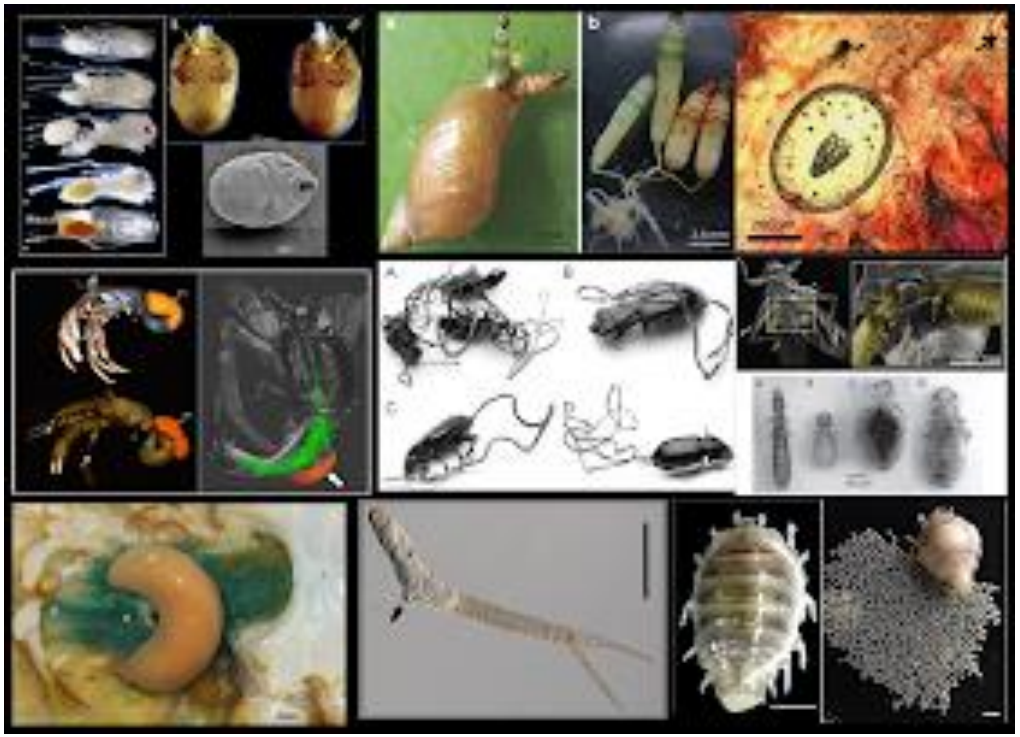
جامعة الملك سعود
King Saud University

Physiology of Parasites (Zoo 512)



Dr.Dina Metwally

Associate professor of Parasitology

Course

- Course title**: Zoo 512 Physiology of Parasites (2+1)**
- Credit hours**: 3 (2+1)**
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Evaluation and Assessment

Activities	%
1- First midterm exam	15%
2-Second midterm exam	15%
3-Practical	30%
4-Final Examination	40
Total	100

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25% absence from both lectures and labs (approximately 10 hrs.), student will be deprived from the course.

Dates of the exams

Exam	Date
1- First midterm exam	October 10,2018 (7th week)
2-Second midterm exam	November 15,2018 (11th week)
4-Final Examination	December 13,2018 (15th week)

Objective

Providing the graduate students of the Department of Zoology with basic information on the physiology of parasite members.

Contents

Studies of :

- The metabolism of carbohydrates, proteins, and lipids in various parasites.
- Enzyme systems of various parasites in relation to host infection.
- The physiological methods followed by parasites in the infection and establishment in the hosts.

Contents (Cont.)

- The effects of parasites on their hosts, the competition between the parasites and their hosts for food and other vital substances, and the effects on the host immune system such as stimulation and inhibition.

Contents (Cont.)

- The structure of systems of some parasitic helminthes, especially the digestive and reproductive systems.
- The general characteristic of teguments and other outer walls of various parasites.

Introduction

- The information regarding physiological processes in parasites is scanty and incomplete.

This is because it has not possible to cultivate parasitic worms in artificial media, and difficults to maintain most of them alive outside the body of their host for any appreciable length of time.

Introduction(Cont.)

Knowledge concerning the physiology of the helminth parasites is of particular interest for several reasons:

- They live in an unusual environment compared with other animals, an environment which is itself undergoing physiological processes.
- The physiological reactions of the parasites, their nutrition, metabolism, and secretions, may have definite effects on their hosts.
- An understanding of the physiological processes of helminths is of practical importance in the development of new anthelmintic.

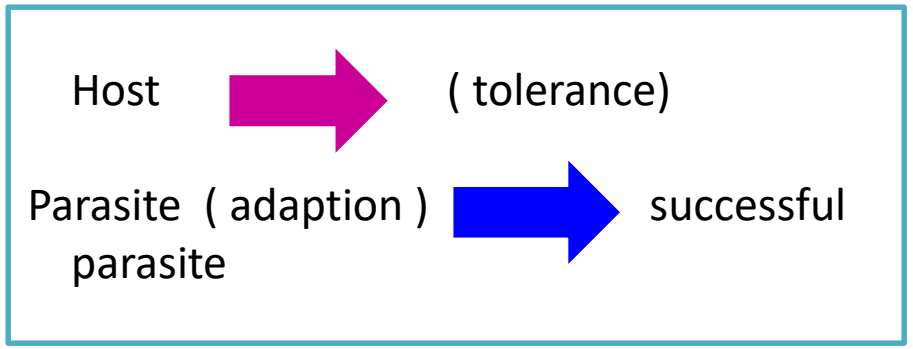
Parasitology can be divided into:

1- The study of the parasite itself

2- Host-Parasite relationships

The most important disciplines are:

- Physiology
- Biochemistry
- Cell biology
- Immunology
- Pharmacology



Parasitology can be divided into (Cont.)

3- Immunology of parasitic infections

The description of the immunological response by the host and the way the parasite tries to evade (escape) the host's immune attack.

This comprises such disciplines as:

A- Humoral and cellular immunology

B- Molecular immunology

Parasitology can be divided into (Cont.)

4- Chemotherapy of parasitic infections

5- Epidemiology

i.e to describe the ways the diseases spread amongst the population. In the case of parasitic infections not only the host, but also the parasite and the vector should be included. The disciplines are:

- Tropical hygiene - Entomology - Geography

What is parasitism?

Symbiosis: Any two organisms living together in close association.

- **Parasitism** is a type of **Symbiosis** in which two organisms live together in close association, one partner (the parasite) lives on the expense of the other (the host) in order to obtain nourishment and shelter. Parasite is metabolically dependent on its host and mostly causes harms to it. In parasitism, the parasite is the benefited partner.
- **Commensalism:** Sharing the table. One partner benefits but the other is not hurt.
- **Mutualism:** Both partners benefits.

Ecto& Endoparasitism

Ectoparasites live on, but not in their hosts (they can nevertheless cause severe illness).

Endoparasite lives within the body and tissues of their hosts. Trypanosomes (which cause sleeping sickness) within the blood of an infected animal.

Infection & infestation:

Infection is caused by organisms that live **inside** the host's body and usually implies **replication** of the agent resulting in a **growing number of pathogens.**

Infestation is caused by organisms that live **upon** the host's skin & are characterized by **a constant number of pathogens**. Severity of disease often depends on infection dose.

What is a parasite?

Parasite: a very diverse set of eukaryotic pathogens.

Protozoa: unicellular eukaryotes

Platyhelminthes: flatworms these include flukes or trematoda (ex.*Faschiola sp*) and tape worms or cestoda (ex.*Taenia sp*).

Nematodes: elongated worms with rigid cuticula.

Arthropodes: insects, ticks and mites which either are parasitic or transmits parasites as vectors.

Obligate/facultative, and permanent/intermittent parasites:

- Most parasites are obligate parasites.
- In some species only some life cycle stages, e.g. the larvae are parasitic, in others parasitic and free living generations can alternate depending on environmental conditions (*Strongiloides sterocoralis*).

Hosts and life cycles

The definitive host is defined as the one in which the parasite reproduces sexually or the one that harbors the adult or mature parasite.

Additional hosts are then designated **intermediate hosts** (harbors the immature stages of the parasite).

- Host which actively (biologically) transmit parasites to humans are often called **vectors** (Tsetse fly).

Paratenic or transport hosts transmit parasites but **not parasite development occurs**, for example all animals except cats can be considered paratenic hosts for ***Toxoplasma gondii*.**

- Paratenic host contains larval stage only without any development.It acts as store.

Hosts and life cycles:

Reservoir host is an alternate animal host from which the parasite can be transmitted to humans (zoonosis) or domestic animals.

Reservoir host contains adult parasite

Accidental hosts, unsuitable for parasite development, but severe disease might follow.

Mechanisms of infection

- A parasitic infection may occur by various routes, depending on the nature of both parasite and host.
- **Infection by passive entry: ie** without efforts

1-By feeding and drinking. Cysts and eggs can be transported by water or by insects such as the housefly. Examples are:

- **Giardia**, an intestinal parasite of beavers may contaminate fresh water lakes and rivers in the US. The drinking of this water may lead to intestinal infections in humans.

Mechanisms of infection (Cont.)

- **Entamoeba**, an intestinal parasite of human is transmitted in the form of cysts by the house fly.
- **Naegleria**, present in surface water may enter via the nose during swimming.
- **Acanthamoeba**, a facultative parasite may contaminate soft contact lenses and cause eye infections.

Mechanisms of infection

- **Trichomonas**, is transmitted via sexual intercourse and is the causative agents of the most common sexually transmitted disease amongst humans.
- ***Trypanosoma equinum*** is a parasite of equines (horses) and is transmitted via sexual intercourse.

- **Infection by active entry ie** with efforts

A-By biting (haematophagous) insects that serve as the active vectors in the transmission of disease:

- Mosquitoes transmit malaria and filariasis

- Black flies transmit onchocerciasis or river blindness

- Tsetse flies transmit sleeping sickness in Africa

- Sandlfies transmit leishmaniasis

B-By highly specialized developmental forms in the life cycle of the parasite.

- Schistosoma cercariae actively penetrate human skin.

Parasite reservoirs

A parasite reservoir (PR) is the biotope where the parasite lives.

In general it is the Definitive Host, where lives the sexual as the PR. A PR can be:

Human reservoir

-Human is the sole host (schistosomiasis)

-Human is an accidental host (leishmaniasis)

Animal reservoir

-Domestic animals

-Wild animals

How do parasites survive inside an immunocom-petent host?

Ectoparasites

Infestation leads to local lesions of minor to moderate importance. This leads only to:

- allergic reactions (itching)
- immunological reactions (without result)
- None of these reactions really harm the parasite, but do harm the host.

How do parasites survive inside an immunocom-petent host?

Intracellular parasite

These parasites try to escape any immunological reactions mounted by the host by hiding themselves inside the host cells where the immune system cannot reach them.**Examples are:**

Toxoplasma in lymphocytes ,*Plasmodium* in erythrocytes,*Leishmania*, in macrophages,*T.cruzi* in muscle cells.

How do parasites survive inside an immunocom-petent host? (Cont.)

- **Extracellular parasites**

Some parasites cover their cell surface with host serum proteins to avoid recognition by the immune system of the host.

Examples are:

- Schistosoma worms that cover themselves with host serum albumin.
- Rodent trypanosomes that cover themselves with ablastin (IgE).

How do parasites survive inside an immunocom-petent host? (Cont.)

- Antigenic variation in the African trypanosomes that live freely in the bloodstream and body fluids of the host is another effective mechanism of evasion.
- Cyst formation by *Entamoeba* spp. and other amoeboid parasites.


Thank you