CHAP: ANIMAL-LIKE PROTISTS

- ✓ **Life Within a Single Plasma Membrane**
- ✓ **Phylum Sarcomastigophora**
- ✓ **Phylum Labyrinthomorpha**
- ✓ **Phylum Apicomplexa**
- ✓ **Phylum Microspora**
- ✓ **Phylum Acetospora**
- ✓ **Phylum Myxozoa**
- ✓ **Phylum Ciliophora**

SUBPHYLUM ACTINOPODA

FORAMINIFERANS

- ✓ marine group of amoebae
- ✓ possess reticulopodia
- ✓ test is primarily calcium carbonate
- ✓ secrete new, larger chambers that remain attached to the older chambers
- ✓ Foram tests are abundant in the fossil record since the Cambrian period
- ✓ fossilized forams used to identify geologic strata

HELIOZOANS

- ✓ aquatic amoebae that are either planktonic or live attached by a stalk to some substrate.
- ✓ Heliozoans are either naked or enclosed within a test that contains openings for axopodia

RADIOLARIANS

- ✓ planktonic marine and freshwater amoebae.
- ✓ They are relatively large
- ✓ They possess a test (usually siliceous) of long, movable spines and needles or of a highly sculptured and ornamented lattice
- ✓ When radiolarians die, their tests drift to the ocean floor.
- ✓ Some of the oldest known fossils of eukaryotic organisms are radiolarians.

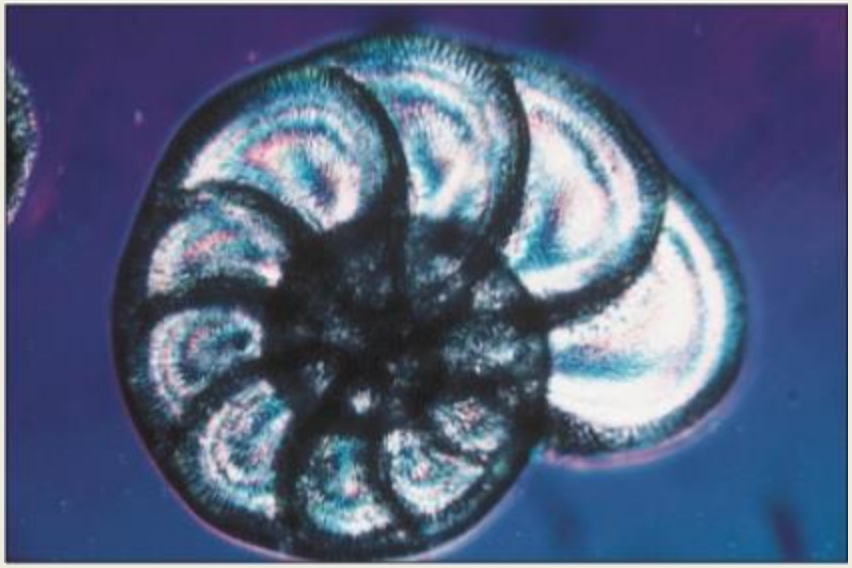


Fig (a) Foraminiferan Test (*Polystomella*)

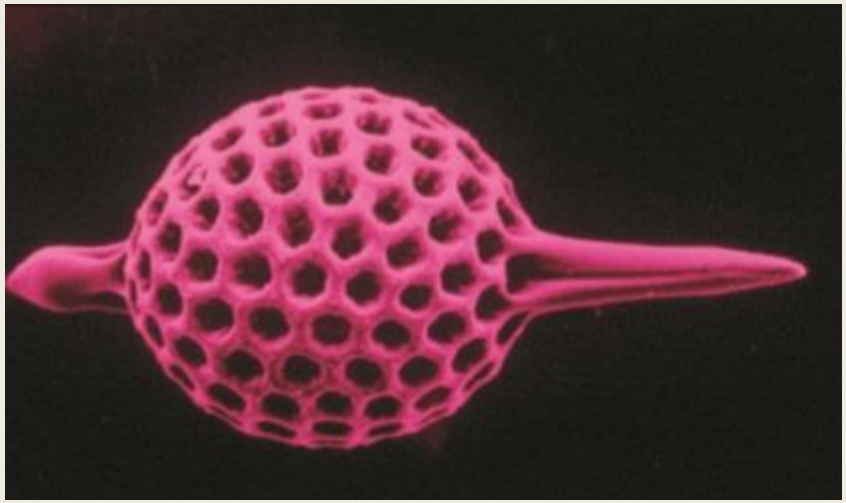


Fig (c) The radiolarian *Spaerostylus*

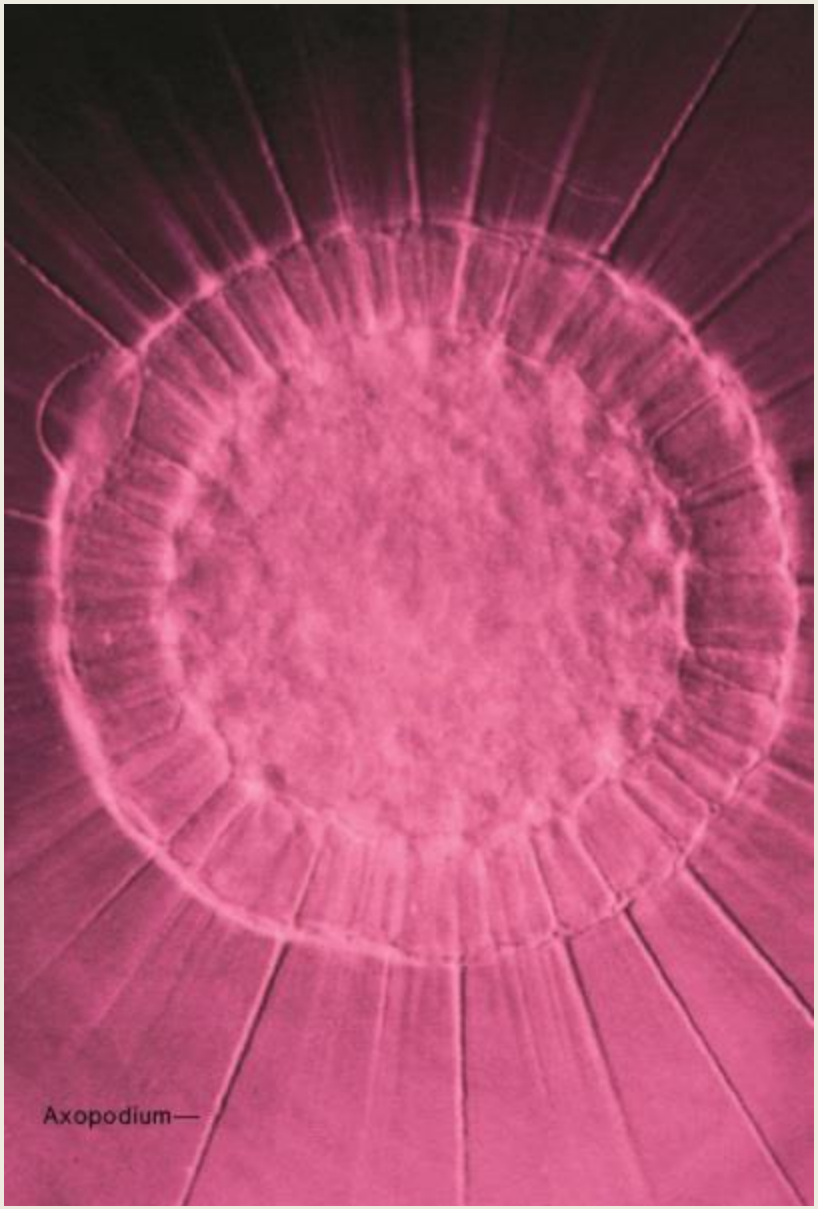


Fig (b) *Actinosphaerium sol*

PHYLUM LABYRINTHOMORPHA

- ✓ consists of protozoa with spindle-shaped, nonamoeboid, vegetative cells.
- ✓ In some genera, amoeboid cells use a typical gliding motion to move within a network of mucous tracks.
- ✓ Most members are marine, and either saprozoic or parasitic on algae or seagrass.
- ✓ Several years ago, **Labyrinthula** killed most of the **“eel grass”** on the Atlantic coast.

PHYLUM APICOMPLEXA

Members of the phylum Apicomplexa are all parasites.

Characteristics of the phylum include:

1. Apical complex for penetrating host cells

2. Single type of nucleus

3. No cilia and flagella, except in certain reproductive stages

4. Life cycles that typically include asexual (schizogony, sporogony) and sexual (gametogony) phases

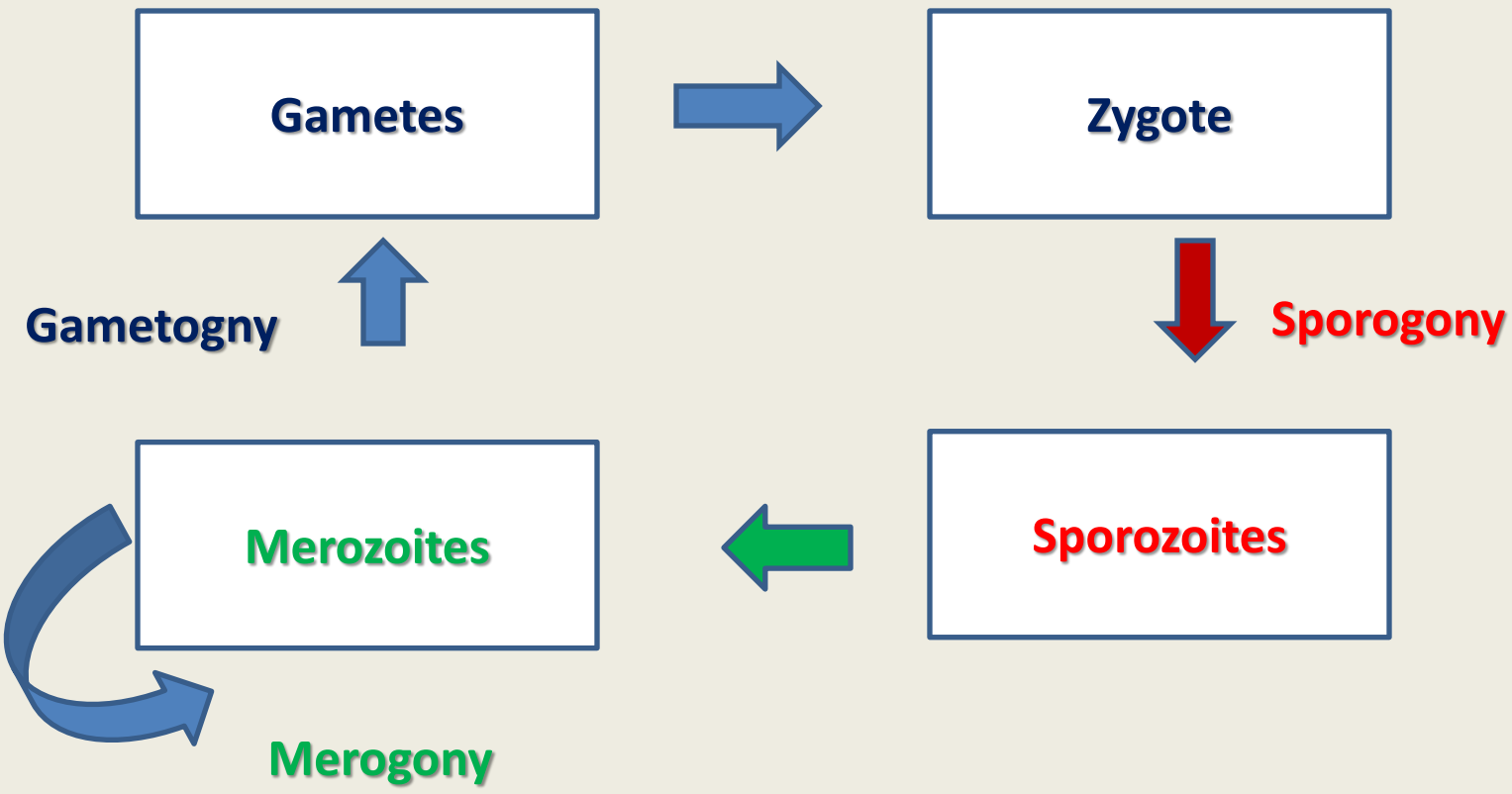
CLASS SPOROZOEA

- ✓ Class name derived from a resistant spore or oocyst.
- ✓ Mostly intracellular parasites.
- ✓ Cause a variety of diseases in domestic animals and humans.
- ✓ Involves sexual reproduction.

Type Examples:

- ✓ **Plasmodium**
- ✓ **Coccidian**
- ✓ **Cryptosporidium**
- ✓ **Toxoplasma**

Generalized Life Cycle Of Apicomplexans



Plasmodium

- Causes malaria in humans (*Anopheles* mosquito as vector)
- Possesses long history during crusades period.
- Life cycle involves vertebrates and mosquito as the hosts.
- The symptoms of malaria recur periodically and are called paroxysms.

Four species of Plasmodium are the most important human malarial species.

- P. vivax
- P. falciparum
- P. malariae
- P. ovale

Plasmodium life cycle

Schizogony (merogony) occurs in liver cells and, later, in the red blood cells (RBCs) of humans. Gametogony occurs in RBCs

During a blood meal, the mosquito takes in micro- and macrogametes, which fuse to form zygotes.

Zygotes penetrate the gut of the mosquito and form oocyst

Meiosis and sporogony form many haploid sporozoites that may enter a new host when the mosquito bites the host.

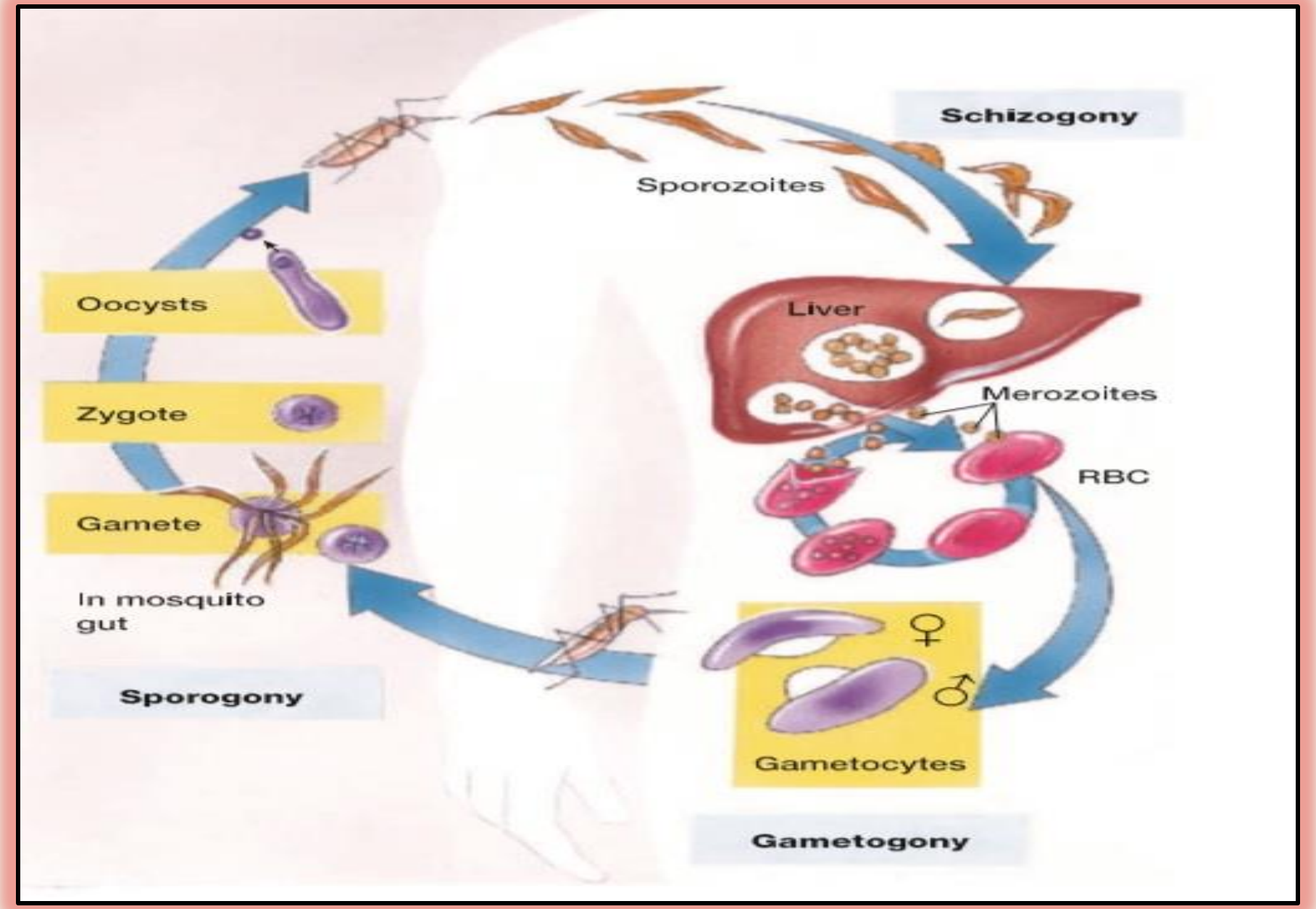


Fig: Phylum Apicomplexa: The Life Cycle of Plasmodium.

Coccideans

- ✓ Parasites in poultry, sheep, cattle and rabbits.
- ✓ Two genera; ***Isospora*** and ***Eimeria*** are particularly poultry parasites.
- ✓ US poultry suffered a loss of $35 million.
- ✓ **Cryptosporidium** cause chronic diarrhea in AIDS patients

Toxoplasma

- ✓ Causes disease in mammals.
- ✓ Sexual reproduction occurred in cats.
- ✓ Infections occur when oocysts are ingested from cats feces or poorly cooked meat.
- ✓ **Congenital toxoplasmosis**; major cause of stillbirths and spontaneous abortions.

Preventive measures:

- ✓ staying away from pet's sandboxes and don't eat poorly cooked pork.

PHYLUM MICROSPORA

- ✓ Small, obligatory intracellular parasites.
- ✓ Several species that parasitize beneficial insects.
- ✓ ***Nosema bombicus*** parasitizes silkworms, causing the disease **pebrine,** and ***N. apis*** causes serious dysentery (foul brood) in honeybees.
- ✓ These parasites have a possible role as biological control agents for insect pests.
- ✓ ***N. locustae*** has approved and registered for use in residual control of rangeland grasshoppers.
- ✓ Recently, four microsporidian genera have been implicated in secondary infections of immunosuppressed and AIDS patients.

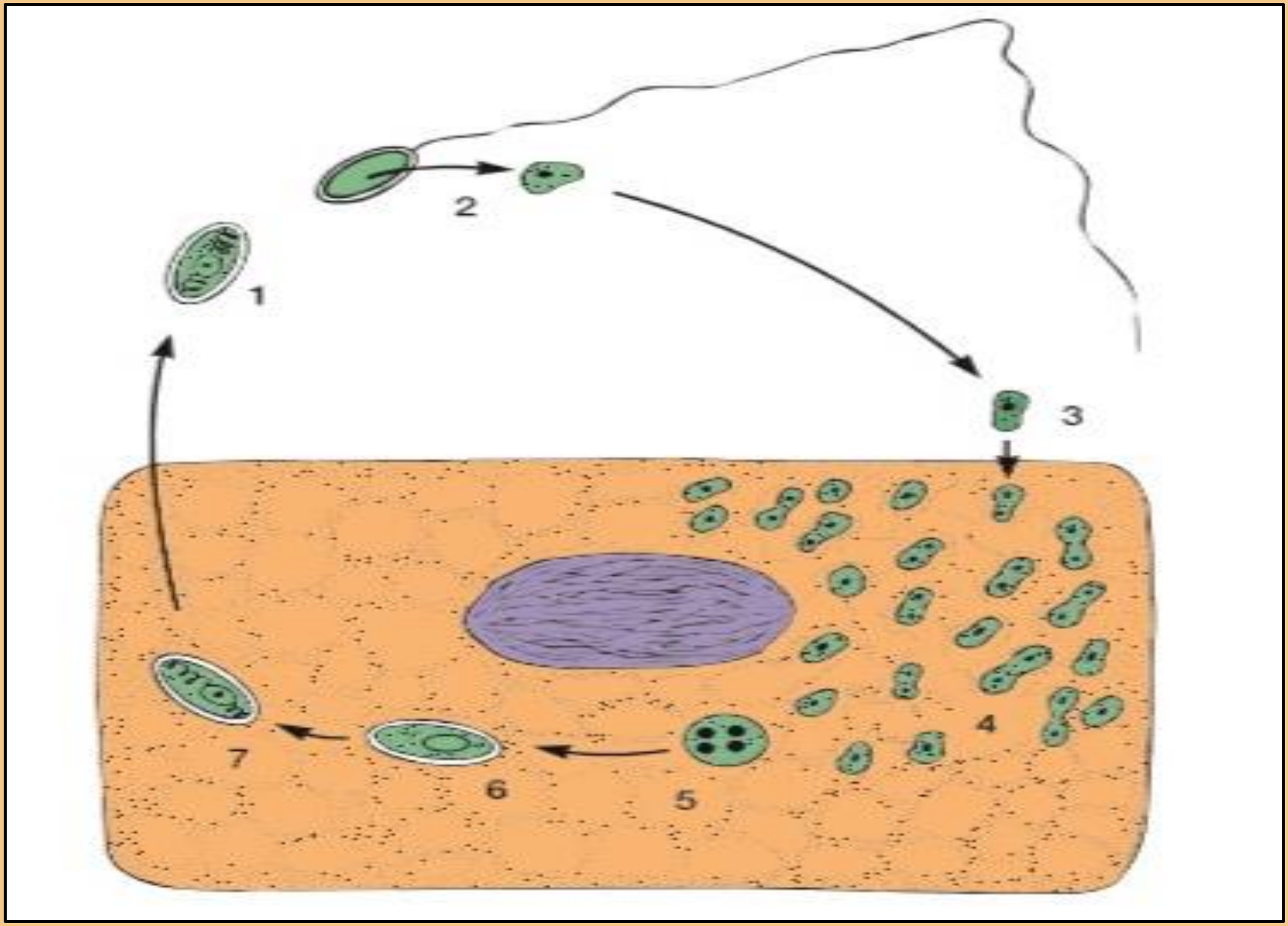


Fig: Phylum Microspora: The Microsporean *Nosema bombicus*, Which Is Fatal to Silkworms.

PHYLUM ACETOSPORA

Characteristics:

- ✓ Acetospora is a relatively small phylum
- ✓ obligatory extracellular parasites
- ✓ spores lacking polar caps or polar filaments.
- ✓ The acetosporeans (e.g., ***Haplosporidium***) primarily are parasitic in the cells, tissues, and body cavities of molluscs.

PHYLUM MYXOZOA

Characteristics:

- ✓ The phylum Myxozoa, commonly called myxosporeans
- ✓ All are obligatory extracellular parasites in freshwater and marine fish.
- ✓ They have a resistant spore with one to six coiled polar filaments.
- ✓ The most economically important myxosporean is ***Myxosoma cerebralis*****.**
- ✓ ***Myxosoma cerebralis*** infects the nervous system and auditory organs of trout and salmon, causing whirling or tumbling disease.

PHYLUM CILIOPHORA

Includes some of the most complex protozoa. Ciliates are widely distributed in freshwater and marine environments. A few ciliates are symbiotic.

CHARACTERISTICS:

- Cilia for locomotion and for the generation of feeding currents in water.
- Relatively **rigid pellicle** and more or less fixed shape.
- Distinct cytostome (mouth) structure.
- **Dimorphic nuclei**, typically a larger macronucleus and one or more smaller micronuclei.
- **Trichocysts** are pellicular structures primarily used for protection. They are rodlike or oval organelles oriented perpendicular to the plasma membrane.

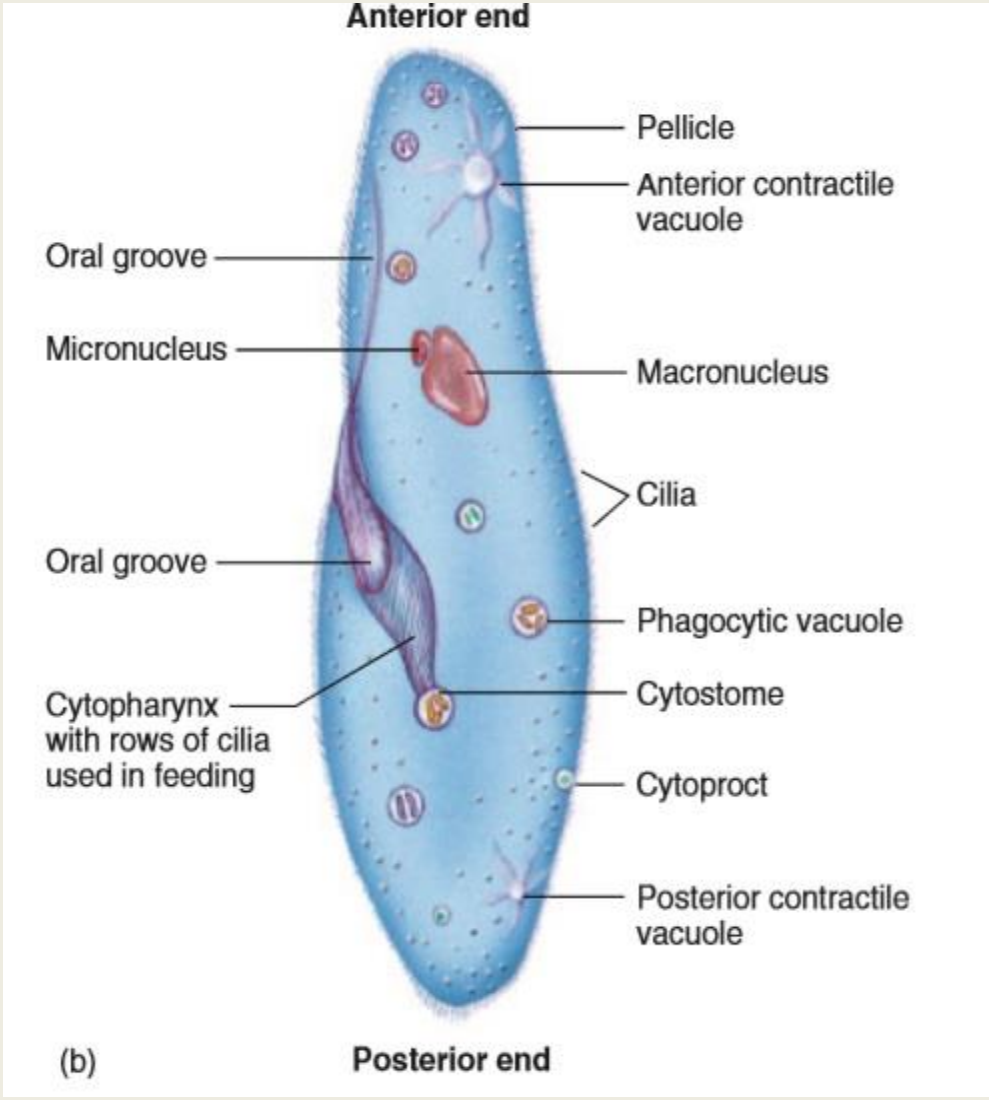


Fig: Phylum Ciliophora. (a) The ciliate, *Paramecium sonneborn*. This paramecium is 40 µm in length. Note the oral groove near the middle of the body that leads into the cytopharynx.
(b) The structure of a typical ciliate such as *Paramecium*

Locomotion

CILIA AND OTHER PELLICULAR STRUCTURES:

- ✓ Cilia are shorter, numerous, and widely distributed over the surface of the protozoan.
- ✓ Many ciliates can reverse the direction of ciliary beating and the direction of cell movement.
- ✓ **Basal bodies (kinetosomes)** of adjacent cilia are interconnected with an elaborate network of fibers that are believed to anchor the cilia and give shape to the organism.
- ✓ Some ciliates have evolved specialized cilia. Cilia may cover the outer surface of the protozoan.
- ✓ They may join to form **cirri**, which are used in movement.

Trichocysts

- ✓ Trichocysts are pellicular structures primarily used for protection.
- ✓ They are rodlike or oval organelles oriented perpendicular to the plasma membrane.
- ✓ In *Paramecium*, they have a “golf tee” appearance.
- ✓ The pellicle can discharge trichocysts, which then remain connected to the body by a sticky thread.

Fig: Discharged Trichocysts of *Paramecium*. Each trichocyst transforms itself into a long, sticky, proteinaceous thread when discharged.

NUTRITION

- Some ciliates, such as Paramecium, have a **ciliated oral groove** along one side of the body.
- Cilia of the oral groove sweep small food particles toward the cytopharynx, where **a food vacuole** forms.
- When the food vacuole reaches an upper size limit, it breaks free and circulates through the endoplasm.
- Some free-living ciliates prey upon other protists or small animals.
- **Suctorians** are ciliates that live attached to their substrate. They possess tentacles whose secretions paralyze prey, often ciliates or amoebae.

Fig: Suctorian (*Tokophrya spp*.) Feeding.

GENETIC CONTROL AND REPRODUCTION

Ciliates have two kinds of nuclei:

- A large, polyploid **macronucleus** regulates daily metabolic activities. It is not involve in reproduction.
- One or more smaller **micronuclei** are the genetic reserve of the cell. Involved in reproduction.

Asexual Reproduction:

- transverse binary fission
- budding.

Sexual Reproduction:

Conjugation

SYMBIOTIC CILIATES

- ✓ Most ciliates are **free living**; however, some are **commensalistic** or **mutualistic,** and a few are parasitic.
- ✓ ***Balantidium coli*** (parasitic ciliate) lives in the large intestines of humans, pigs, and other mammals.
- ✓ At times, it is a ciliary feeder; at other times, it produces proteolytic enzymes that digest host epithelium, causing a flask-shaped ulcer.
- ✓ *B. coli* is passed from one host to another in cysts that form as feces begin to dehydrate in the large intestine.

Conjugation in ciliates

- ✓ Bring mating types together.
- ✓ Meiosis.
- ✓ Four haploid pronuclei.
- ✓ Three degenerate.
- ✓ Mitosis & fusion of pronuclei.
- ✓ Conjugants separate.
- ✓ Nuclear division.
- ✓ Cytoplasmic division.

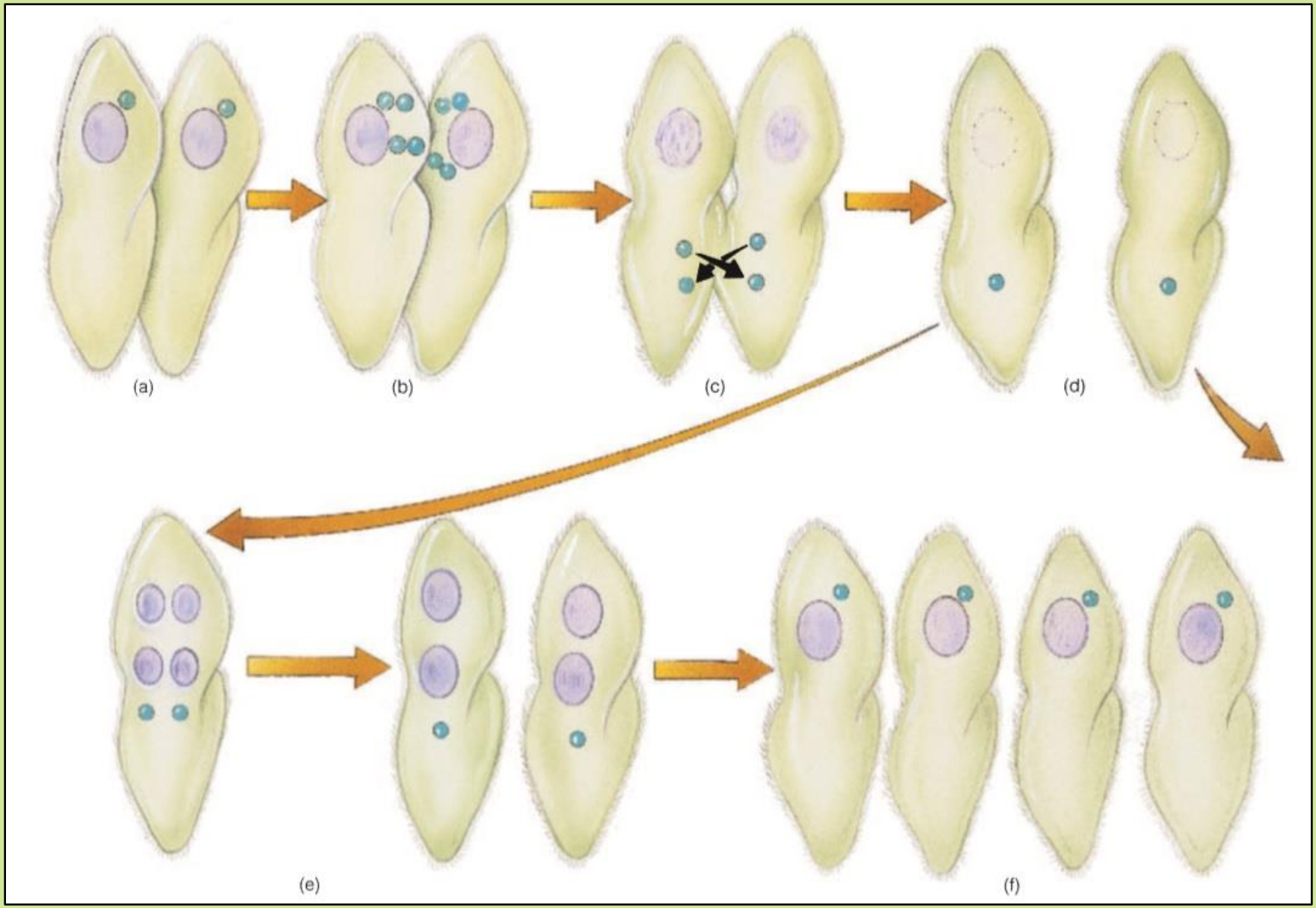


Fig: Conjugation in Paramecium