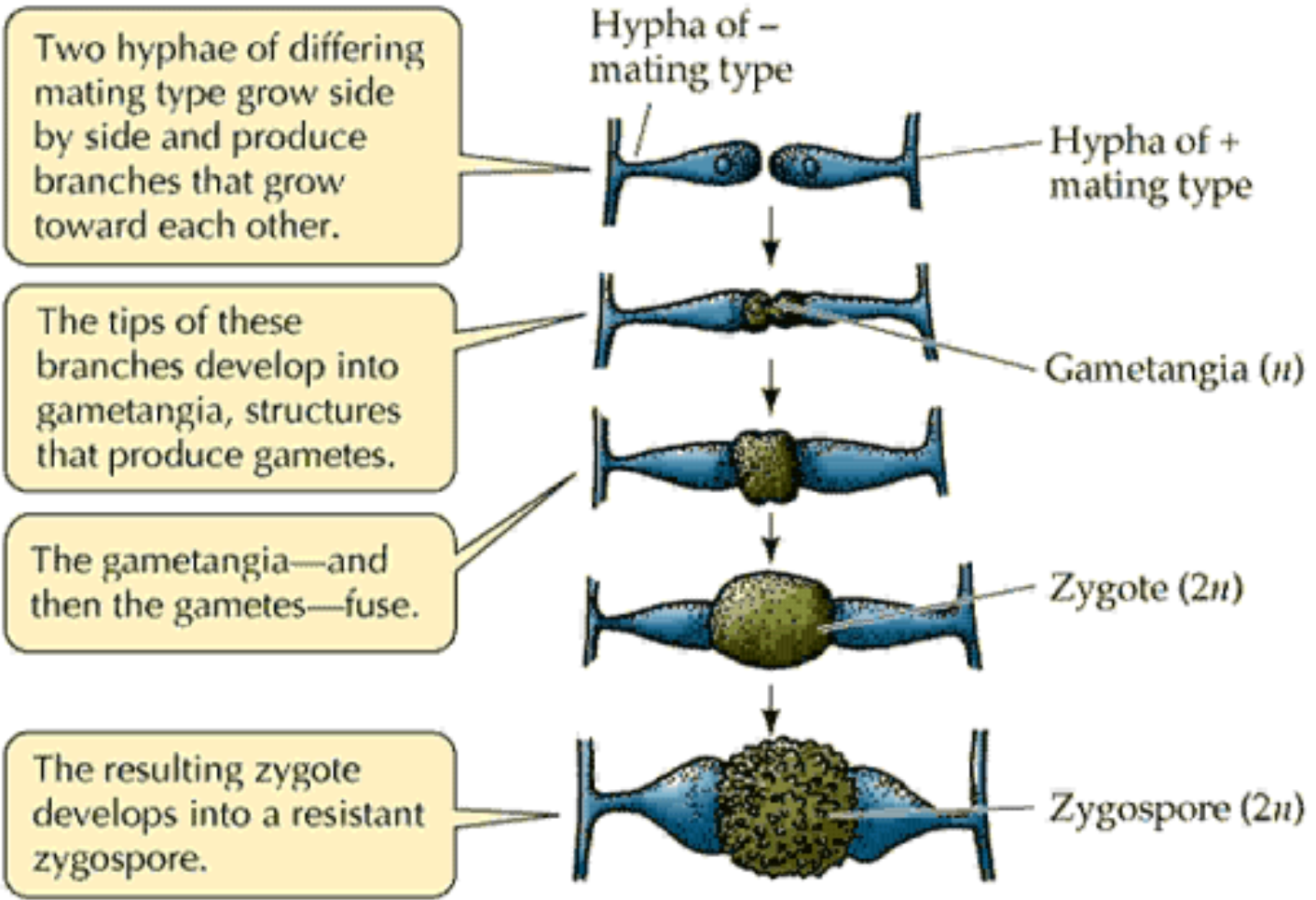
Thallus types in the chytrids. All are monocentric types (a polycentric type is illustrated in Fig. 2-9c). (a) Holocarpic thallus showing complete conversion into zoosporangium; (b-d) Eucarpic thalli showing zoosporangia with rhizoids.



Homothallic fungus (*Saprolegnia*)



Homothallic fungus



Heterothallic fungus (eucarpic)

The first step of sexual reproduction, **protoplasts** of both **male and female gametes** are bringing together **in one cell** **without fusion** of their nuclei. This process is known as **plasmogamy**.

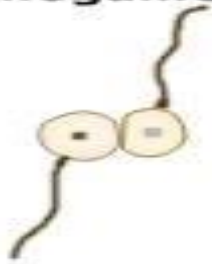
In the lower fungi, sexual reproduction accomplished **in three ways** namely :

- 1- Planogametic copulation.**
- 2- Gametangial contact .**
- 3- Gametangial copulation.**

Types of sexual reproduction In lower fungi (phycomycetes)

1- Planogametic copulation:

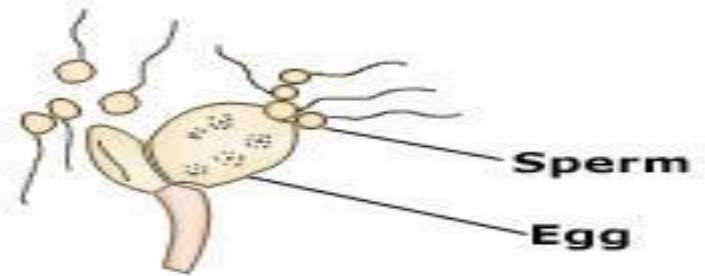
Planogametic copulation



Isogamy

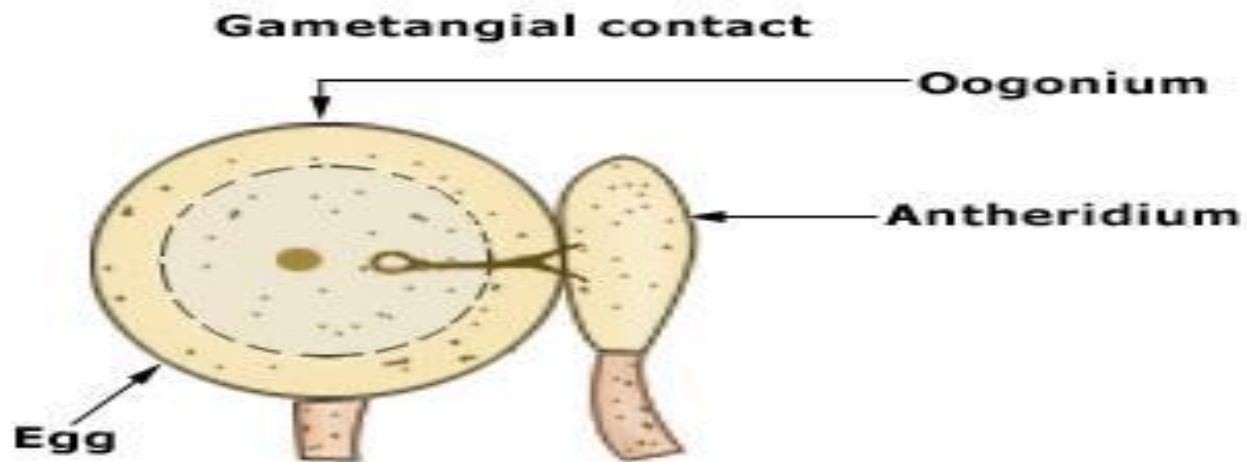


Anisogamy

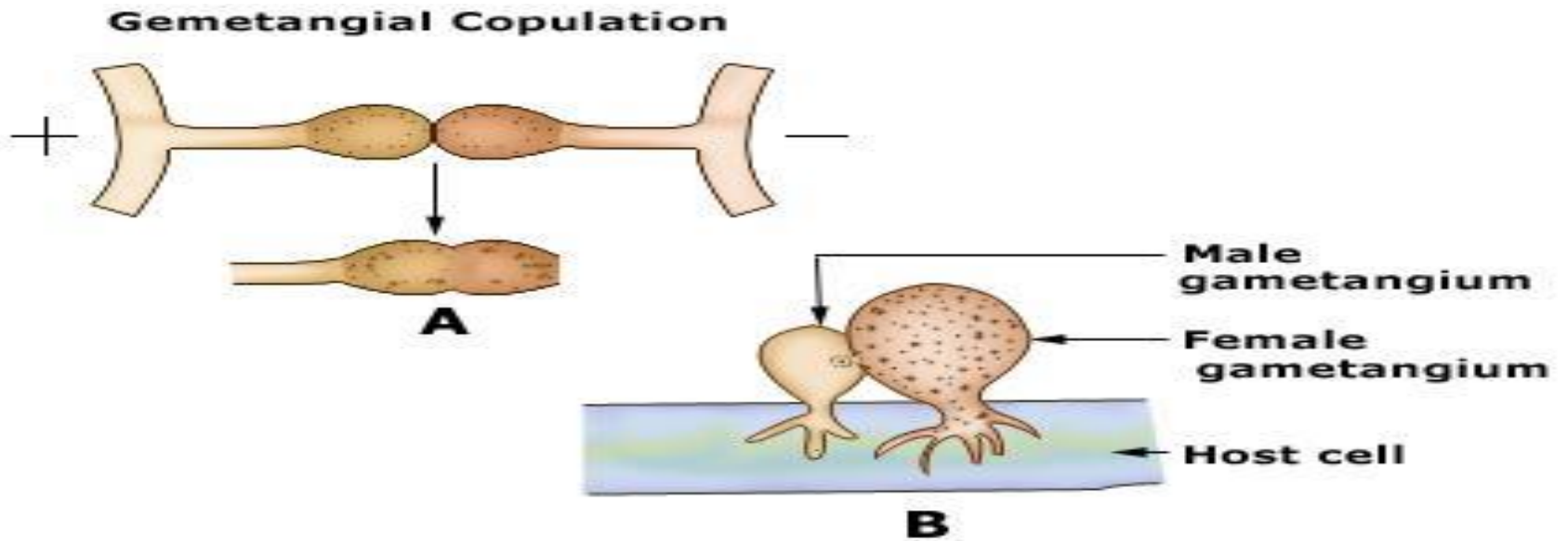


Oogamy

2- Gametangial contact :



3- Gametangial copulation:



1- Planogametic copulation

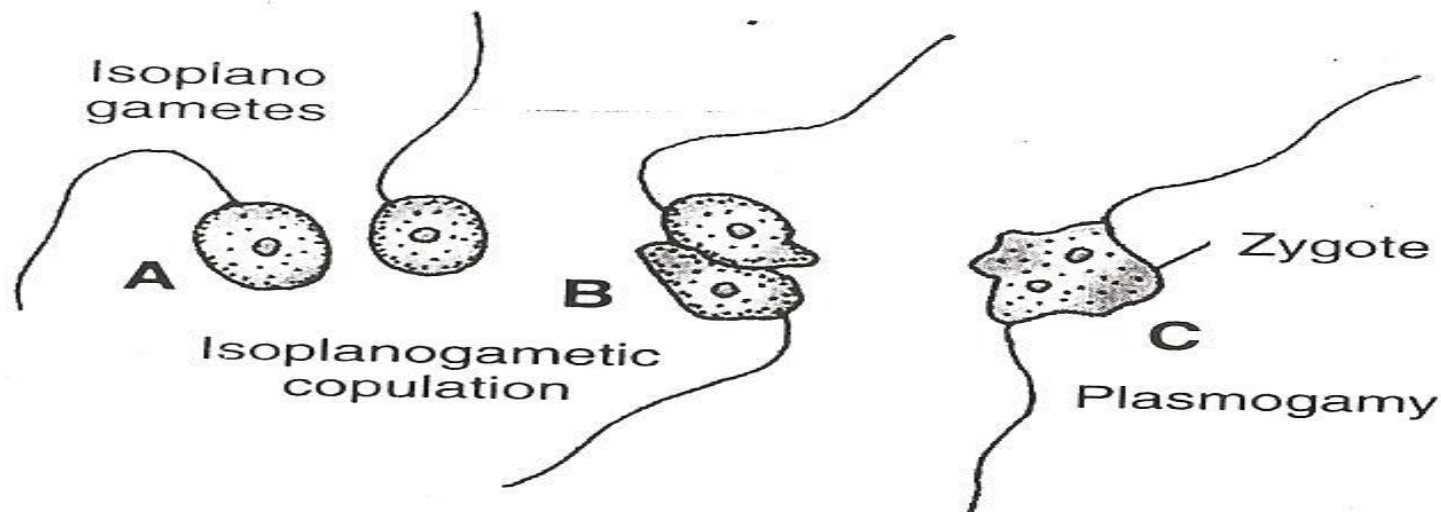
One or both the gametes of a uniting pair are motile (flagellate) and are called the planogametes.

i - The planogametes in the Chytridiomycetes are uniflagellate. The single flagellum is of whiplash type. It is inserted at the posterior end.

ii- The planogametes in **plasmodiophoromycetes** are **biflagellate** gametes. Both flagella are of **whiplash type** of **unequal length**. They are inserted at the **anterior end**. The **shorter** one has **blunt tip** and the **longer** one has a **pointed tip**.

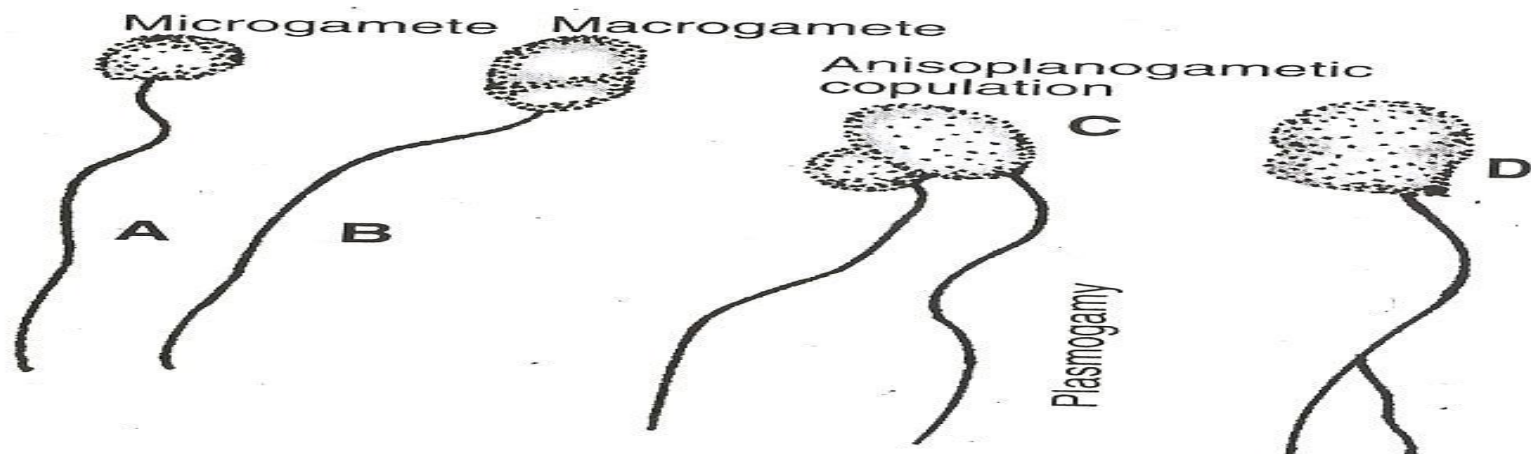
1:(a)- Isoplanogametic copulation:

It takes place **between two morphologically similar motile gametes** known as the **isoplanogametes**. Sexual fusion between isoplanogametes is described as **isoplanogametic copulation**.



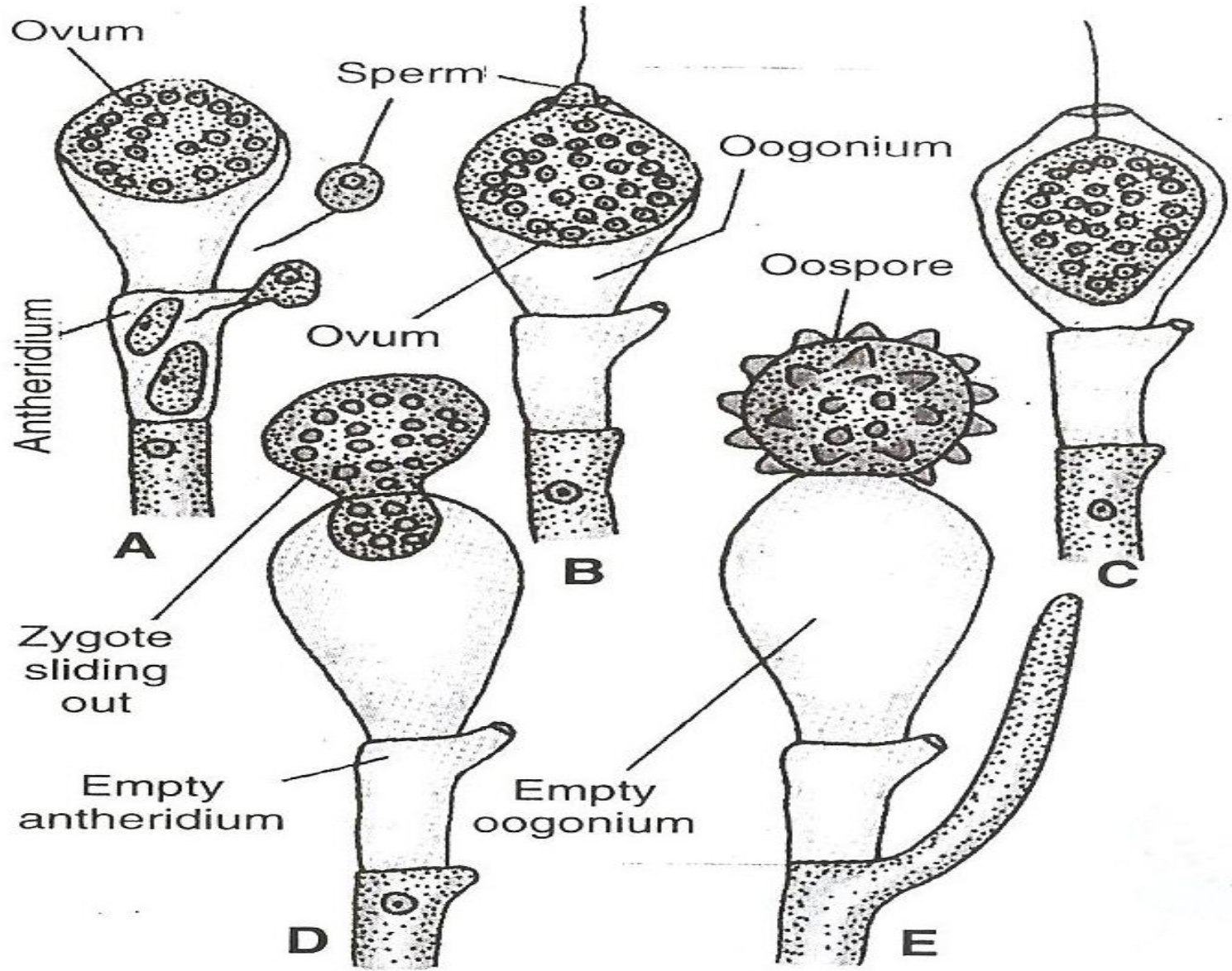
1:(b)-Anisoplanogametic copulation:

It takes place by two types of planogametes which are **morphologically similar** but **differ in size**. These are termed **anisoplanogametes**. The gametic union between anisoplanogametes is known as **anisoplanogametic copulation**. It is illustrated by ***Allomyces***.



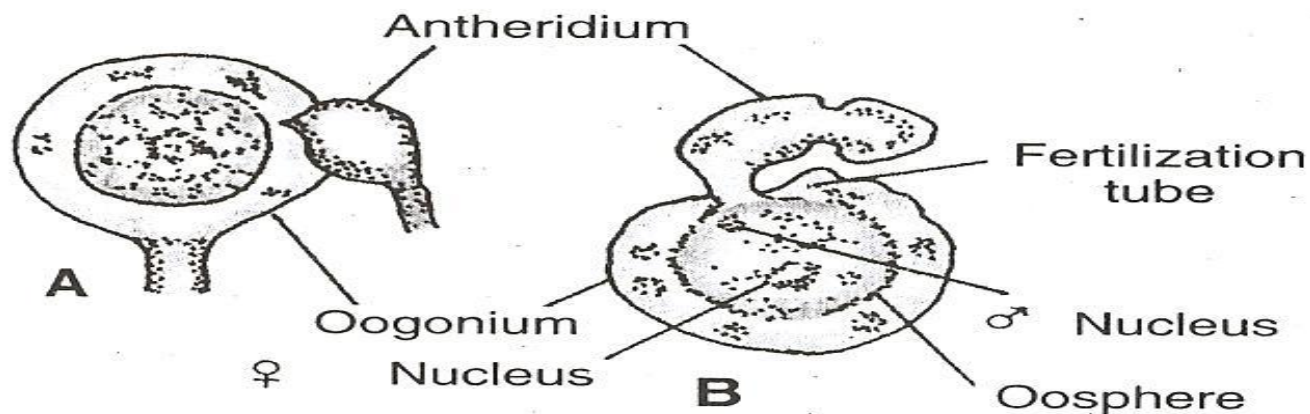
1:(c)- Ooplanogametic copulation:

It produces small male gametes in large numbers in the sex organ called **antheridium**. These are known as **sperms**. The **oogonium** produces a single large immobile female gamete called **egg or ovum**. The sperm enters the oogonium **through the apical pore** to **fertilize the egg**. The gametic union between a **motile male gamete (sperm)** and an **immobile female gamete (egg or ovum)** is called **ooplanogametic copulation**.



2- Gametangial contact :

A group of **aplanogametic** lower fungi (**Oomycetes**) produce immotile gametes (**aplanogametes**). The male gametangium is called the **antheridium** and the female **oogonium**. The oogonium may contain **one to many eggs**. At the time of sexual act, the antheridium and the oogonium **come in contact**. Antheridium in this position **puts out a slender, tubular outgrowth** at the point of contact with the oogonium. It is known as the **fertilization tube**.

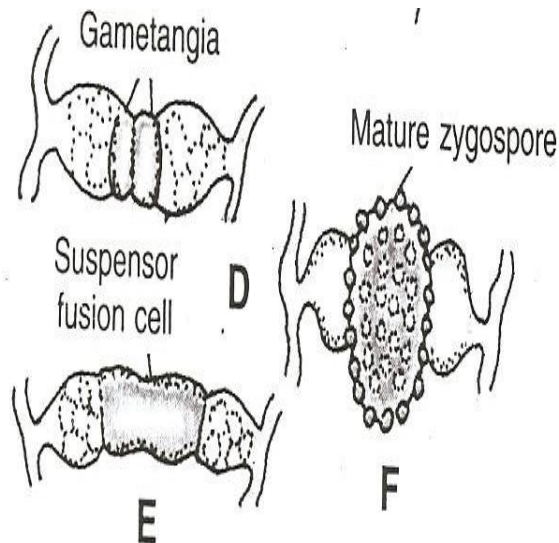


3- Gametangial copulation :

The uniting gametangia are usually morphologically similar (isogamous). Rarely they are dissimilar and unequal in size (anisogamous).

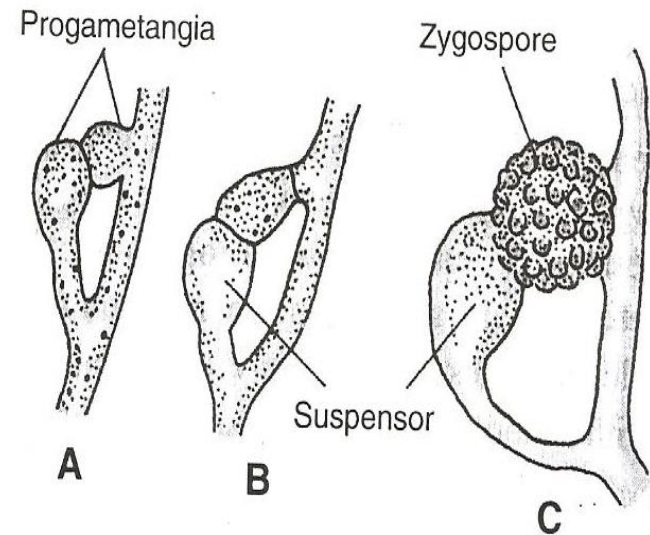
Isogamous

Typical examples of this method of gametic union are Rhizopus and Mucor



Anisogamous

the copulating gametangia and their suspensors are unequal in size

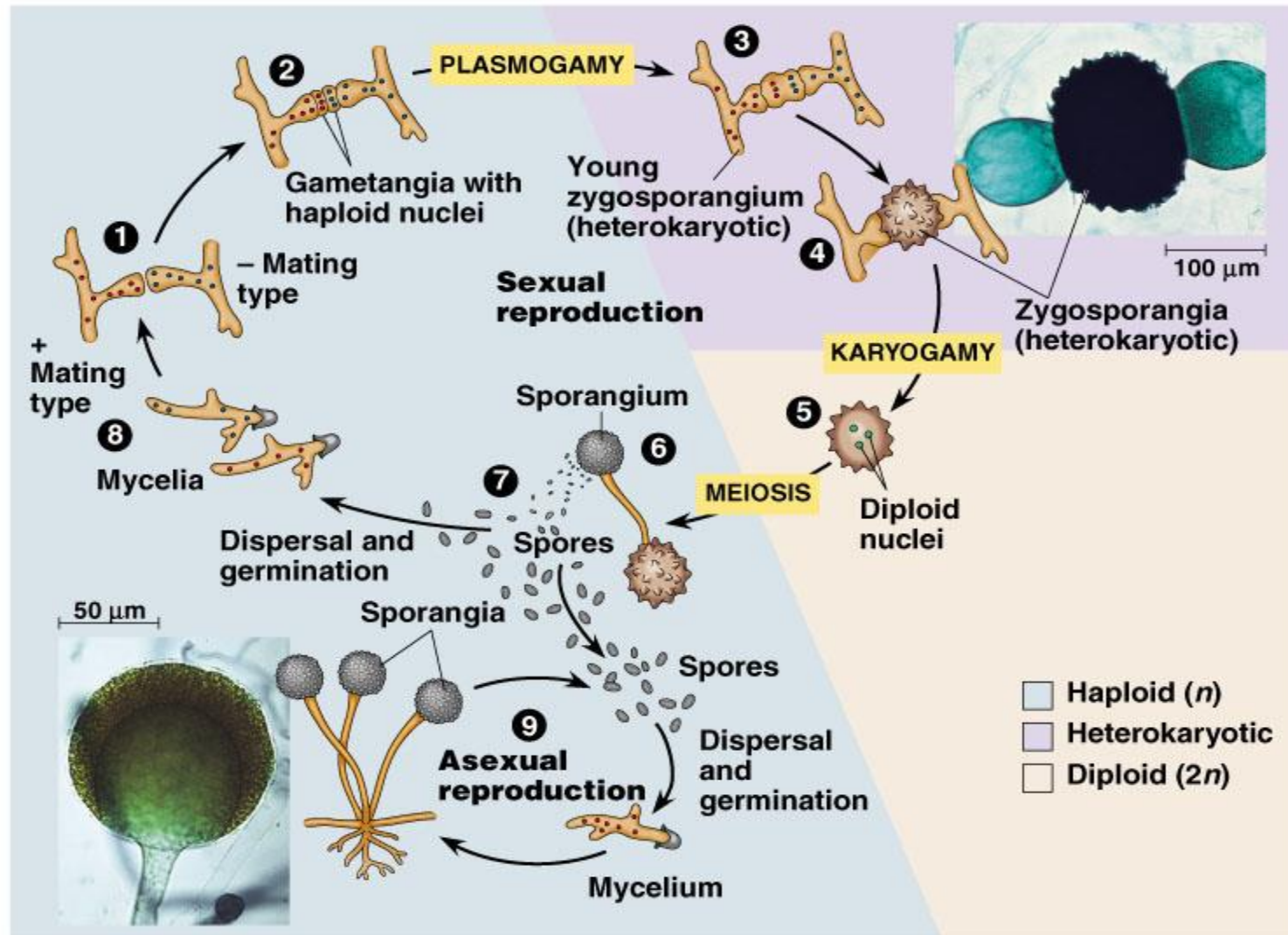


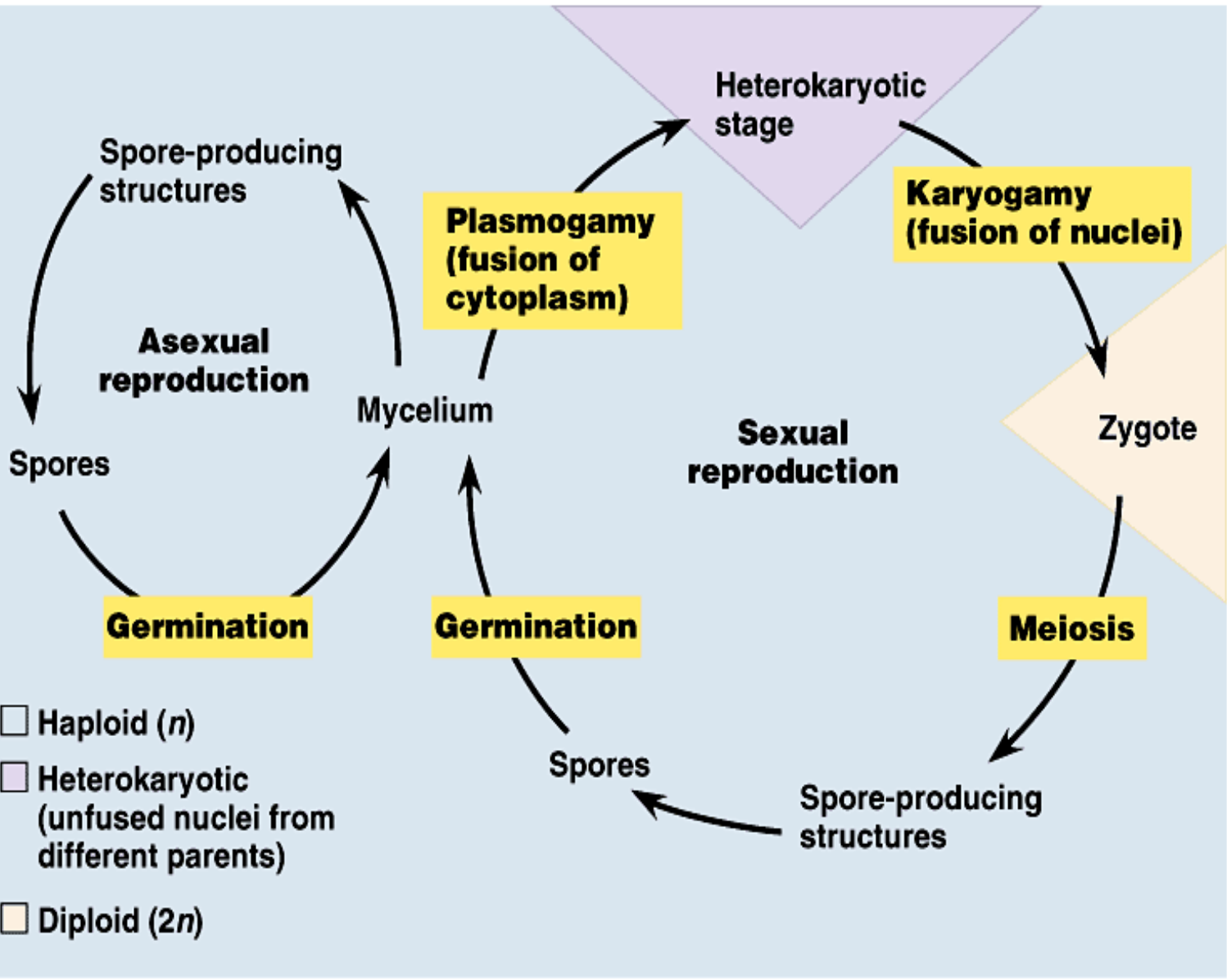
Germination of zygospore in Phycomycetes (the lower fungi)

On the return of the favorable conditions for growth, the zygospore germinates in either of the following ways :-

1- The diploid contents of zygospore ($2n$) undergo meiosis. The zygospore containing the haploid protoplast (n) then directly germinates to give rise to new haplomycelium. *Rhizopus* is an example.

Life cycle of a Zygomycete fungus (asexual and sexual)





2- Rarely as in *Allomyces*, the **diploid zygospore** germinates by putting out a **germ tube** which grows and branches to form the **diplomycelium**. **No meiosis** takes place **prior** or **during germination** of the zygospore.
Basidiospore

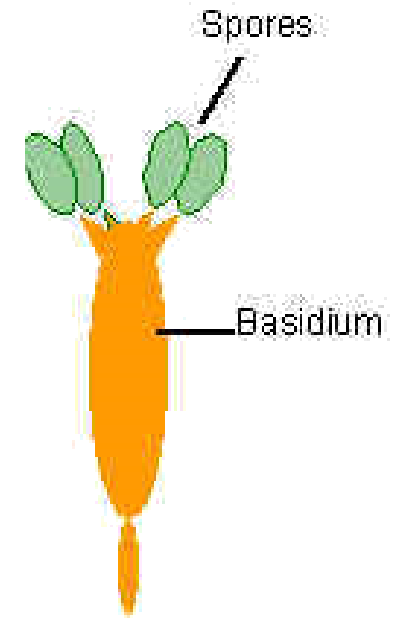
Sexual spores of fungi



Zygospor



Oospore



Basidiospor