



# Phylum Apicomplexa

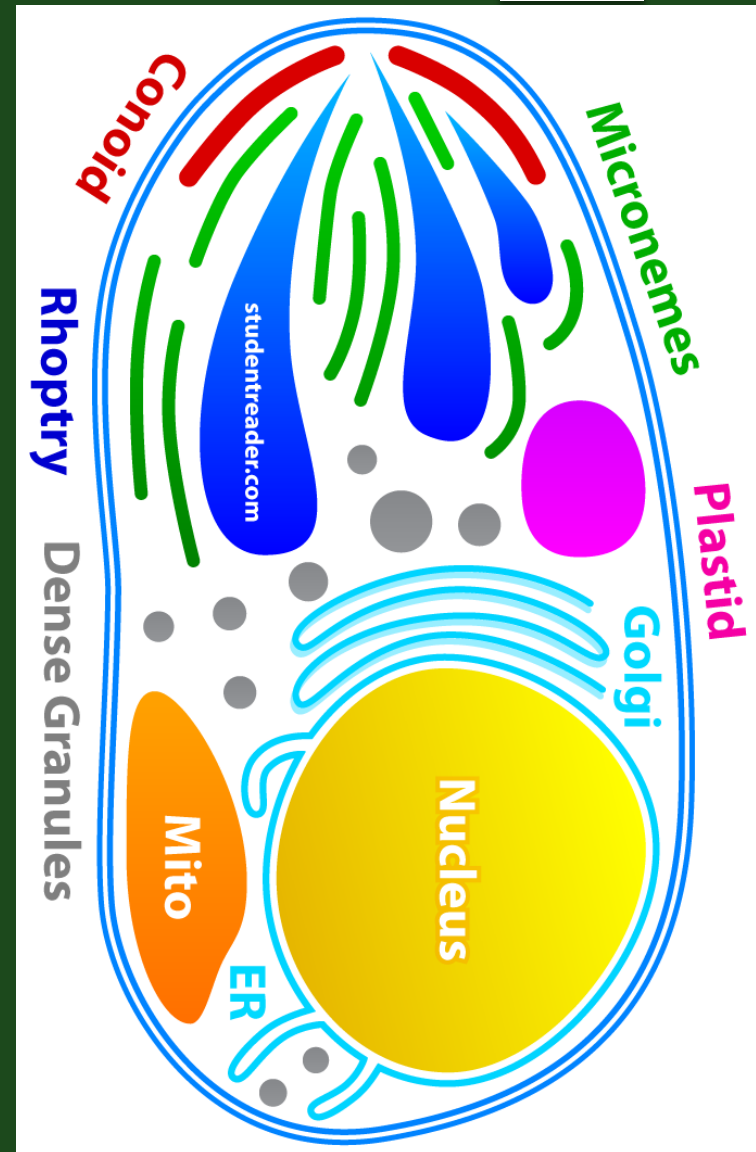
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# Apicomplexa

- Apical organelle
  - Consists of **polar ring** and **conoid**, **rhoptries** and **micronemes**
- Only microgametes have flagella
- Complex life cycle
  - Sporogony
  - Merogony
  - Gametogony
- Class Sporozoea
- Class Piroplasma



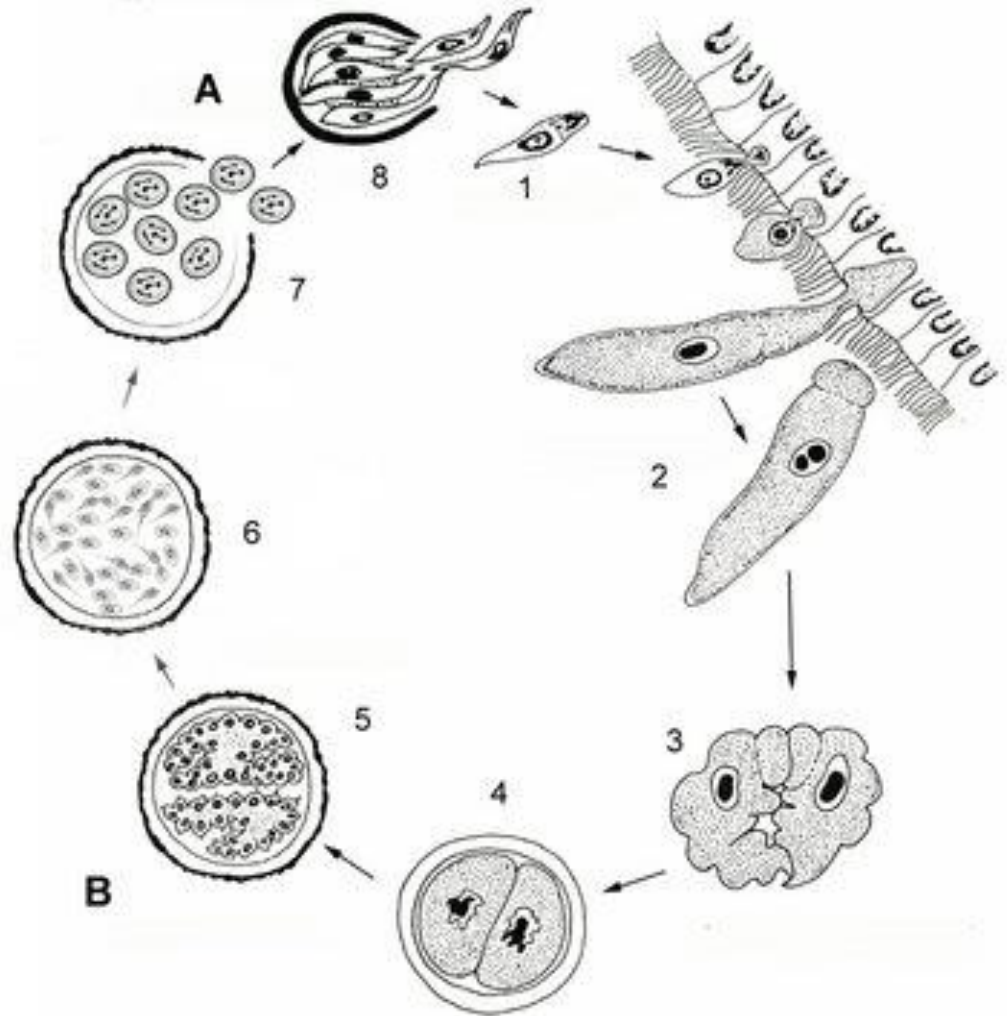
# Class Sporozoea

- ▶ All parasitic
- ▶ Reproduction is both sexual (gametes) and asexual (spores)
- ▶ Resistant spores or oocysts
- ▶ 2 Subclasses:
  - ▶ Gregarinians – large parasites of invertebrates
    - ▶ *Gregarina*, *Monocystis*
  - ▶ Coccidians – intracellular parasites
    - ▶ *Plasmodium*, *Toxoplasma*, *Cryptosporidium*, *Isospora*, *Sarcocystis*

# Subclass Gregarina

- ▶ *Gregarina*
  - ▶ Coelozoic parasite of orthopterans
  - ▶ Occur in digestive tract of cockroach, grasshoppers
  - ▶ protomerite, deutomerite, epimerite
  - ▶ Not medically important, but is significant for understanding sporozoan parasites of man, mammals and birds.
  - ▶ Life cycle

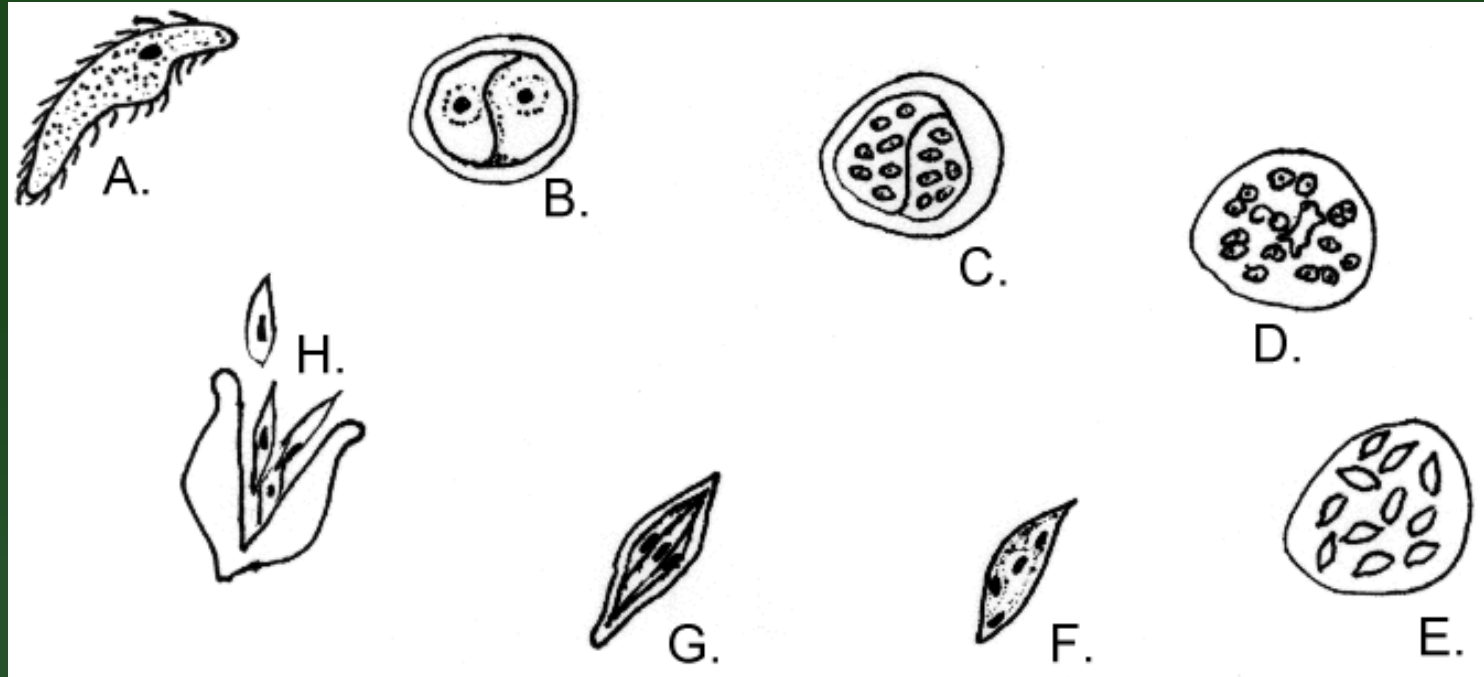
- 1 sporozoite
- 2 trophozoite
- 3 Sporont in syzygy
- 4 gametocytes in gametocyst
- 5 gametogony (multiple fission of gametocytes) = macro- & microgametes
- 6 zygote
- 7 oocysts
- 8 sporocyst rupture releasing sporozoites



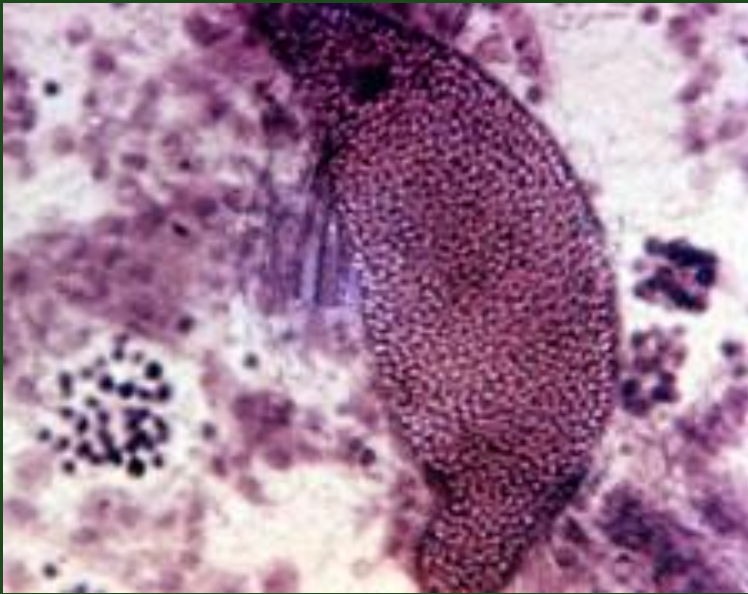
# Subclass Gregarina

- ▶ *Monocystis lumbrici*
  - ▶ Occurs in seminal vesicle of earthworm
  - ▶ Ingestion of mature spores containing sporozoites by the earthworm
  - ▶ Not medically important, but is significant for understanding sporozoan parasites of man, mammals and birds.
  - ▶ Life cycle

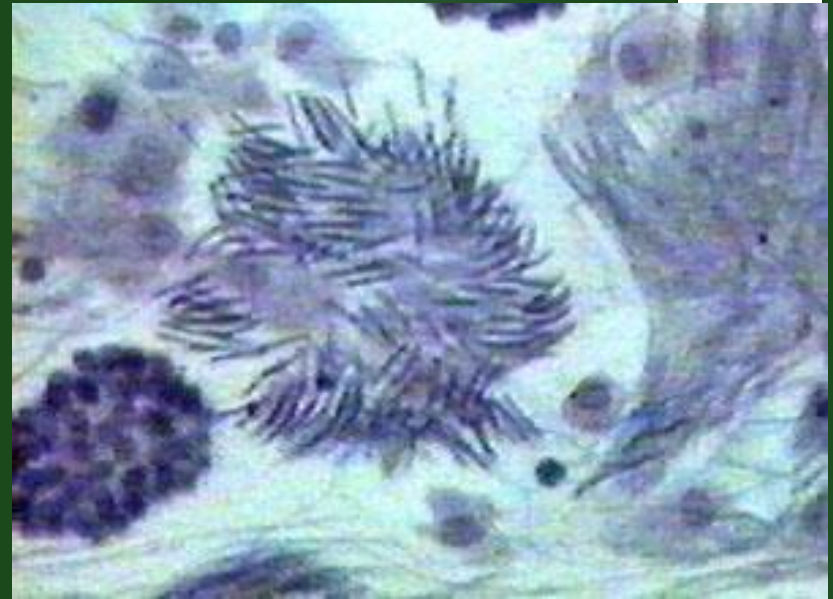
# *Monocystis* sp.: An earthworm parasite



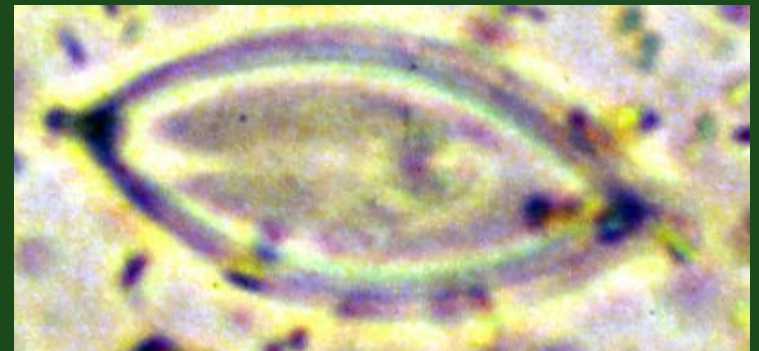
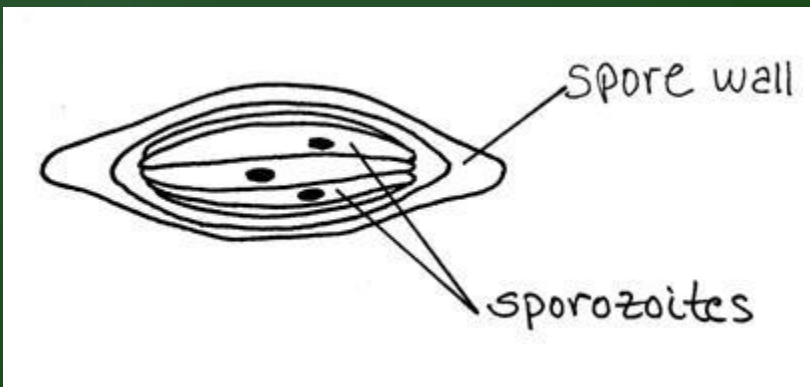
- A. Feeding **Trophozoite** with host sperm tails on outer surface
- B. Mating **gamont pair**
- C. Gamonts producing **gametes within gametocyst**
- D. Pairing of mating gametes to form **zygotes**
- E. Haploid **oocysts within gametocyst**
- F. Single **oocyst with developing sporozoites**
- G. Mature **oocyst with eight sporozoites**
- H. **Oocyst** shedding sporozoites



Trophozoite



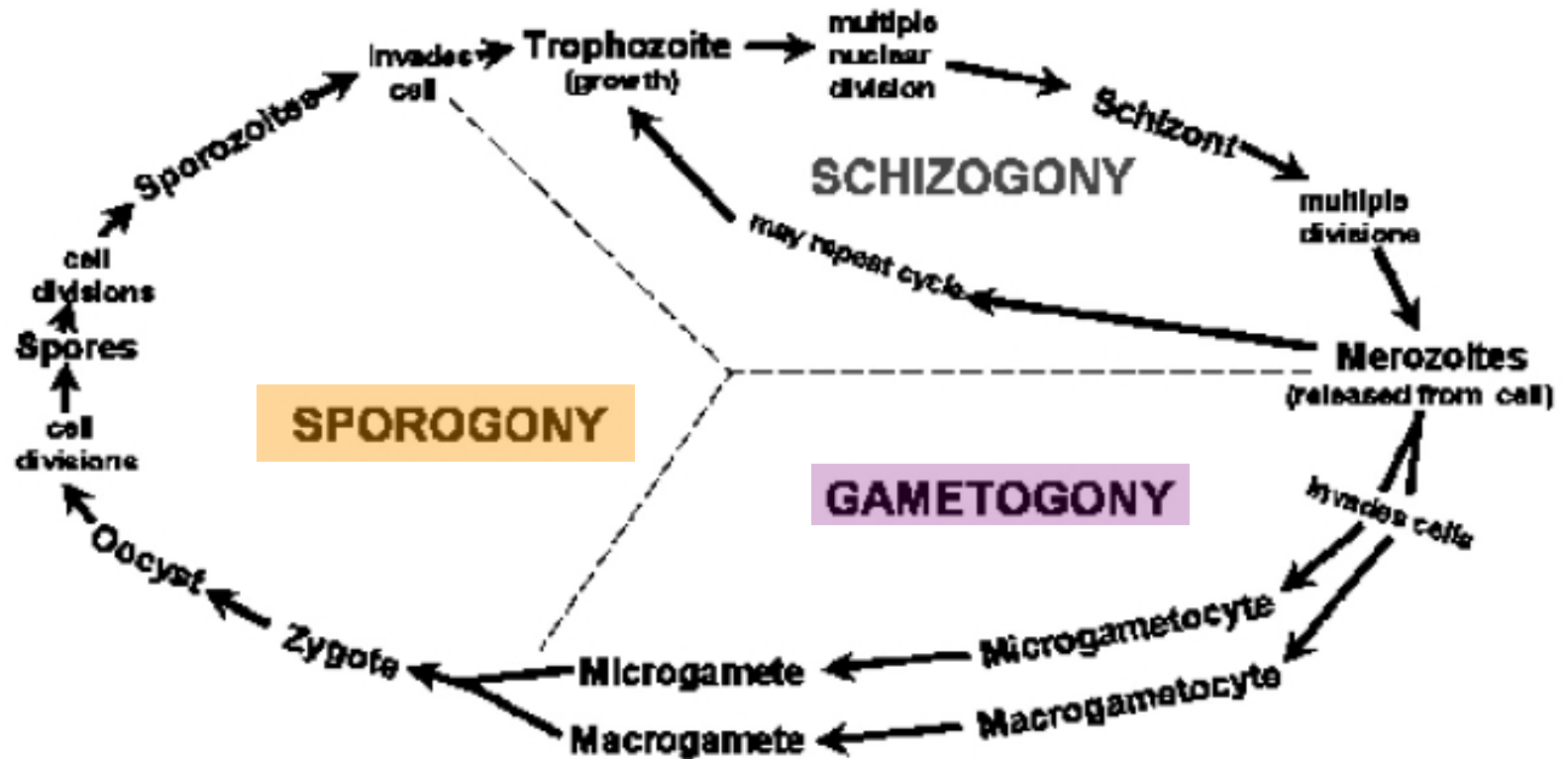
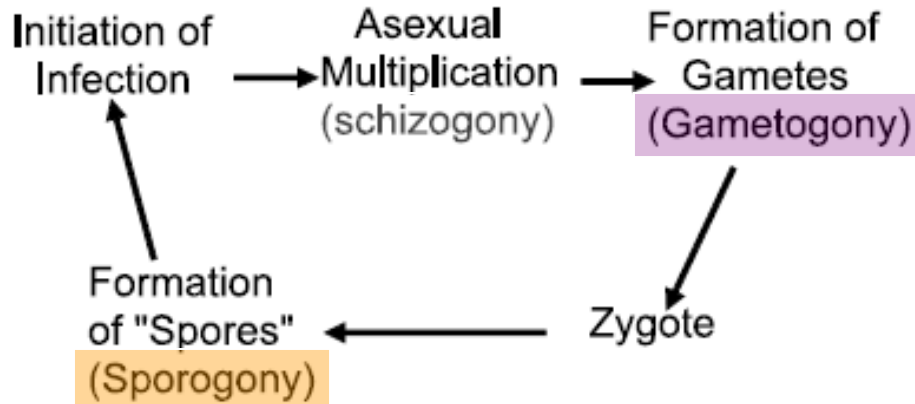
Trophozoite with adhered sperm tails; feeding on morula



Oocyst with sporozoites



# BASIC CYCLE OF SPOROZOANS



# Subclass Coccidia

- ▶ *Toxoplasma*

- ▶ Toxoplasmosis

- ▶ Cats as definitive host

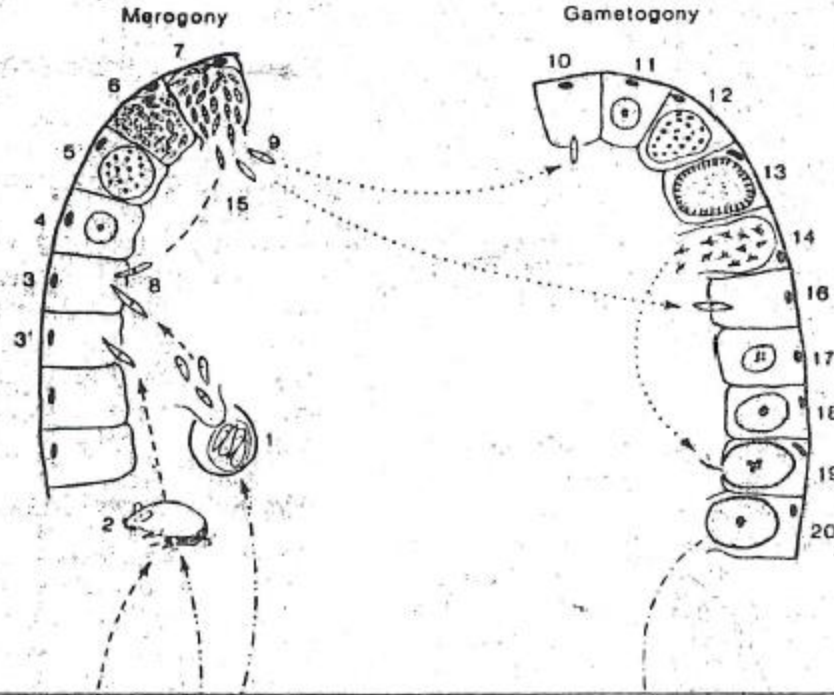
- ▶ Life cycle: 3 phases

- ▶ Merogony/Schizogony – multiple *asexual* reproduction inside host cell resulting into numerous daughter cells at once

- ▶ Gametogony – formation of *gametes* (microflagellates and macroflagellates)

- ▶ Sporogony – formation of zygote and multiple division or fission, producing *sporozoites*

**A. Intestinal epithelium in cat**



**B. Cat feces**



**C. Extraintestinal stages in tissues of various intermediate hosts**



*O/WO*

# *Toxoplasma gondii*

## ▶ Tachyzoites

- ▶ Acute infection → tissue invasion

## ▶ Bradyzoites

- ▶ Chronic infection → cyst formation in muscles, CNS

## • Diagnosis

- Trophozoite from smears of lymph nodes, bone marrow, spleen, liver, brain

## • Treatment

- Pyrimethamine
- Sulfonamides



# Subclass Coccidia

## ▶ *Plasmodium*

- ▶ Parasites of blood cells of vertebrates
- ▶ Parasites of bloodsucking Diptera
- ▶ *Anopheles* mosquito – definitive host
  - ▶ Usually bites at night: 10PM-2AM
- ▶ Man – intermediate host

## ▶ *Plasmodium falciparum*

## ▶ *Plasmodium vivax*

## ▶ *Plasmodium ovale*

## ▶ *Plasmodium malariae*

# Subclass Coccidia

- ▶ Life cycle:

- ▶ Merogony – liver (vertebrate host)

- Exoerythrocytic merogony in liver of man

- Erythrocytic merogony in RBC of man

- ▶ Gametogony –

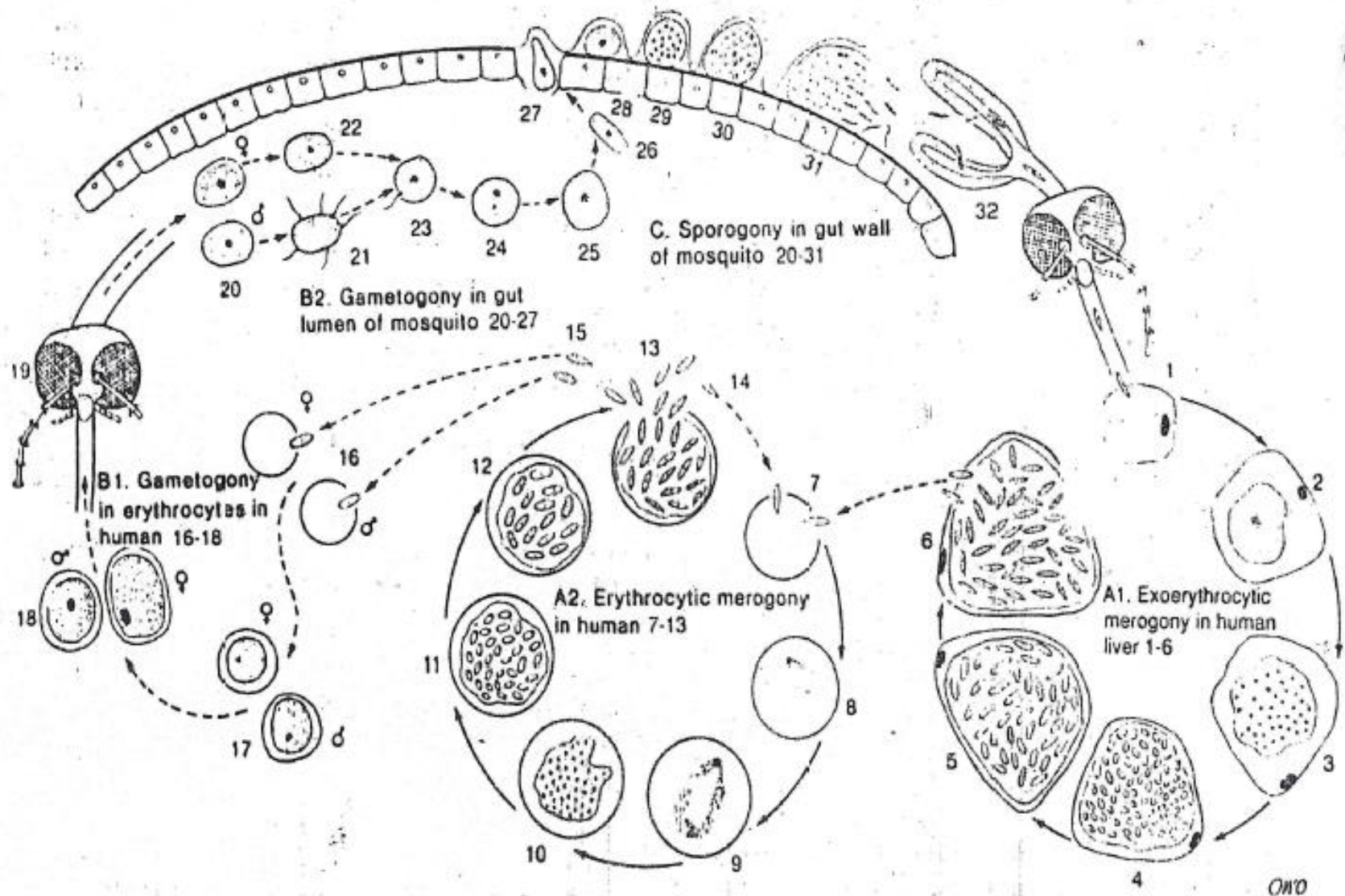
- ▶ 1<sup>st</sup> part: RBC of vertebrate host,

- ▶ 2<sup>nd</sup> part: alimentary canal of mosquito

- ▶ Sporogony – salivary gland of mosquito

# Plasmodium

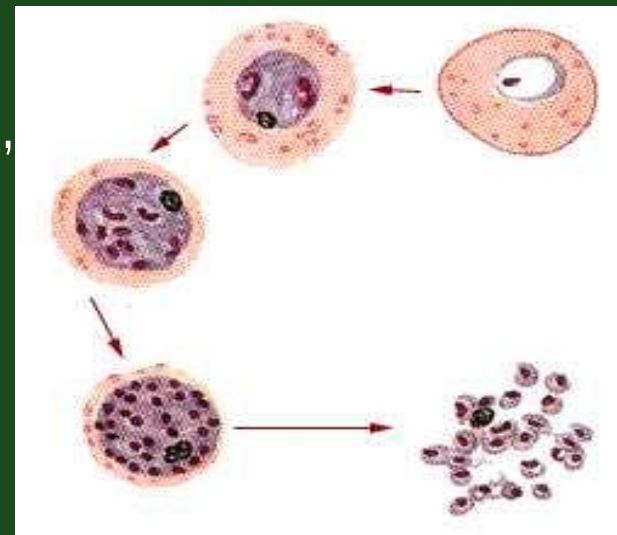
- ▶ Stages in Merogony
  - ▶ Trophozoite – ring stage
  - ▶ Meront
  - ▶ Segmenter
  - ▶ Merozoites
- ▶ Stages in Gametogony (man)
  - ▶ Microgametocyte
  - ▶ Macrogametocyte
- ▶ Stages in Gametogony (mosquito)
  - ▶ Macrogamete
  - ▶ Microgamete
- ▶ Stages in Sporooony (man)
  - ▶ Oocyst containing sporozoites





# Plasmodium: Merozoites

- ▶ Forms at an interval of 48hrs (tertian) or 72hrs (quartan) causing relapsing fever
- ▶ In RBC, usually vacuolated, ring-shaped, ameboid, uninucleated, called as **trophozoite** until the nucleus begins to divide
- ▶ Feed partially on hemoglobin leaving residues such as globin and iron porphyrin hemozoin
- ▶ RBC metabolism of *Plasmodium* species leads to morphologic alterations in RBC
  - ▶ *P. vivax*: enlarged RBC, Shuffner's dots
  - ▶ *P. ovale*: subspherical shapes, Shuffner's
  - ▶ *P. malariae*: Ziemann's dots
  - ▶ *P. falciparum*: Maurer's dots or clefts



# Plasmodium

## ▶ Malaria

- ▶ Periodic and sequential attacks of chills, fever and sweating
- ▶ Related to periodic release of merozoite after schizogony (RBC)
- ▶ Fever pattern:
  - ▶ *P. falciparum* – 36-48hrs, most virulent and fatal, malignant tertian
  - ▶ *Plasmodium vivax* – 48hrs, rarely fatal, benign tertian
  - ▶ *Plasmodium ovale* – 48 hrs, mild tertian
  - ▶ *Plasmodium malariae* – 72hrs, quartan malaria

# Plasmodium

- ▶ Diagnosis:
  - ▶ Thick and Thin Blood Smear
    - ▶ Used to measure the prevalence and incidence
    - ▶ Remain to be the gold standard
    - ▶ Peak or after peak
- ▶ Advance Diagnosis:
  - ▶ Rapid Diagnostic Tests
  - ▶ IFA
  - ▶ PCR

# Plasmodium

- ▶ Treatment
  - ▶ Chloroquine and sulfadoxine pyrimethamine - *P. falciparum*
  - ▶ Chloroquine – *P. vivax*
- ▶ Prevention
  - ▶ Chemoprophylaxis
    - ▶ Doxycycline

A. Young trophozoites  
or ring stages



B. Older trophozoites



C. Immature schizonts



D. Mature schizonts  
or segmenters



E. Microgametocytes



F. Macrogametocytes

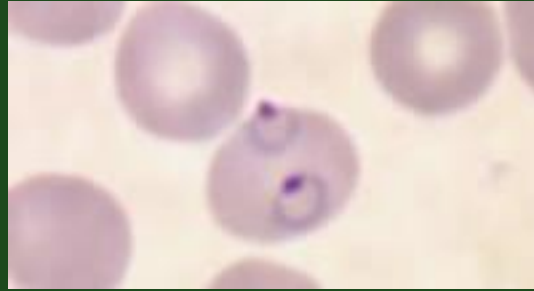


*Plasmodium  
vivax*

*Plasmodium  
malariae*

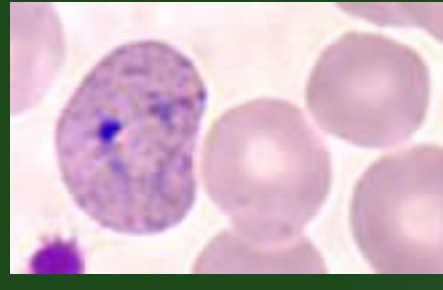
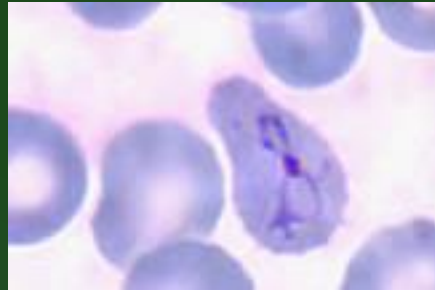
*Plasmodium  
falciparum*

*P. falciparum*  
Ring

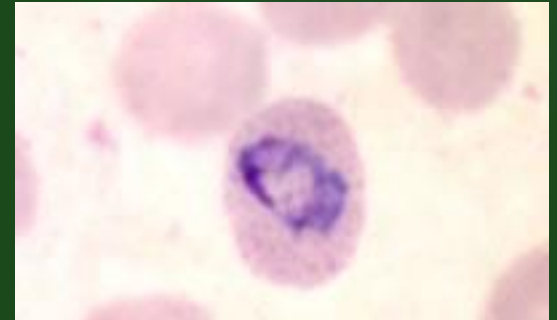


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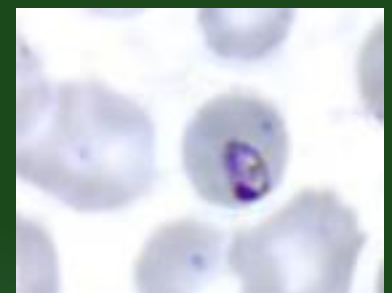
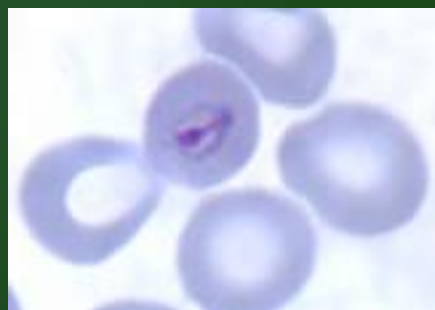
*P. vivax*  
Ring



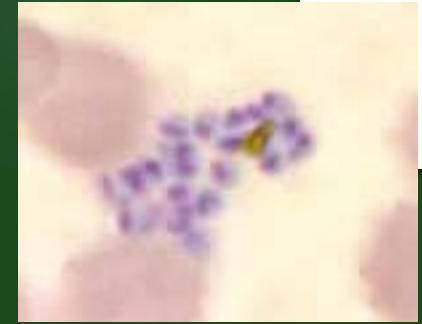
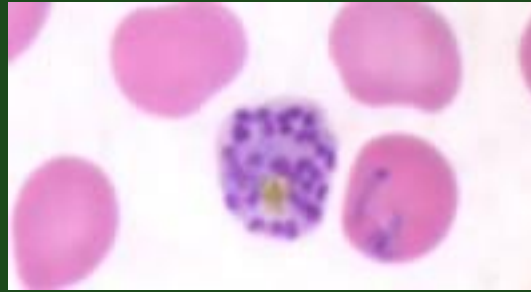
*P. ovale*  
Ring



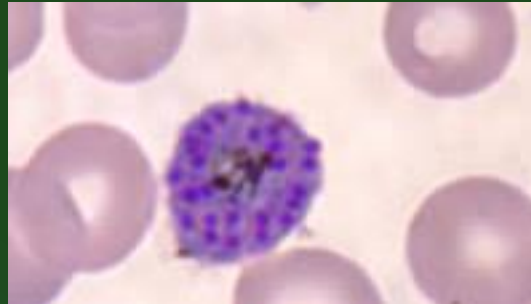
*P. malariae*  
ring



*P. falciparum*  
Schizont



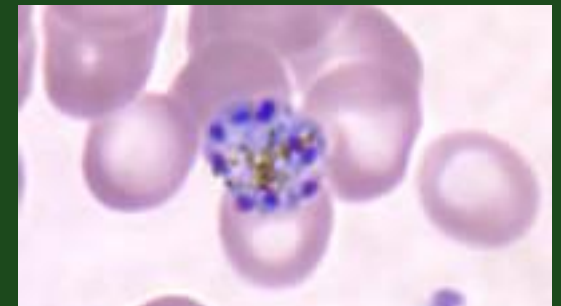
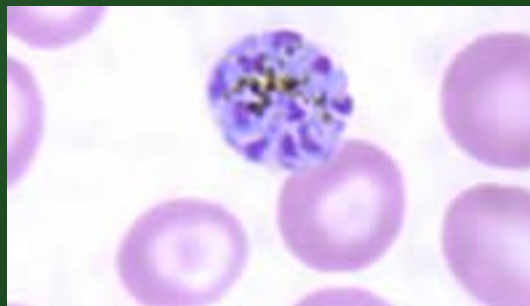
*P. vivax*  
schizont



*P. ovale*  
Schizont



*P. malariae*  
schizont



# CILIATE



## ▶ *Balantidium coli*

- ▶ Pathogenic in man, commensal in swine
- ▶ Invasion of the human intestine similar to that of *E. histolytica*
- ▶ clinical manifestations if present include persistent diarrhea, occasional dysentery, abdominal pain, and weight loss
- ▶ Treatment: Metronidazole

