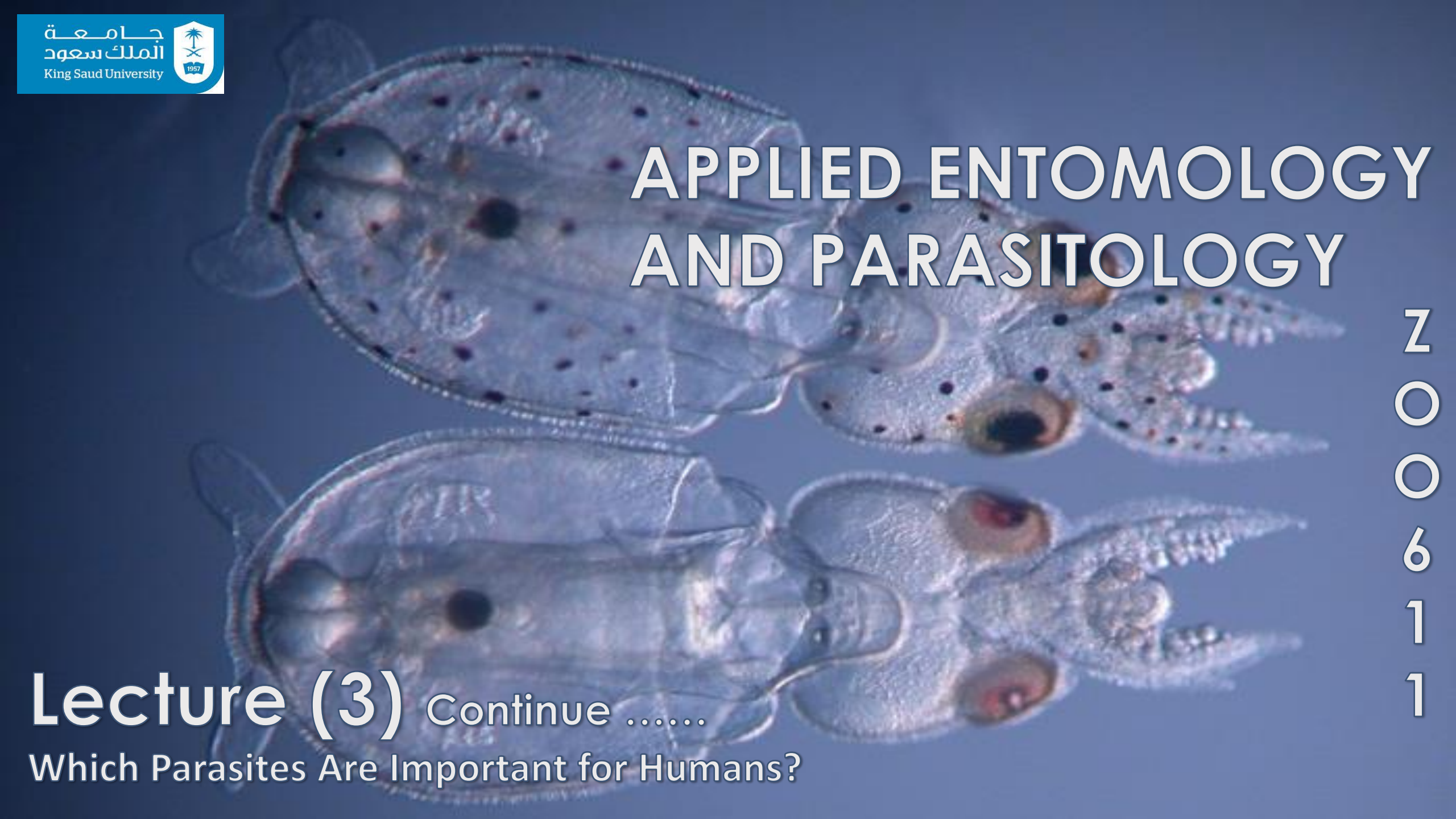


# APPLIED ENTOMOLOGY AND PARASITOLOGY

ZOO611

## Lecture (3) Continue ……

### Which Parasites Are Important for Humans?

# *Leishmania* species (Agents of the Skin, Mucosa and American Leishmaniasis)

There are 3 species of *Leishmania* found in humans that transmitted via bites of sandflies:

## *Leishmania donovani*

…It causes **visceral leishmaniasis or Kalaazar Disease.**

…Visceral leishmaniasis affects the visceral organs, most notably the liver, spleen and bone marrow.

## *Leishmania tropica*

It causes **cutaneous leishmaniasis** or **oriental sore disease**


## *Leishmania braziliensis*

…It causes **mucocutaneous leishmaniasis dsiease**

**Incubation period:** 2–4 weeks, in rare cases up to 1 year.

**Patency:** Many months

# Therapy.

A systemic therapy is not justified in cases of simple cutaneous leishmaniasis because of the tendency of self-healing and the potential toxicity of the drugs.

If necessary, only repeated perilesional injections with 1–3 ml (100–300 mg) sodium stibogluconate as well as treatment of secondary bacterial infections should be done.

A systematic therapy, however, is strongly recommended in cases of mucocutaneous leishmaniasis; diffuse cutaneous, disseminated or deforming cutaneous leishmaniasis; and visceral leishmaniasis

| Drug | Mode of action on the parasite | Route and main indication |
|---|---|---|
| Pentavalent antimonials<br>– Sodium stibogluconate<br>– Meglumine antimon | Inhibition of glycolysis and fatty acid oxidation<br>Dose dependent inhibition of ATP and GTP formation | im/iv: VL, CL, MCL, PKDL<br>intralesional: CL |
| Pentamidine isethionate | Inhibition of polyamine biosynthesis and disruption of mitochondrial membrane potential | im: CL, MCL<br>Intralesional: CL |
| Amphotericin B and lipid formulations | Inhibition of cell membrane synthesis by binding to ergosterol<br>Pore formation in cell membrane | iv: VL, CL, MCL, PKDL |
| Paromomycin | Possible interference with RNA synthesis and membrane permeability | im: VL<br>Topical: CL |
| Allopurinol | Interference with protein synthesis (purine salvage cycle) | Oral: VL, CL |

*VL* visceral leishmaniasis; *CL* cutaneous leishmaniasis; *MCL* mucocutaneous leishmaniasis; *PKDL* post-kala-azar dermal leishmaniasis; *im* intramuscular; *iv* intravenous

## *Cryptosporidium* spp. (Cryptosporidiosis)

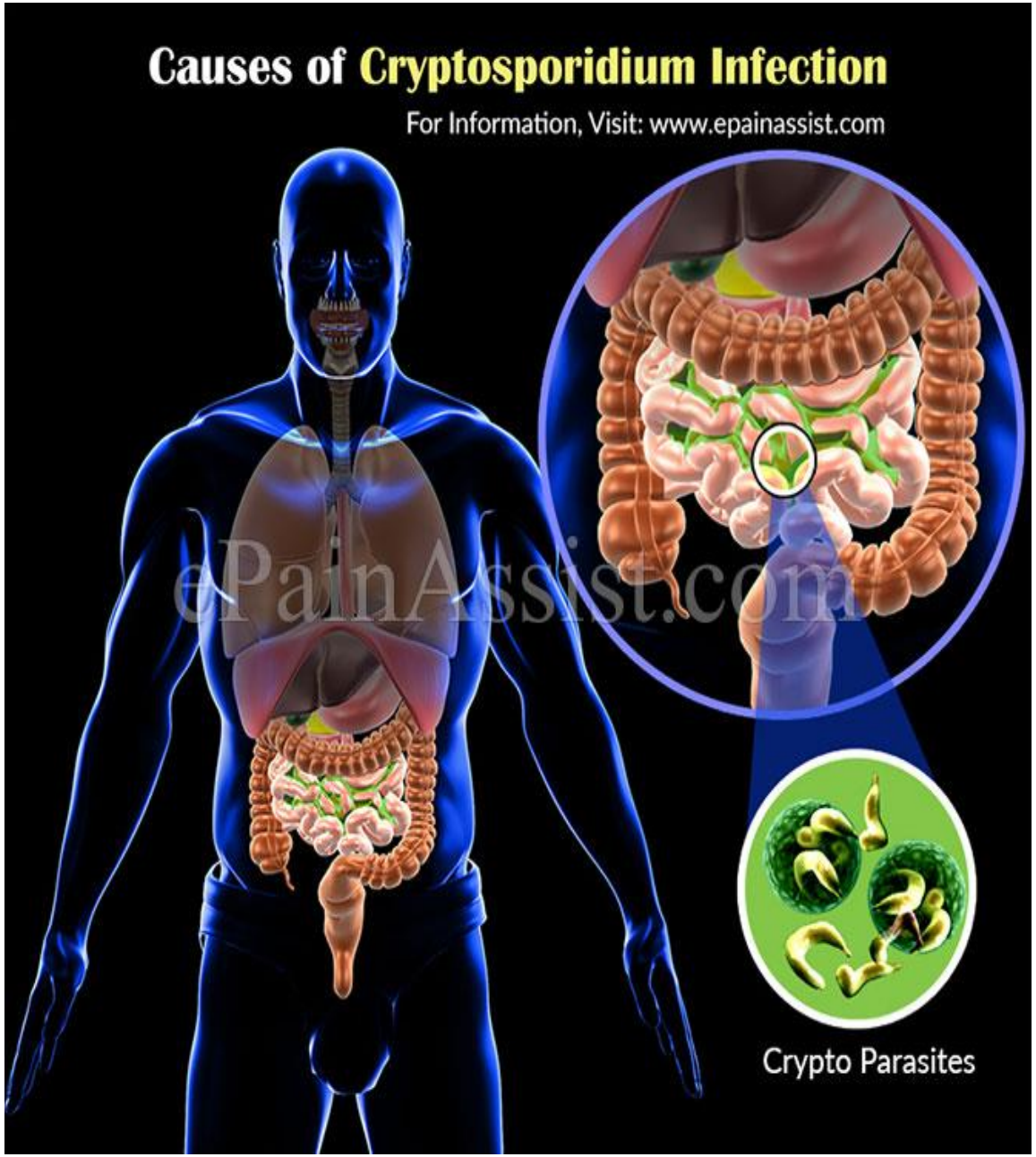
.... It is a spore producing parasite found in the intestine of infected people and animals. Also, it is the most common cause of Cryptosporidiosis.

### Infection

1. Ingesting food or drinks contaminated with fecal material.
2. Swallowing recreational water contaminated with Cryptosporidium.
3. Not washing hands.
4. Sexual practices leading to oral exposure with fecal material

### Symptoms:

1. Diarrhea
2. Stomach cramps
3. Dehydration
4. Nausea
5. Vomiting
6. Fever
7. Weight loss
8. Sometimes no symptoms are seen



**Incubation period:** 1–2 days.

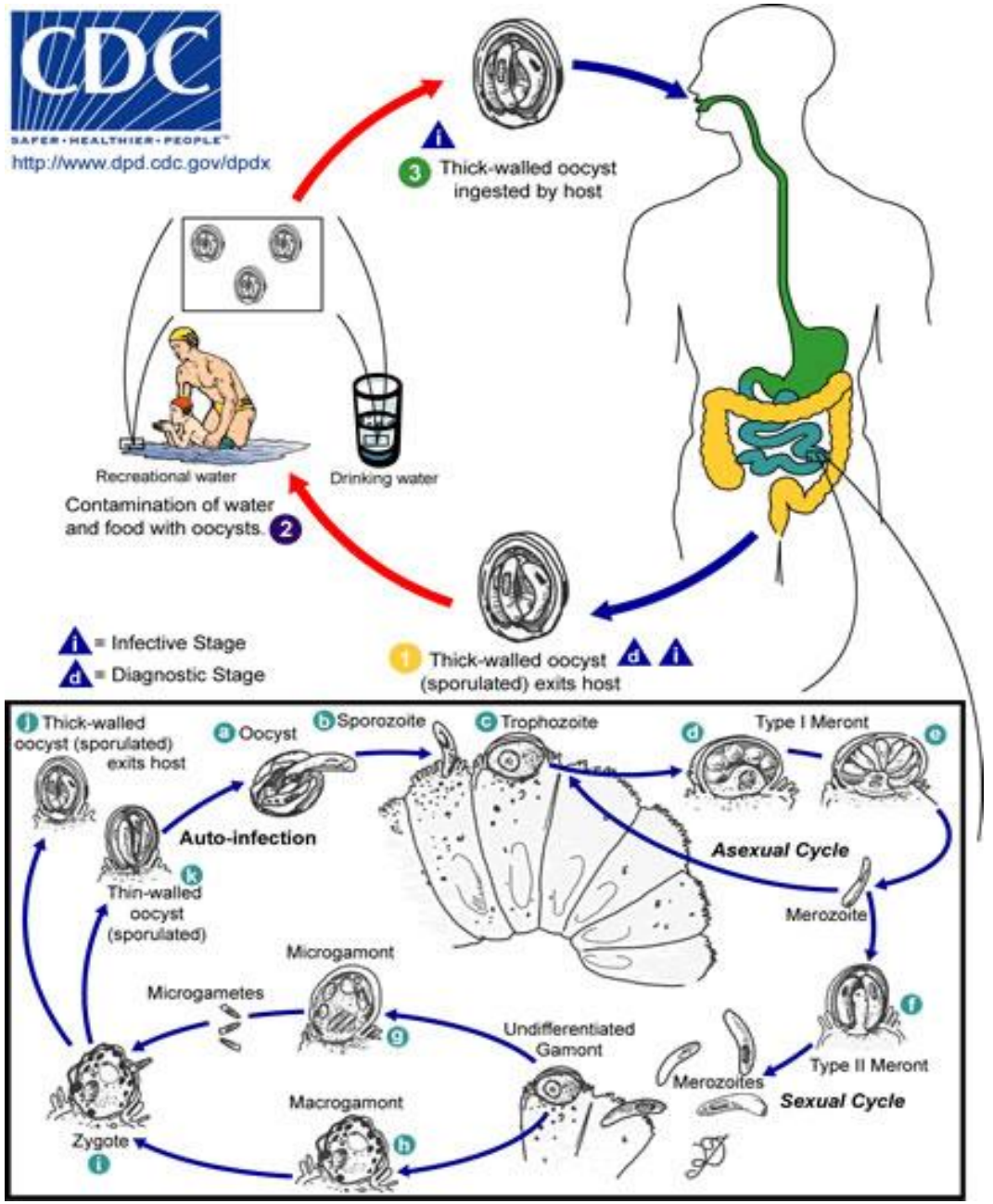
**Patency:** 12–14 days.

# Therapy.

An effective treatment registered at the governmental medical care authorities does not yet exist.

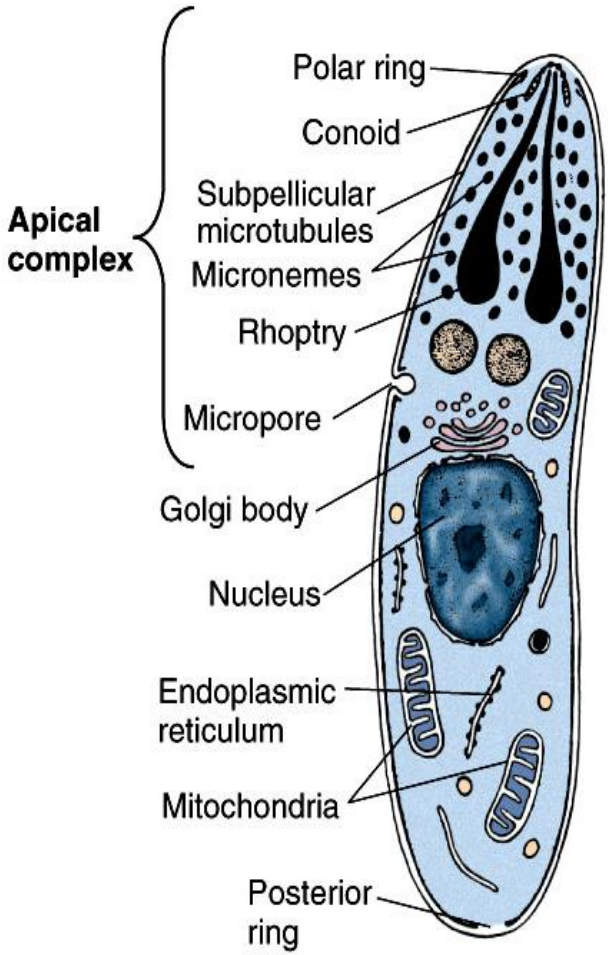
Bovine colostrum (lactobin), paromomycin (2 g daily, orally), octreotide (up to 0.5 mg subcutaneously per day), spiramycin and azithromycin were used successfully in many cases.

Nitazoxanide 3500 mg daily in case of adults and 2100 mg daily in the case of children reduced the symptoms significantly, but did not heal.



## Phylum Apicomplexa

…The Apicomplexa Levine, 1970 constitute a large protozoan phylum of obligate eukaryotic intracellular parasites responsible for many serious diseases of humans, domestic animals and, making these parasites economically important for medical research. It comprised of organisms that possessed **the apical complex** which help in penetrating host.




P: Euglenozoa
C: Kinetoplastea
O: Kinetoplastida

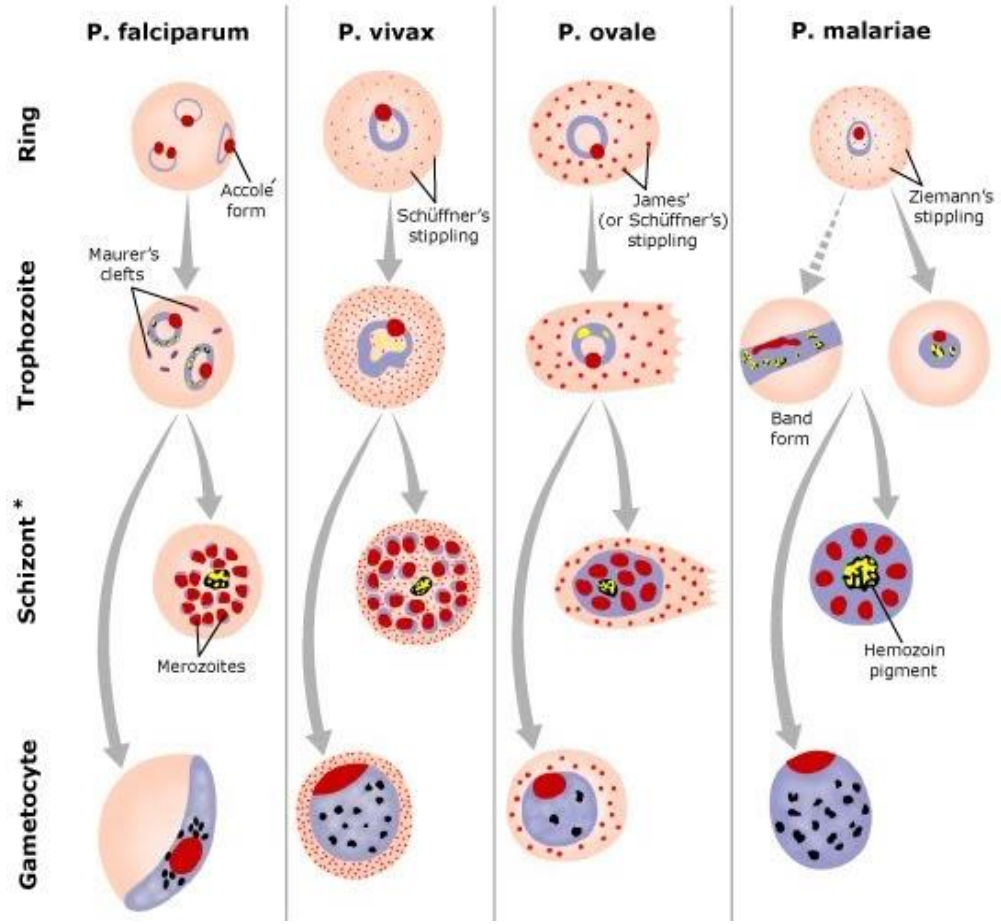
Apicomplexa
Coccidea
Haematozoa
Adeleina
Eimeriina
Haemosporidia
Piroplasmida

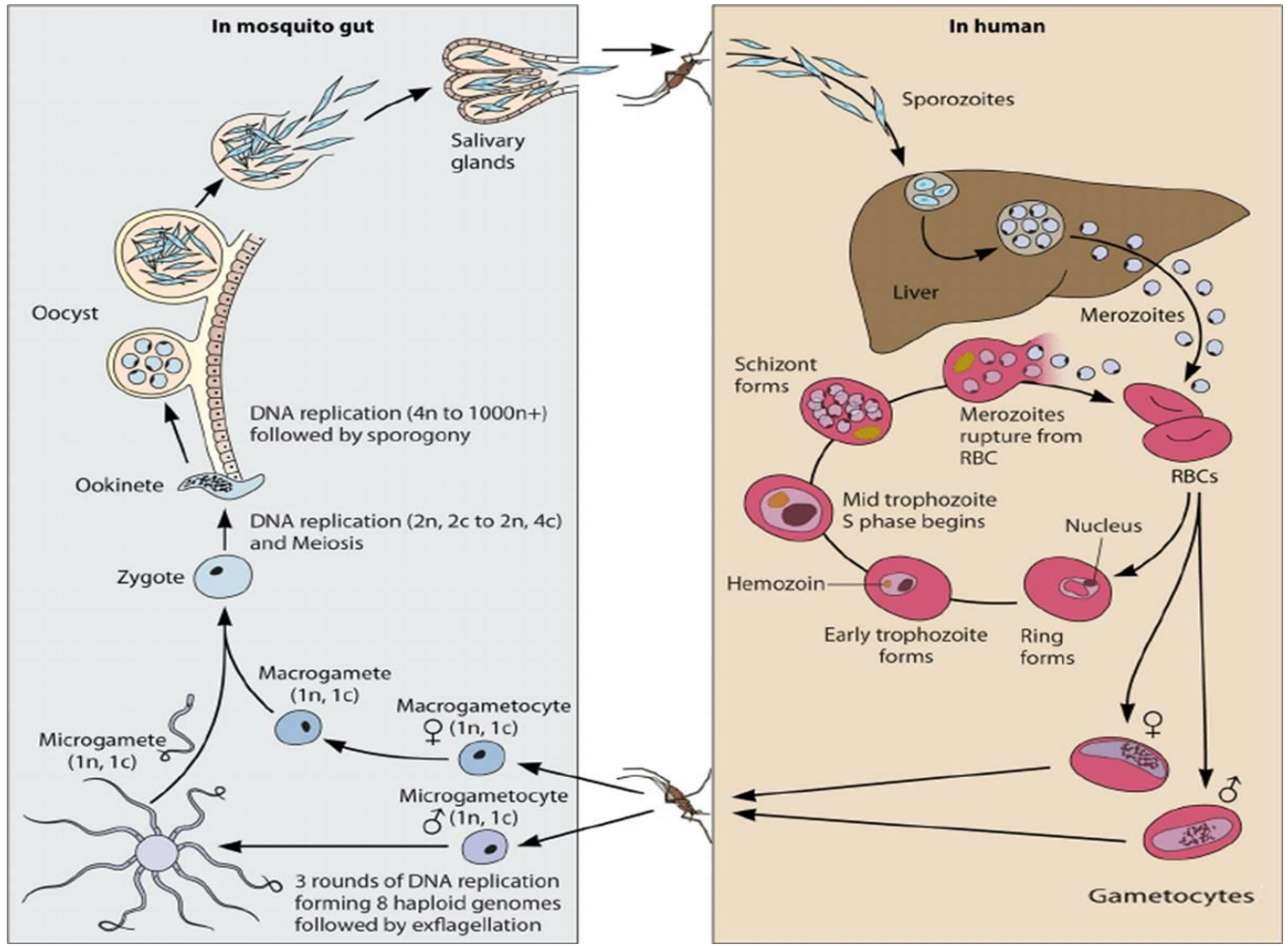
trypanosomatids | haemogregarines | haemococcidia | haemosporidia | piroplasms

| | | | | |
|---|---|---|---|---|
| extracellular blood stages | intracellular blood stages | | | |
| | nucleate and anucleate red blood cells, sometimes white blood cells | | | |
| asexual (mastigote fission) | sexual recombination [gamogony with syngamy (fusion of gametes)] | | | |
| | syzygy (gamont alignment) | no syzygy | | syzygy? 'ray bodies' |
| mammals, birds, reptiles, amphibians, fish | mammals, birds, reptiles, amphibians, fish | reptiles, amphibians, birds | mammals, birds, reptiles | mammals, birds, reptiles |
| diptera, bugs, leeches | diptera, ticks, leeches | diptera, ticks, leeches | diptera | ticks |
| injected, contaminative | ingested (injected) | | injected | |

## ***Plasmodium* spp.**

…. They are intracellular blood parasites of blood cells and tissues of birds and mammals. There are four species of *Plasmodium* causing **MALARIA** to the human.

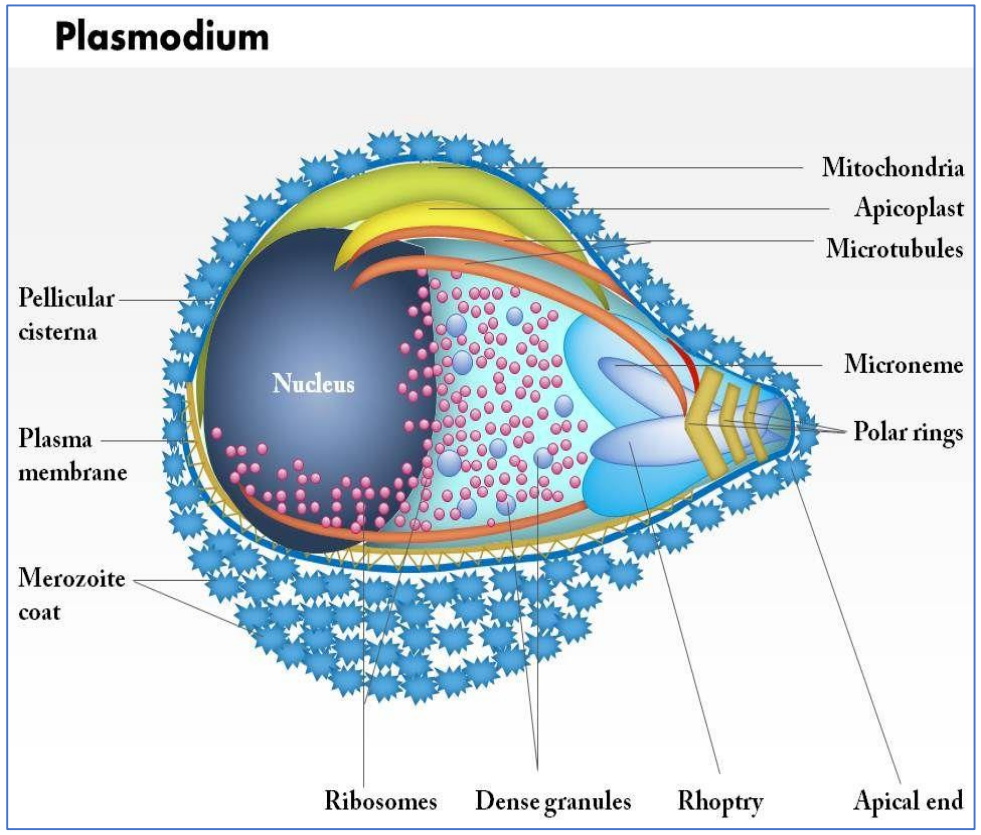


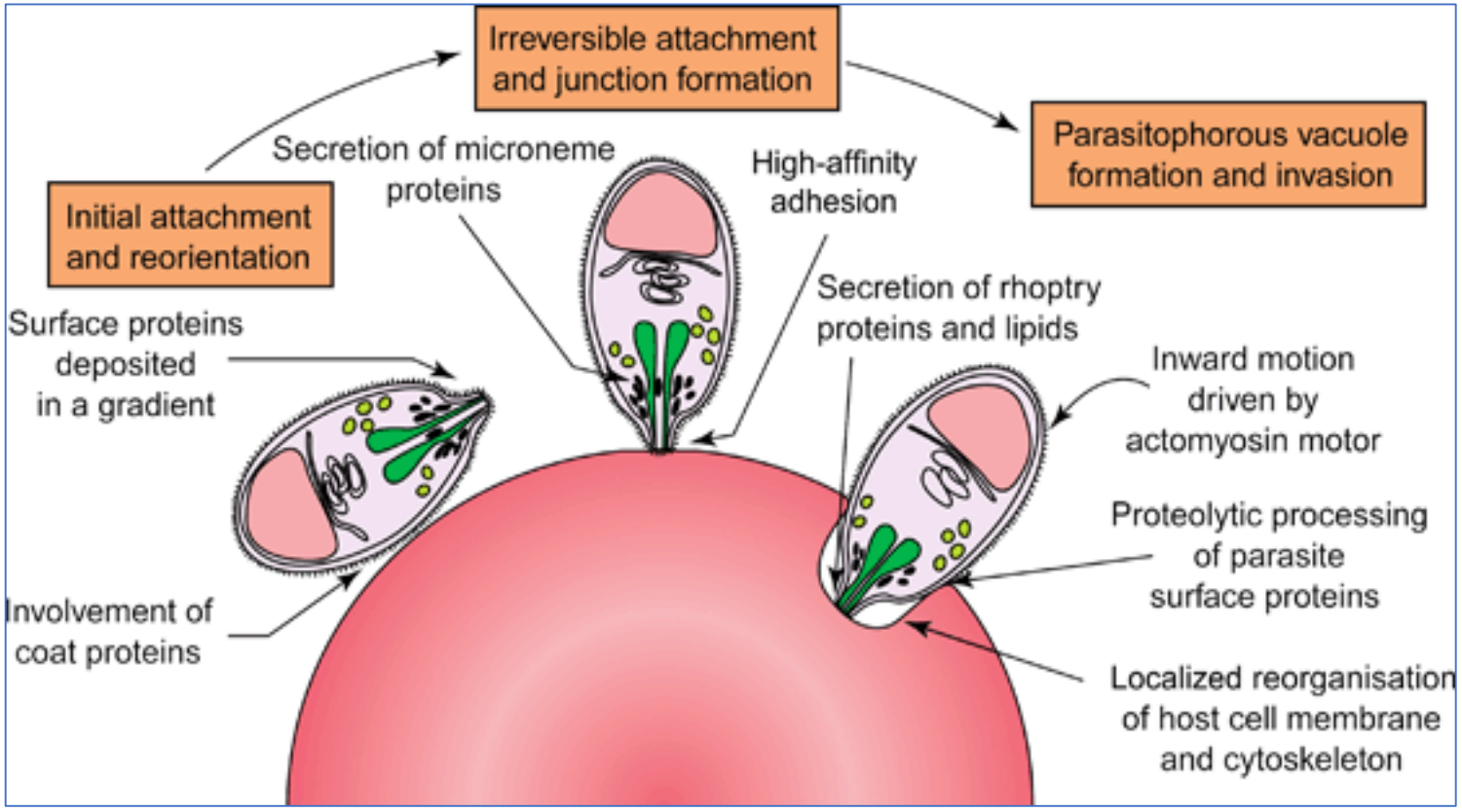



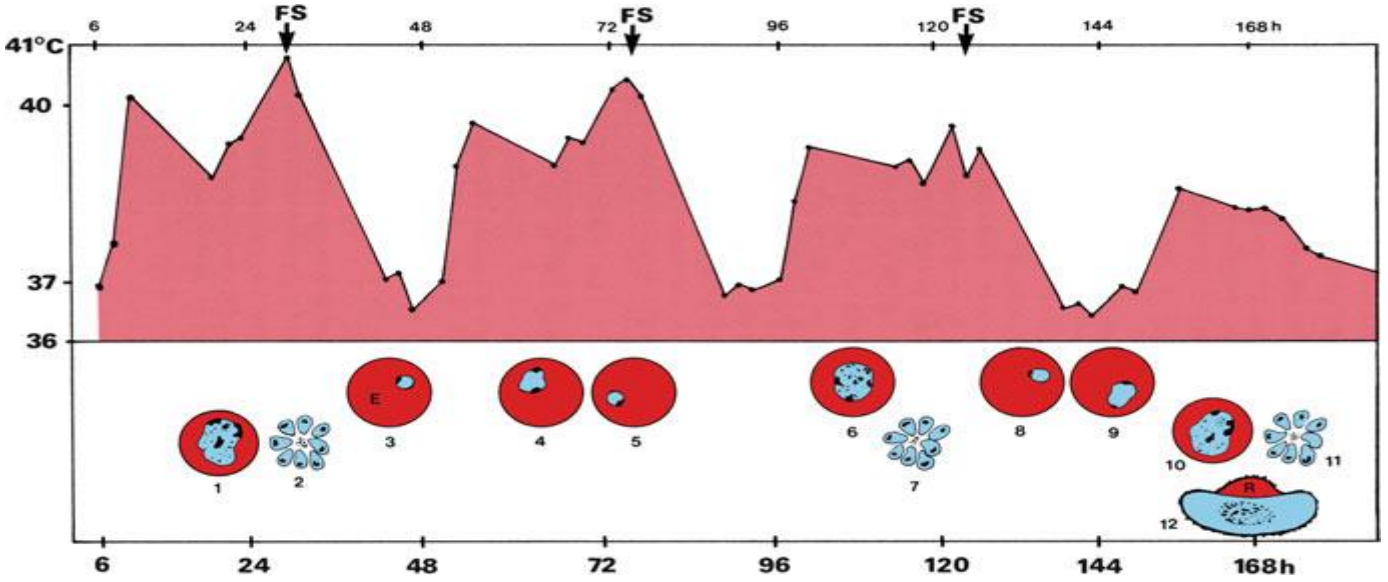

**Pathway of infection:** Cutaneously by the bite of nightly active female *Anopheles* mosquitos. *Caution: The transmission by blood transfusion is possible, since schizonts survive at low temperatures (although they stop dividing) in a fridge.*

## Invasion of an RBC by a *P. falciparum* merozoite

Invasion is a complex multi-stage process. Initial attachment can occur with the merozoite in any orientation and involves low-affinity interactions between merozoite surface proteins and receptors on the target cell. Subsequent interactions are facilitated by proteins that are initially hidden within the apical organelles and are secreted only shortly prior to or at the time of attachment.






Diagrammatic representation of the fever curve and development of the blood stages of *P. falciparum* in an infected human during four consecutive phases. C Celsius grades of fever; FS high fever phase; h hours

Comparison of the developmental cycles of the *Plasmodium* species of humans

| Species | Prepatent period = interval between infection and the first ability to detect the parasite | Mean of beginning of erythrocytic schizogony | Duration of erythrocytic schizogony | First appearance of gamonts in blood |
|---|---|---|---|---|
| *P. vivax* | 8 d | 13–17 d | 48 j | 11–13 d |
| *P. ovale* | 8 d | 13–17 d | 48 h | 20–22 d |
| *P. falciparum* | 5 d | 8–12 d | 36–48 h | 17–22 d |
| *P. malariae* | 13–17 d | 28–37 d | 72 h | 24–31 d |

*d* days; *h* hours

Comparison of the clinical symptoms of the different human malaria types

| Criterion | *P. falciparum* | *P. vivax* | *P. ovale* | *P. malariae* |
|---|---|---|---|---|
| Average incubation period | 8–24 days | 9–18 days | 10–17 days | 18–40 days |
| Prodromal symptoms | Influenza-like | Influenza-like | Influenza-like | Influenza-like |
| Fever | Daily, recurrent or continuing | Sporadic to daily | Sporadic to daily | Periodically every 72 h |
| Periodicity of established fever attack | No fever; permanent fever or every 36–48 h | 48 h | 48 h | 72 h |
| Initial paroxysm | Severe, for 16–36 h | Slight to severe, for 10 h | Slight for 10 h | Slight to severe, for 11 h |
| Duration of untreated disease | 2–3 weeks | 3–8 weeks or even longer | 2–3 weeks | 3–24 weeks |
| Duration of persistence of parasites in an untreated disease | 6–8 months | 5–7 years | Up to 2 years | 30 years or more |
| Anaemia | ++++ | ++ | + | ++ |
| CNS syndrome | ++++ | +/– | +/– | +/– |
| Kidney syndrome | +++ | +/– | – | +++ |
| Blackwater fever | ++++ | + | + | + |

+, present, frequency; –, absent

## The recommended doses in the treatment of malaria:

**1. Riamet™(artemether/lumefantrine)**: 80/480 mg (=4 pills) initially, after 8 h four further pills. Then four pills 2 daily on days 2 and 3 starting at a body weight of 35 kg.

**2. Malarone® and generica (atovaquone/proguanil):** 1000 mg/400 mg (=4 pills) as single dose on 3 following days starting at 40 kg bodyweight.

**3. Lariam® (mefloquine):** Initially 750 mg (3 pills), after 6–8 h further 500 mg (=2 pills).

**4. Eurartesim® (piperaquine tetraphosphate + dihydroartemisinin):** 120 mg/960 mg (=3 pills) as a single dose on three consecutive days starting in the case of persons of 36–75 kg bodyweight.

**5. Resochin®, Quensyl® (chloroquine):** Only in limited regions, 600 mg base (=4 pills), then 6, 24 and 48 h after the start of medication always 300 mg.

# Quinine

Oldest antimalarial alkaloid isolated from barks of chinchona tree.

**Pharmacological actions:**

**1- Antimalarial**: suppressive agent

**2- Local irritational action:** general protoplasmic poison

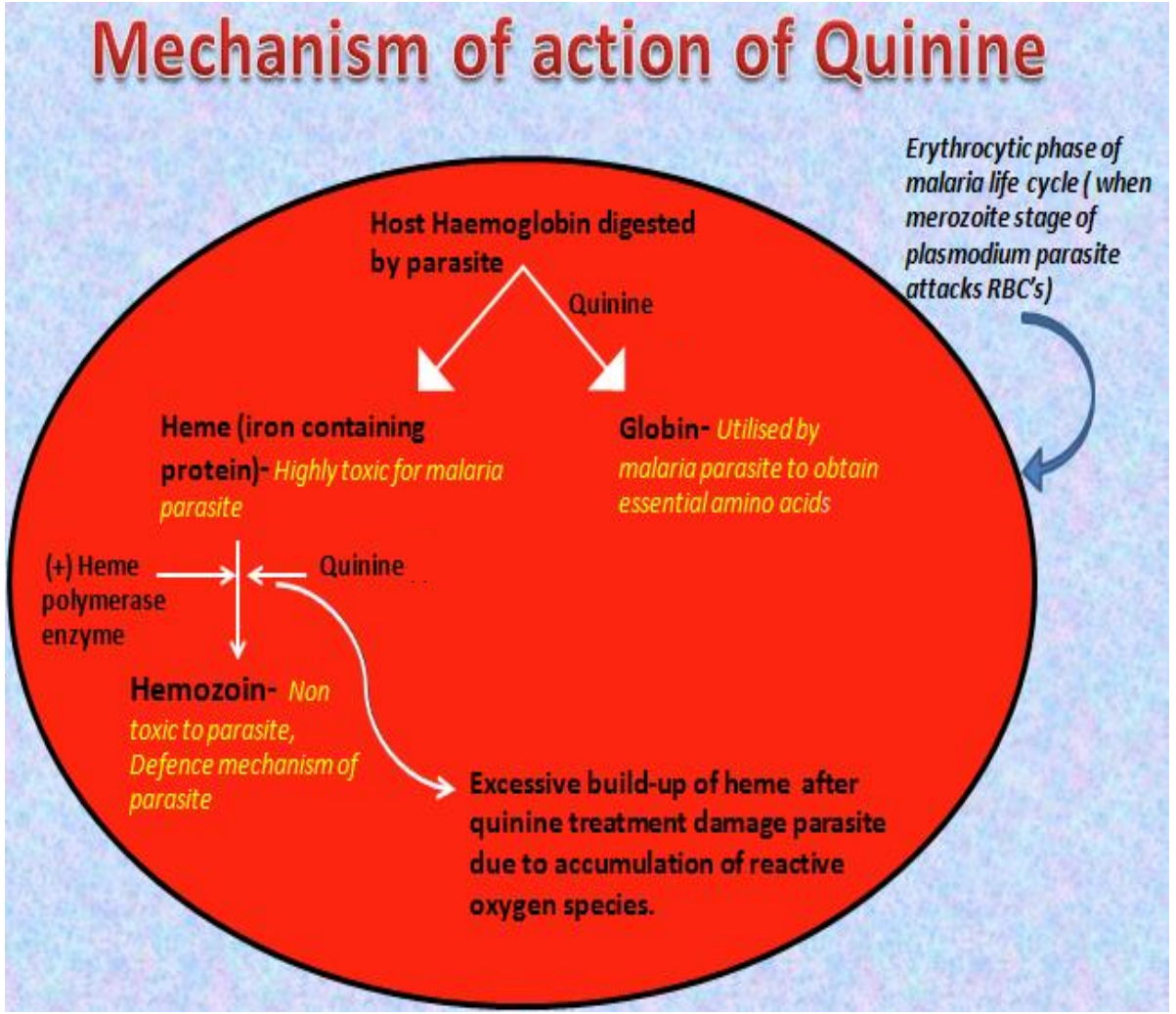
**3- GI tract:** bitter, nausea, vomiting

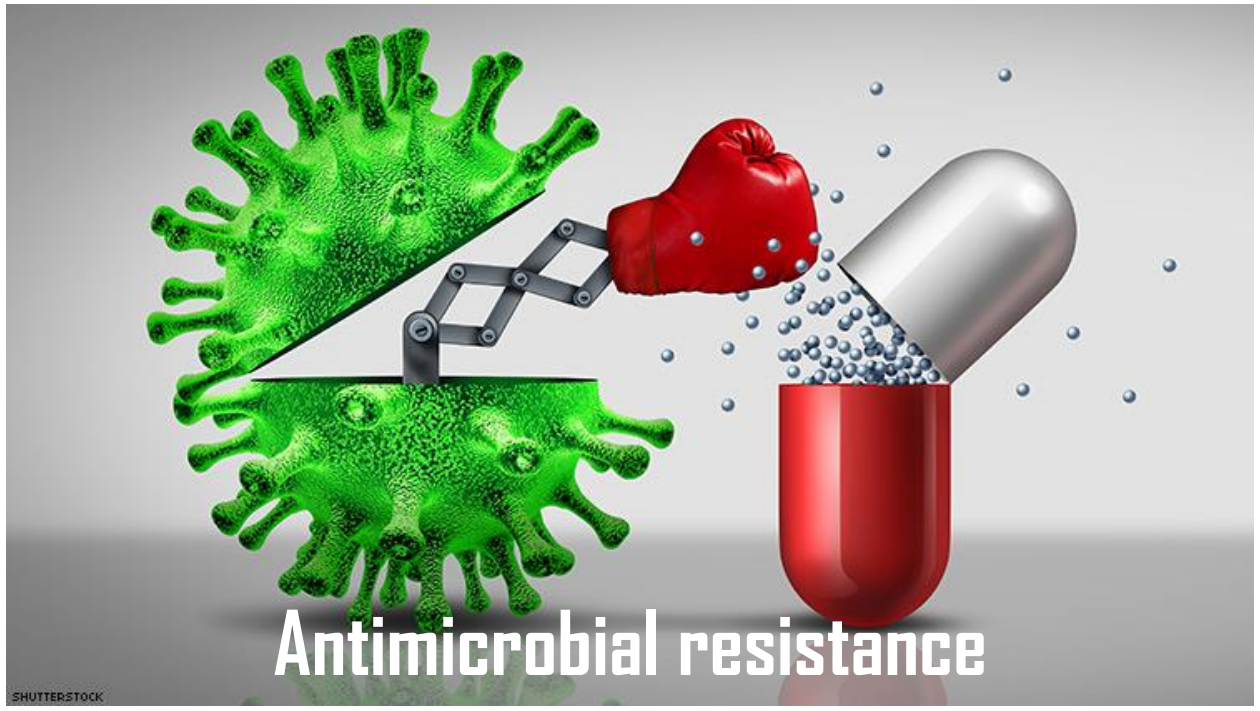
*General protoplasmic poison*, decrease cilliary activity, inhibit phagocytosis and fibroblast growth

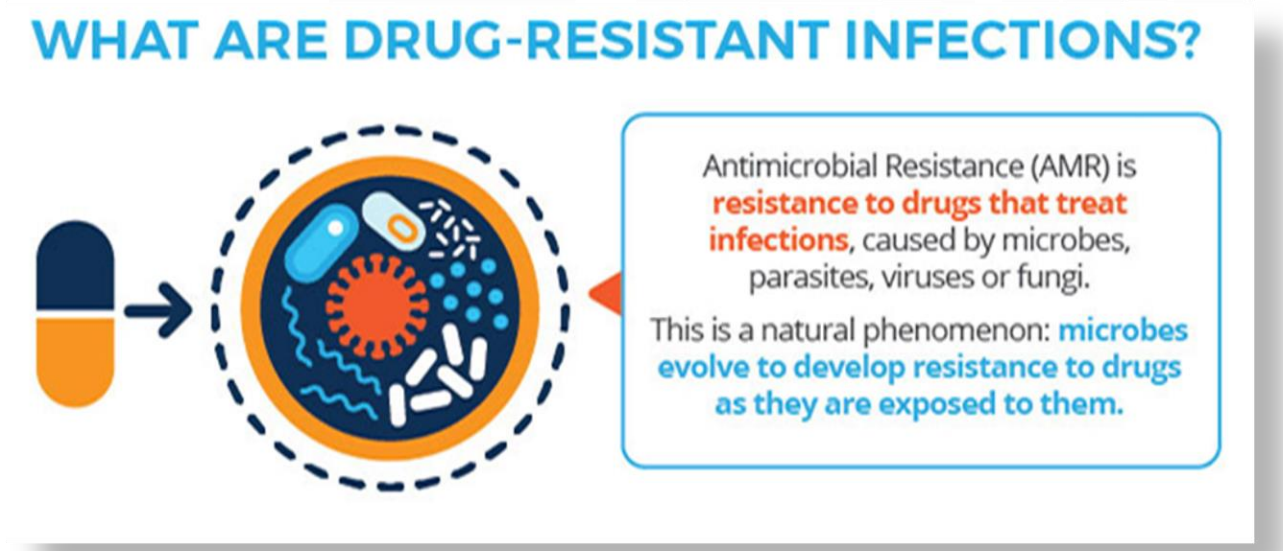
*Local anesthetic action*, at high conc. Edema, pain at site of injection

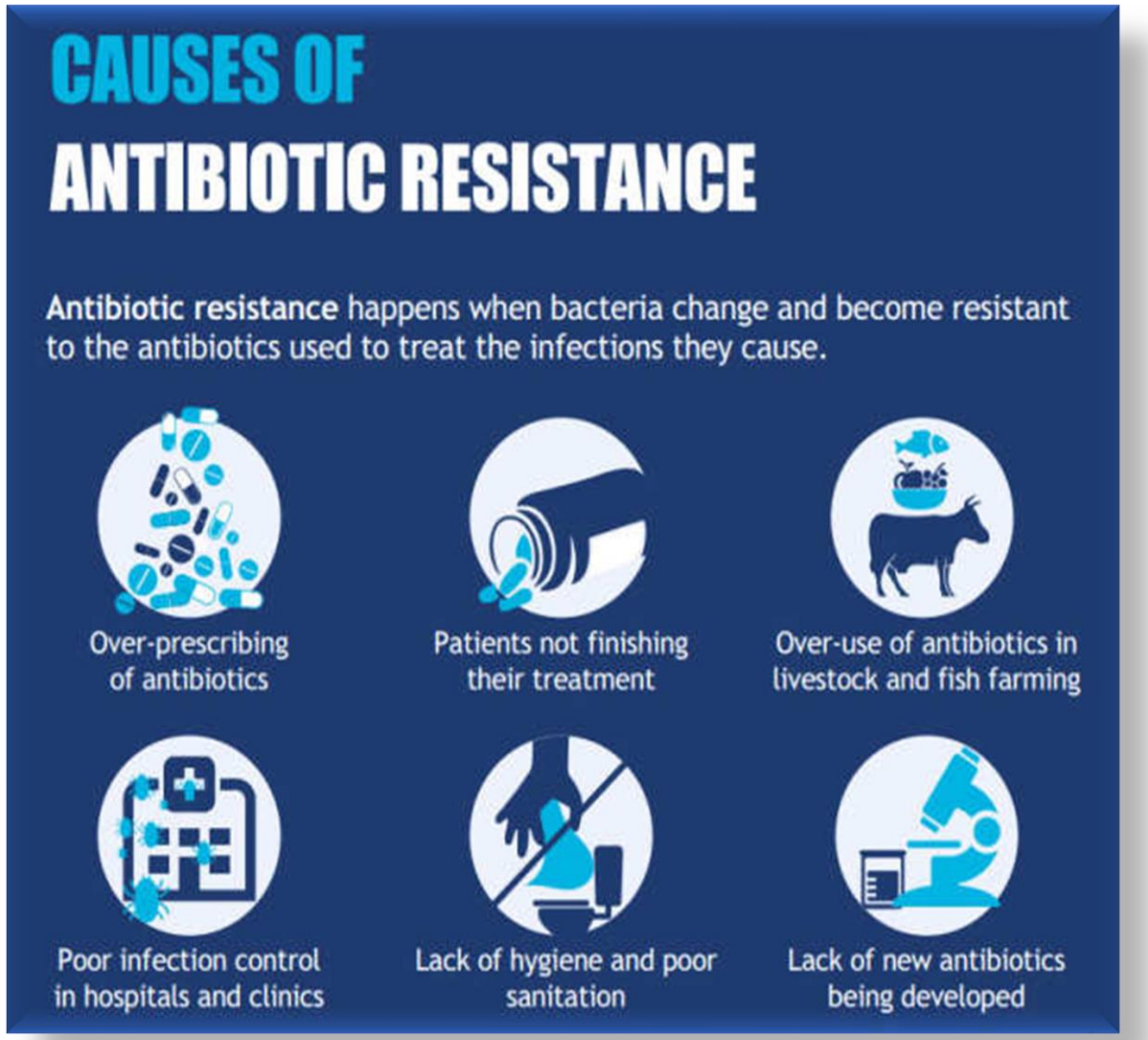
**4- CVS:** myocardial depression, decrease excitability and conductivity intravenous dose-hypotension

**5- Miscellaneous:** analgesic, antipyretic, skeletal muscle relaxant



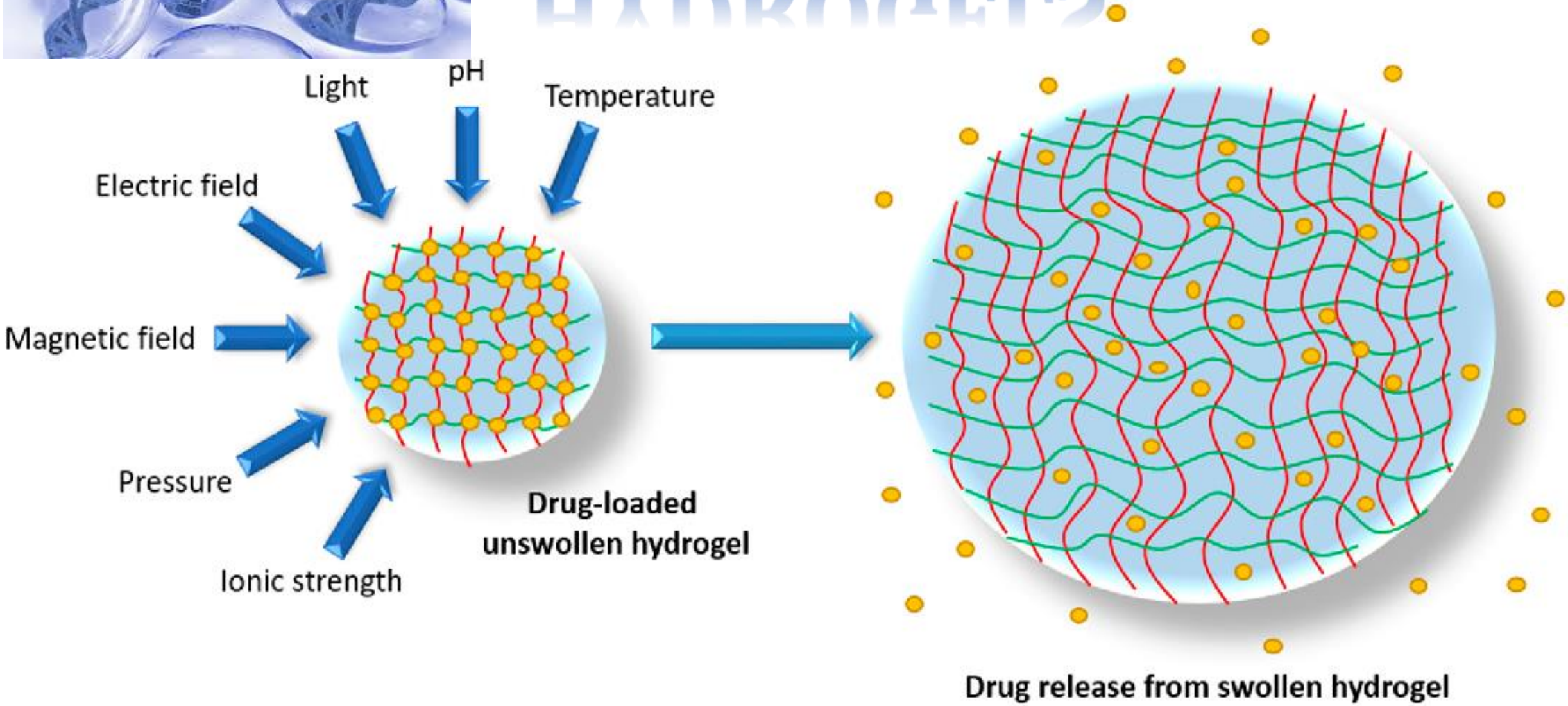


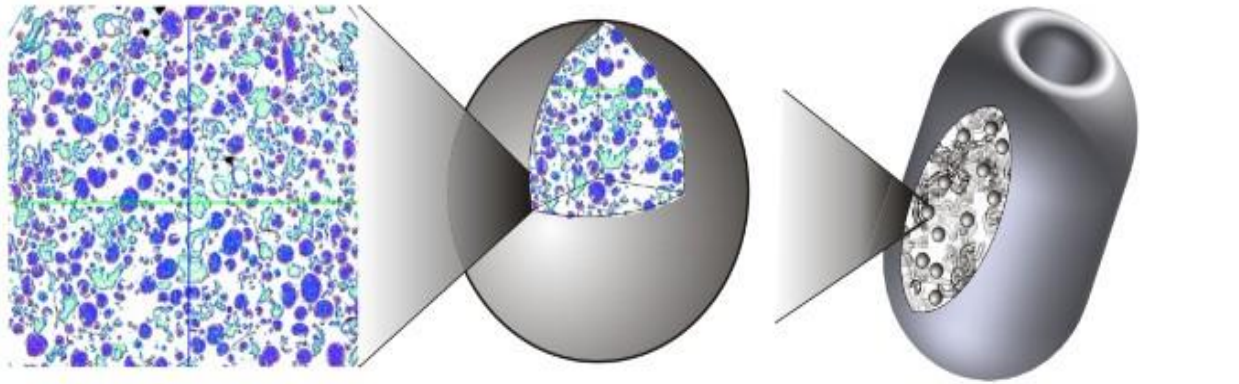




Due to the presence of drug resistance, there are new approaches for the treatment as hydrogels, microspheres, nanomedicine.

# HYDROGELS


Light
pH
Temperature
Electric field
Magnetic field
Pressure
Ionic strength
Drug-loaded
unswollen hydrogel
Drug release from swollen hydrogel

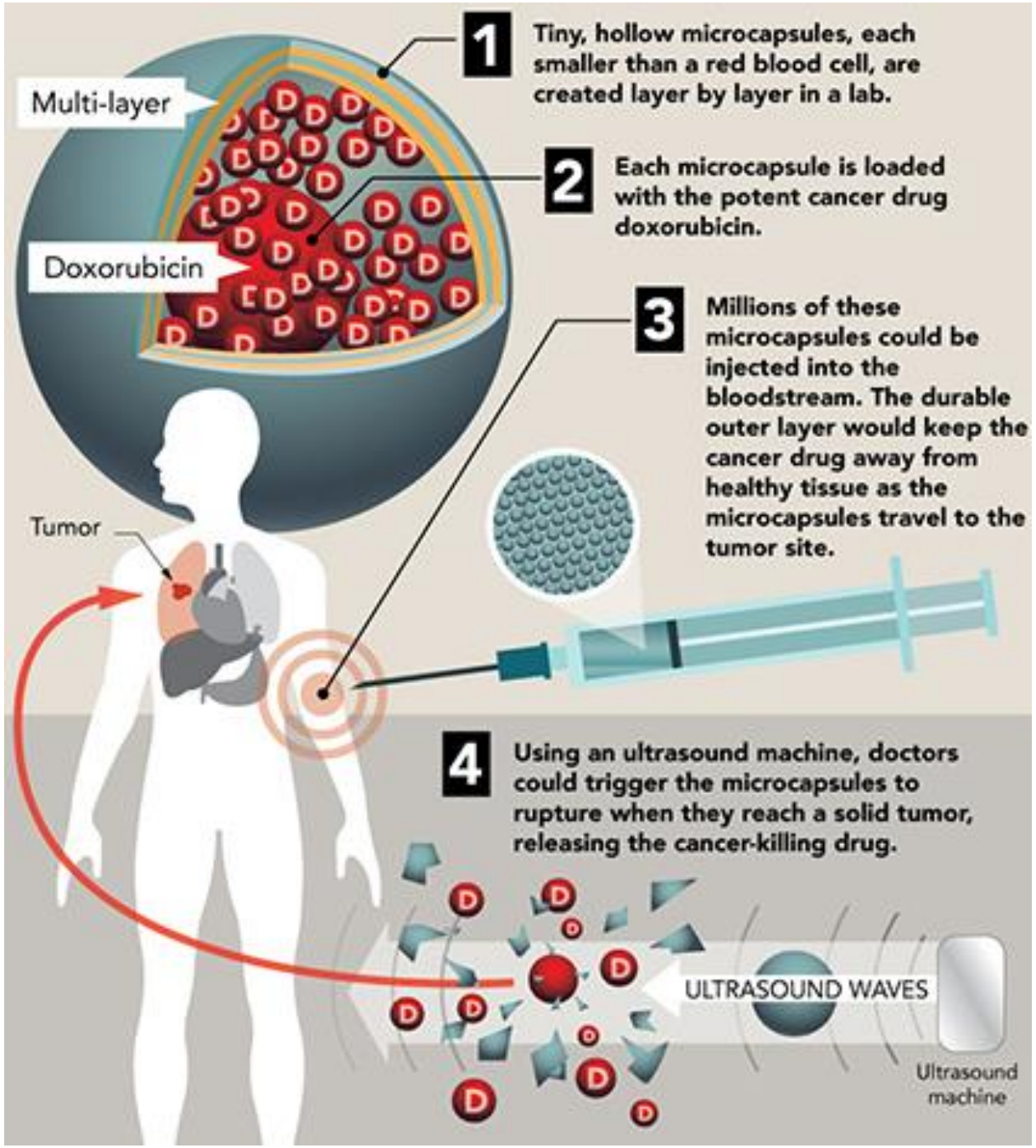
# MICROSPHERES



polymer matrix with agent

microsphere

carrier system with microspheres



# NANOMEDICINE:

## THE FUTURE OF MEDICINE

Nanomedicine, refers to highly specific medical intervention at the molecular level for curing disease or repairing damaged tissues.
Though in its infancy, could we be looking at the future of medicine?
Early clinical trials certainly look promising.

## HOW NANOMEDICINE WORKS

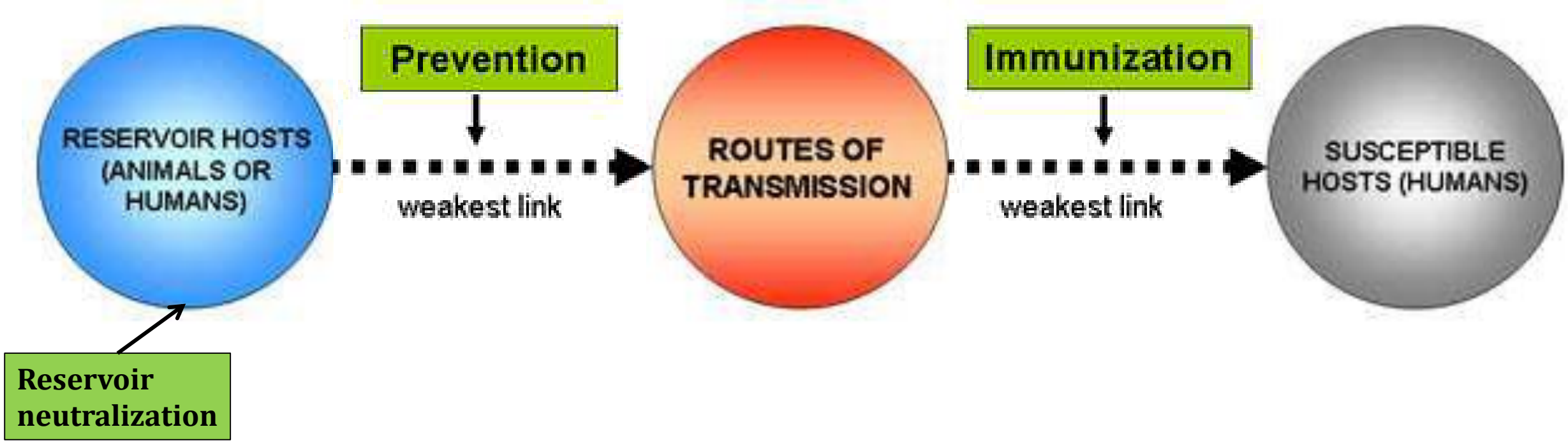
Nanomedicine works by ***injecting nanoparticles*** into the body

***CAN BE USED TO:***

One human hair is approximately

# PREVENTION, CONTROL AND ERADICATION OF ZOONOSES

The fundamental concept in prevention, control and eradication of zoonotic diseases is focused upon **'breaking the chain of transmission at its epidemiologically weakest link'** in the infection cycle *viz.,* controlling the reservoirs (animals), and immunization of susceptible hosts (human beings).



4 Step

# MALARIA PREVENTION

act

## Use Of Bed Nets

People at risk of malaria should sleep under Long Lasting Insecticide Nets every night

## Use Of Insecticide

Individuals should ensure they spray their homes with indoor residual spray/insecticide

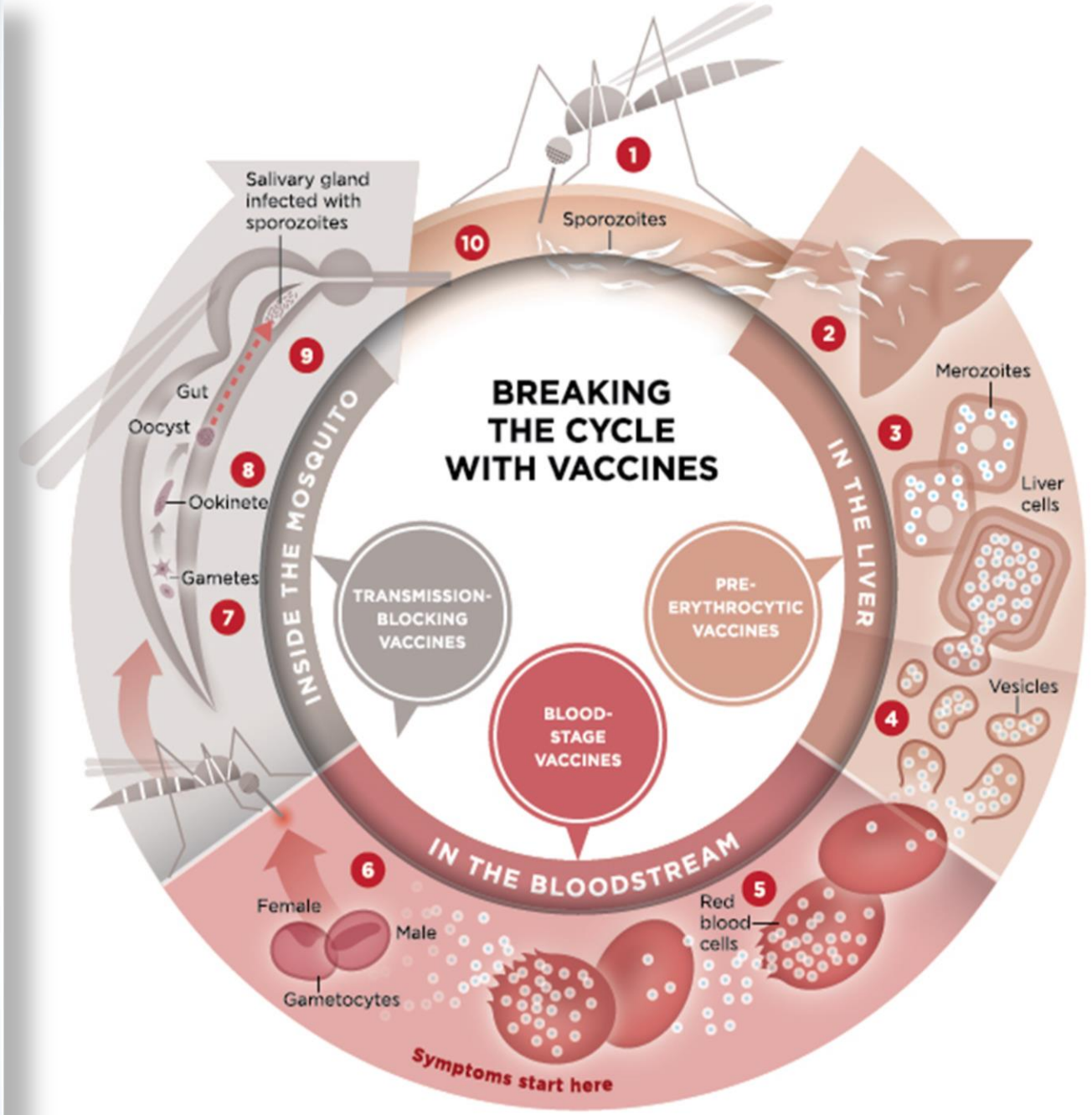
## Keep Your Environment Clean

To avoid breeding of mosquitoes which can cause malaria.

## See A Doctor

Seek immediate medical advice if you have malaria symptoms

**LET'S END MALARIA FOR GOOD**




Any
questions