BIOLOGY

Biology: The science which studies life.

Branches of biology:

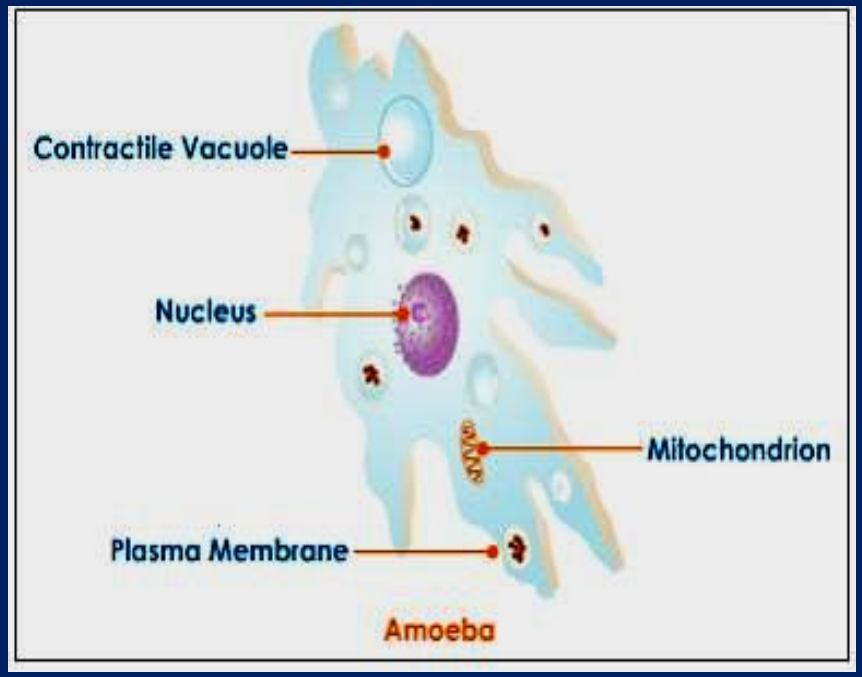
1- Macro-biology:
Science which deals or studies all macro-organisms which can be seen by naked eyes (multicellular organisms).These sciences are.

- **A -Zoology: Science which studies the animals.**
- **B -Botany: Science which studies the plants.**

2- Micro-biology: Science which deals with or studies all micro-organism which can not be seen by naked eyes (All unicellular micro-organisms).

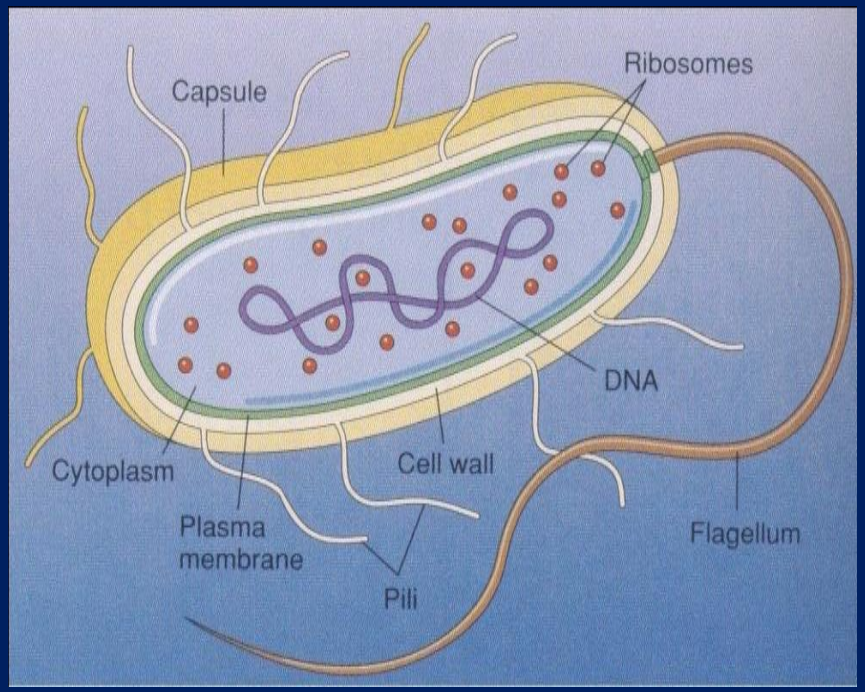
A-Eukaryotic

A-Eukaryotic with true nucleus and true organelles like Amoeba such as fungi and protists and parasites.



B-Prokaryotic cells

B-Prokaryotic without true nucleus and true organelles like bacterium



Differences between Pro and Eu karyotic cells

Characteristic	Prokaryotic	Eukaryotic
		
Size of cell	Typically 0.2–2.0 μm in diameter	Typically 10–100 μm in diameter
Nucleus	No nuclear membrane or nucleoli	True nucleus, consisting of nuclear membrane and nucleoli
Membrane-enclosed organelles	Absent	Present; examples include lysosomes, Golgi complex, endoplasmic reticulum, mitochondria, and chloroplasts
Flagella	Consist of two protein building blocks	Complex; consist of multiple microtubules
Glycocalyx	Present as a capsule or slime layer	Present in some cells that lack a cell wall
Cell wall	Usually present; chemically complex (typical bacterial cell wall includes peptidoglycan)	When present, chemically simple
Plasma membrane	No carbohydrates and generally lacks sterols	Sterols and carbohydrates that serve as receptors present
Cytoplasm	No cytoskeleton or cytoplasmic streaming	Cytoskeleton; cytoplasmic streaming
Ribosomes	Smaller size (70S)	Larger size (80S); smaller size (70S) in organelles
Chromosome (DNA)	Single circular chromosome; lacks histones	Multiple linear chromosomes with histones arrangement
Cell division	Binary fission	Mitosis
Sexual reproduction	No meiosis; transfer of DNA fragments only	Involves meiosis

Medical Parasitology
Introduction

- **Medical Parasitology:**
  It is the science which deals with organism or parasites which cause human infection and their host, life cycle, and relationship between them.

- **Medical Parasites:**
  Are organisms that infect human to ensure feeding and shelter by living on or within human body.

- **Pathogens:**
  Are any organism(Bacteria, parasite, fungus, virus) causing a disease and clinical adverse effects.

- **Pathology: It is science which studies disease.**

- **Pathogenesis: The development of a disease and the chain of events leading to that disease**

- **Pathogenicity: Capability of causing disease or producing disease**

Type of parasites

According to types of living:

- **Obligatory parasite: it is a parasite which must lives in the host, can not be exists in free living.**
- **Facultative parasite: it is a parasite which can lives in the host and as free living.**

According to the place of living :

- **Endoparasite: Parasite which lives inside the body of the host, ex. *Entamoeba histolytica***
- **Ectoparasite: Parasite which lives on the external surface of the body of host, ex. lice, flea.**

According to the pathogenicity

- **Pathogenic parasite:** parasites causing disease with tissue damage and clear clinical symptoms or without symptoms. i.e. (Asymptomatic) .

  $. Pathogenic stage of any parasite: is stage which is capable of causing disease.

  $. Diagnostic stage :is the stage by which we can diagnosis the disease or the infection or the parasite.

  $. Infective stage: is specific stage in the parasite life cycle which initiate an infection in the definitive or I.Host.

- **Non-pathogenic parasity:** It is harmless parasite not causing disease or tissue damage.(Commensalism in living).

3- Opportunistic Parasite:

is an parasite particularly those that take advantage of certain situations, they do not cause a disease in a healthy host which with a healthy immune system. A compromised immune system however, provides an "opportunity" for the pathogens to cause diseases like:

1- Tumor or malignancy.

2- HIV.

3- Using immunosuppression drugs.

4- Pregnancy.

Life cycle

Life cycle:

It is the developmental stages which parasite pass through to multiply and reproduce and increase in numbers. This may be direct life cycle (without intermediate host or vector). indirect life cycle (needed intermediate hosts or vector)

Routes and modes of infections:

1- Orally: Most prominent route, the infective stage of the parasite enters the host orally with contaminated food and water.

2- Respiratory system: Eggs of some helminthes like pin-worm may enter through inhalation the air carried the eggs.

3- Skin: Infective stage of parasites penetrated directly by the parasite itself (ex. *Schist soma* cercaria) or inoculated by vector (ex. *Plasmodium*, *Leishmania* spp.)

4- Placentally: **from the mother to infant through the placenta ;ex:T*oxoplasma* spp.**

5- Blood transfusion: **ex. *Trypanosoma* spp.**

6- Sexually: **by sexual contacted : *Trichomonas vaginalis.***

7- Transplantation: **(organ donor for liver , heart, spleen..etc.).**

Types of the hosts:

Host: It is an organism which harbors or nourishes parasites organism to ensure for its food and shelter.

1-Definitive host(Final H.): It is a host that harbors the mature parasites or sexual stage of the parasite.

2- Intermediate host: A host carries **immature (larval stage)** or **asexual stages** of the parasite.

3-Reservoir host: Host that **store** the parasite **(usually animals)**

4-Accidental host: Host infected with the parasite **accidentally** (not its normal or natural host).

5-Vector host: It is a host **(usually insect)** that transmits the parasite either biologically or mechanically.

Types of parasites transmission by vector

1-Biological transmission:

In this type, parasite transmitted biologically with biological division and multiplication inside the host.

2-Mechanically transmission :

In this type, parasite transmitted by external parts of the vector (Wings, legs…..etc.) without parasite division.

Relationships between parasites and host

It is the permanent relationship between two dissimilar organisms which depending each others. They are three types

1- Parasitism :

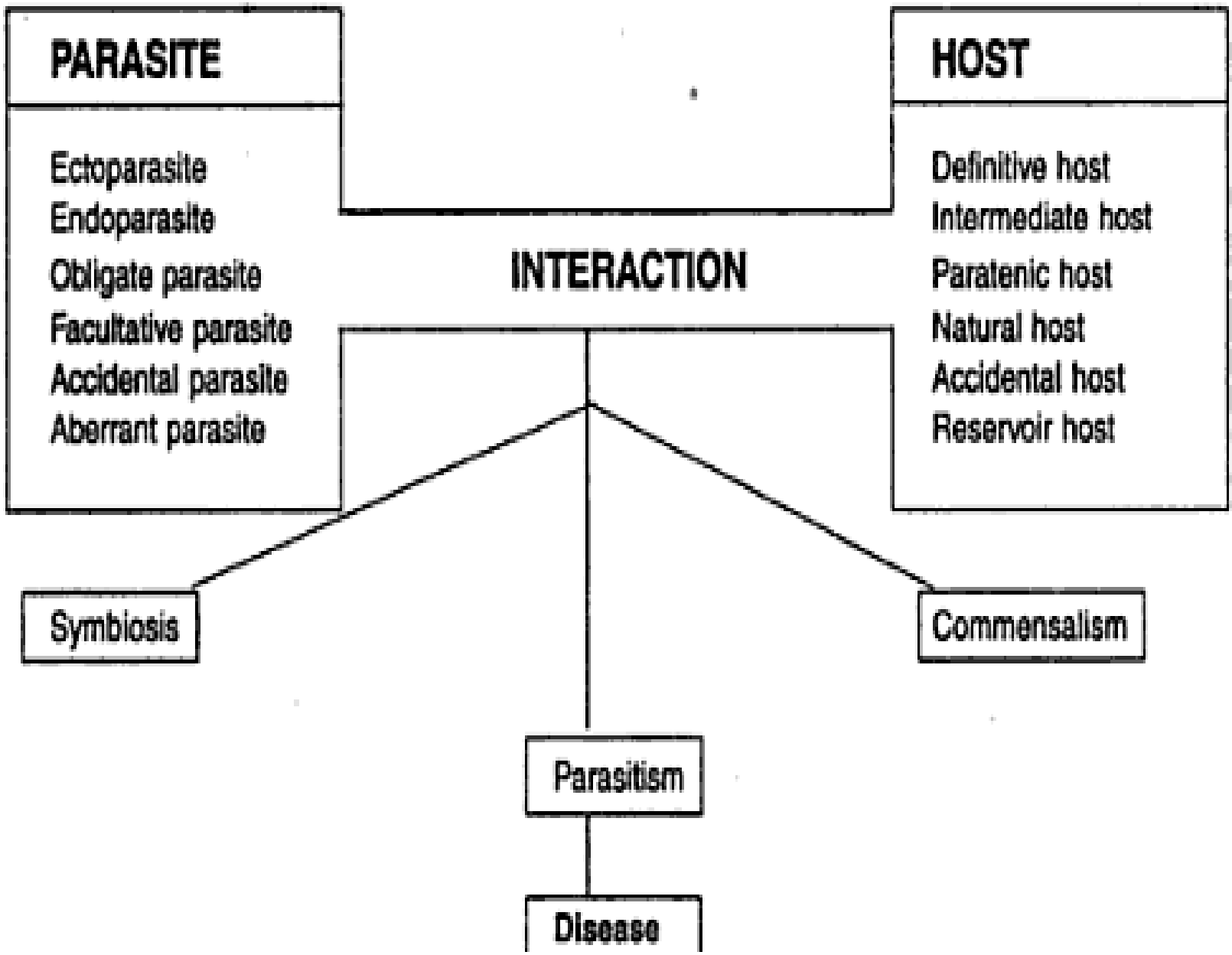
It is a relationship between two different organisms; one called the parasite which depend on the other which is called the host. This relationship may be harmful for the host.

2-Commensalism:

It is the relationship in which one organism gets benefit Without causing any injury to the host.

3-Mutualism:

both organisms mutually got benefits.


PARASITE
Ectoparasite
Endoparasite
Obligate parasite
Facultative parasite
Accidental parasite
Aberrant parasite
HOST
Definitive host
Intermediate host
Paratenic host
Natural host
Accidental host
Reservoir host
INTERACTION
Symbiosis
Commensalism
Parasitism
Disease

Epidemiology

It is the science which deals with factors that affecting the prevalence of the parasite.

These factors are:-

1- Source of infection.
2- Mode of infection
3- Suceptibility of the host.

Prevalence: It is the number of infected individual at given time in given area

Incidence: It is the rate of frequency which disease or new disease occurred .

Endemic and Epidemic diseases

- **Endemic:** Common diseases that occur at a constant (steady state) but relatively low rate in the population to be endemic.

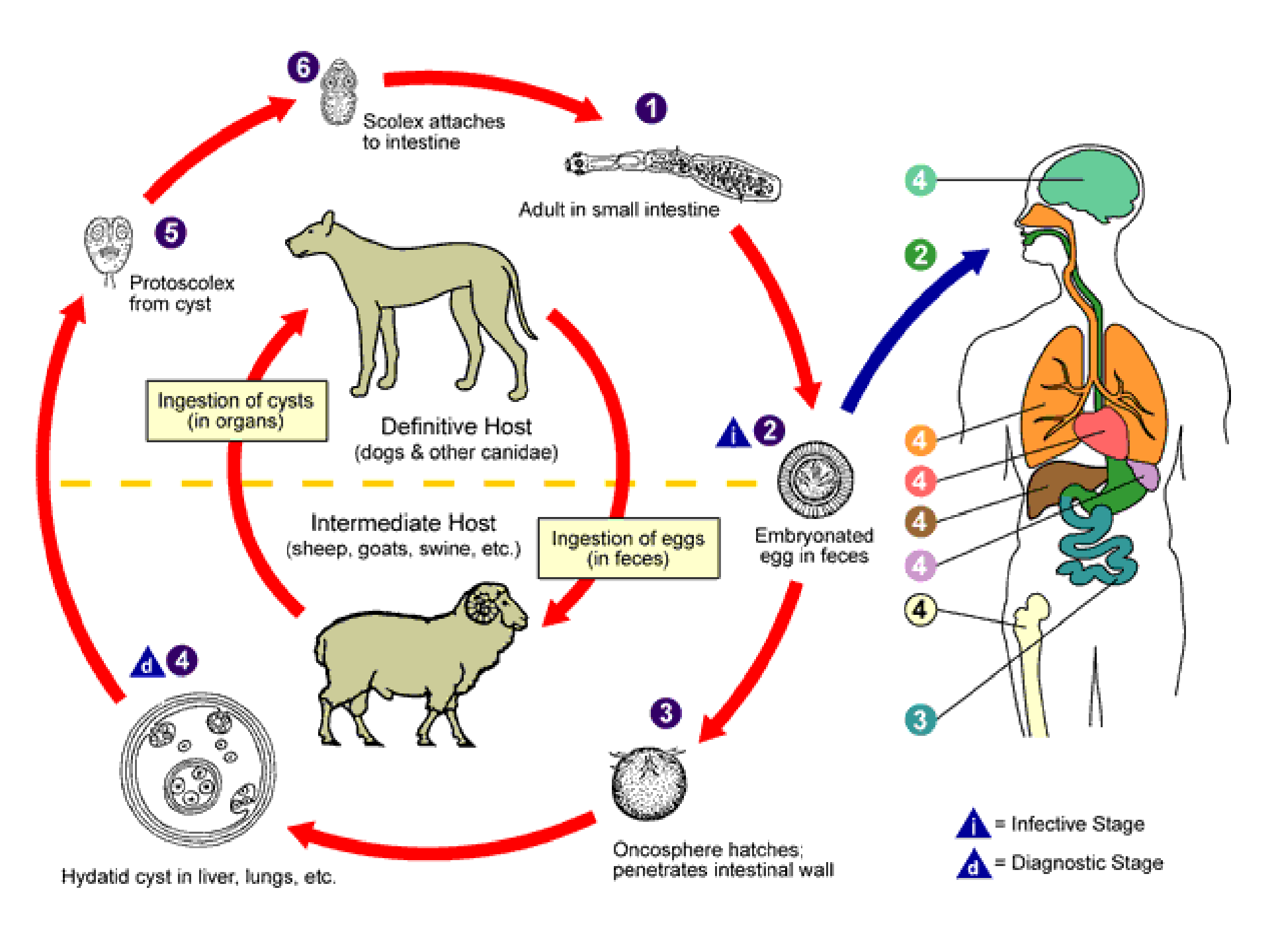
- **Epidemic:** It is an outbreak of a disease that involves a large number of people in a contained area (e.g., village, city, country). An epidemic that is worldwide in scope is referred to as a pandemic

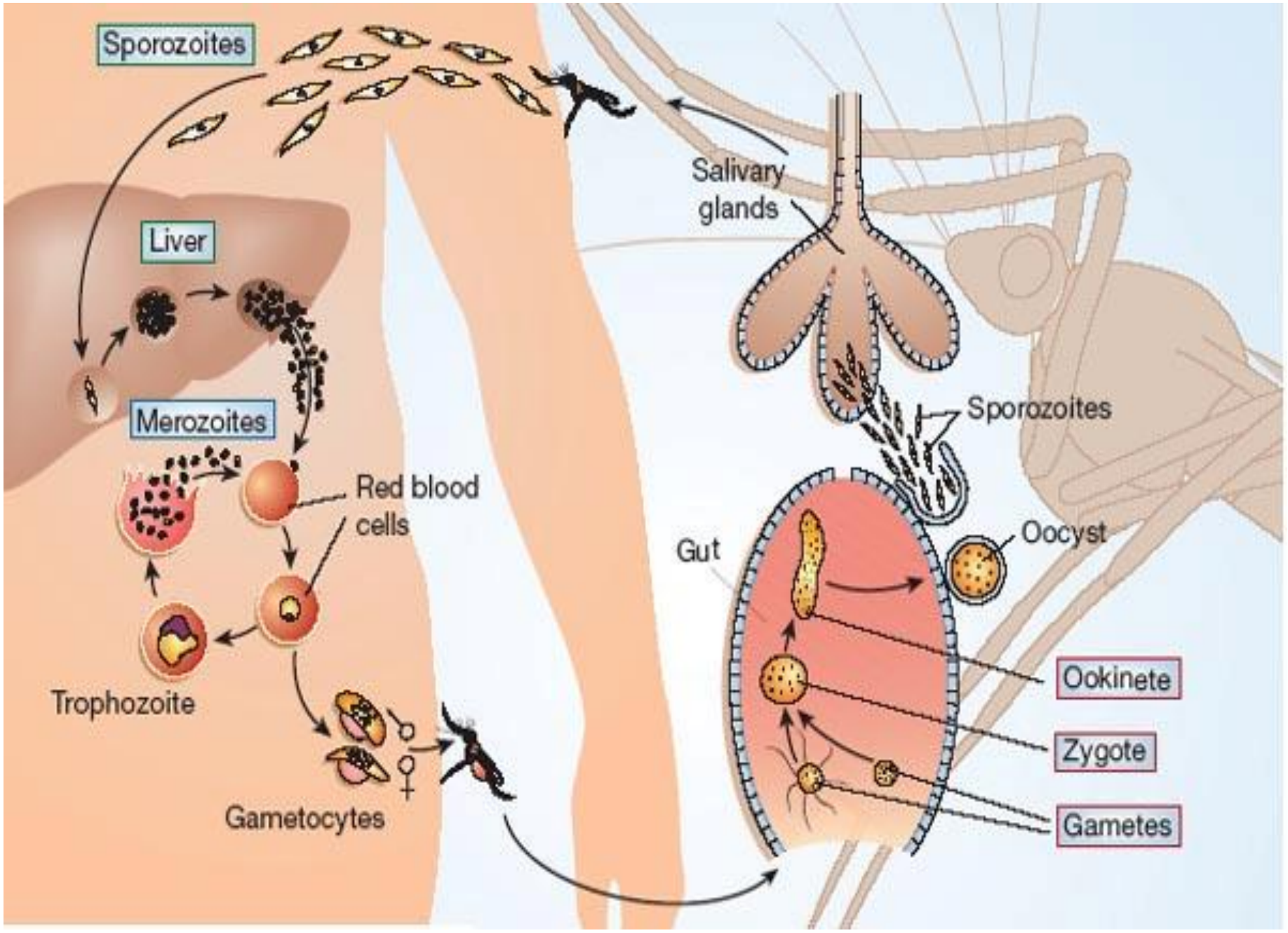
Pandemic and Sporadic Disease

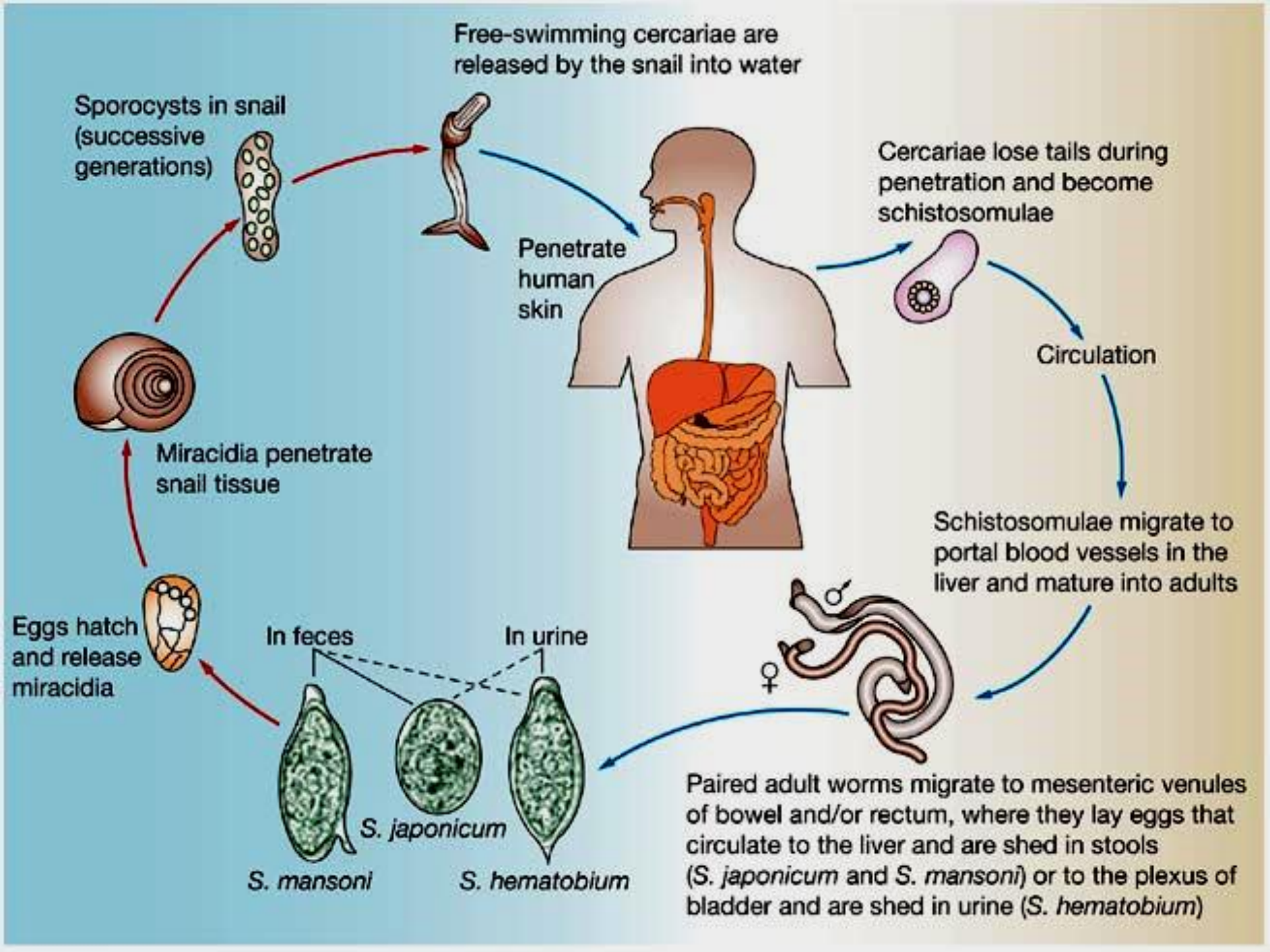
- **Pandemic:** It is an **Epidemic** of **infectious diseases** that is spreading through human populations across a large region; for instance a continents ‹or even worldwide.

- **Sporadic** (i.e. scattered occurring singly; irregularly, widely scattered; not epidemic or endemic.

Zoonosis: Infectious disease transmitted from animal to the human.


6
Scolex attaches to intestine
1
Adult in small intestine
5
Protoscolex from cyst
Ingestion of cysts (in organs)
Definitive Host
(dogs & other canidae)
i 2
Embryonated egg in feces
Intermediate Host
(sheep, goats, swine, etc.)
Ingestion of eggs (in feces)
d 4
Hydatid cyst in liver, lungs, etc.
3
Oncosphere hatches; penetrates intestinal wall
4
2
4
4
4
4
4
3
i = Infective Stage
d = Diagnostic Stage


Sporozoites
Liver
Merozoites
Red blood cells
Trophozoite
Gametocytes
Salivary glands
Sporozoites
Oocyst
Gut
Ookinete
Zygote
Gametes


Free-swimming cercariae are released by the snail into water
Sporocysts in snail (successive generations)
Penetrate human skin
Cercariae lose tails during penetration and become schistosomulae
Circulation
Schistosomulae migrate to portal blood vessels in the liver and mature into adults
Paired adult worms migrate to mesenteric venules of bowel and/or rectum, where they lay eggs that circulate to the liver and are shed in stools (S. japonicum and S. mansoni) or to the plexus of bladder and are shed in urine (S. hematobium)
In feces
In urine
S. mansoni
S. japonicum
S. hematobium
Eggs hatch and release miracidia
Miracidia penetrate snail tissue