

## Parasitology

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
	Parasitology	2 <sup>nd</sup>	1 <sup>st</sup>	6	Obligatory
<b>LECTURER(S)</b>			<b>Postal address, telephone n°, e-mail address</b>		
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<b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>					
PHARMACY					
<b>PREREQUISITES and/or RECOMMENDATIONS</b>					
<ul style="list-style-type: none"> <li>- Have studied the subjects Human Anatomy and Histology, Structural and Metabolic Biochemistry</li> <li>- Have adequate knowledge of: Scientific English, Basic Computer skills</li> </ul>					
<b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE</b>					
Concepts of Parasitology. Current importance of parasites in developed and developing countries: immunodepression, tourism, immigration and adoptions. Main diseases producing parasites in man: morphology, biological cycle, transmission mechanisms, more characteristic symptomatology, treatment, prophylactic / control measures.					



**GENERAL AND PARTICULAR ABILITIES**

CG3, CG4, CG6, CG7, CG9, CG13, CG15, CEM3.3, CEM3.4, CEM3.5, CEM3.8

**OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)**

Know and understand:

- The importance of Parasitology in our environment and in the developing countries and the reason for the prevalence of some parasites in relation to others
- The importance of Parasitology in the professional practice of the pharmacist.
- The phenomenon of parasitism
- The main parasites that affect the man.
- The treatment of choice in the main parasitic diseases.

Relate:

- The knowledge acquired about the morphology and life cycle of the parasites with their diagnosis.
- The knowledge acquired about the life cycle of the parasites and their epidemiology with the control and preventive measures against the diseases they produce.

**DETAILED SUBJECT SYLLABUS**

**UNIT 1. Parasitology: Origin. Definition. Types of biological associations. Parasitism. Types of parasites and hosts.**

Knowing / understanding:

What Parasitology studies, the existing importance in both develop and developing countries and the importance of its knowledge to the pharmacist.

Biological associations.

The peculiarities of the phenomenon of parasitism and parasites beings.

The different types of parasites and hosts according to the classification criteria.

Basic concepts in Parasitology.

Basic rules of zoological nomenclature. Position of parasitic organisms in the group of living organisms.

**UNIT 2. Adaptations to parasitism: morphological and physiological adaptations.**

Knowing / understanding:

The morphological and structural adaptations: size, shape, development of fixed organs ...

Biological and biochemical adaptations: changes in various organs and systems, increase of the biotic potential...

Ethological adaptations: synchronization of the host-parasite life cycles that parasitic organisms have developed as a result of its unique way of life.

**UNIT 3. Phases of parasitism. Parasite-host contact. Routes of entry, establishment and exiting**



## the host.

Knowing / understanding:

The succession of steps that must occur for a stable host-parasite system to occur.

The diverse mechanisms by which parasites can contact their suitable hosts and factors that influencing them.

Routes of entry for parasites in humans.

Location and setting at the right niche. Frequently habitats of parasites within the human organism.

Exiting the host. Types and factors influencing them.

Relate:

The location in the host with parasitic output mechanisms

## UNIT 4. Effects of parasites on their hosts.

Knowing / understanding:

Factors influencing the effects of parasites in the host: number, pathogenicity and virulence, in the host location, sensitivity and responsiveness of the host and nature of the damage.

The effects of parasites in the host: mechanical effects, tissue changes, predatory actions, toxic effects, impaired host defenses, infectious shares and other effects.

Relate:

The location within the human organism with the effects produced.

## UNIT 5. General characteristics of the parasitic protozoa. Classification. Phylum Sarcomastigophora. Subphylum Sarcodina: *Entamoeba histolytica*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.

Knowing / understanding:

Morphological and biological characteristics that identify a organism of the Protozoa subkingdom

Differential characteristics of amoebas.

*Entamoeba histolytica*: Geographical distribution. Size. Morphology (emphasizing on the structures of diagnostic interest). Life cycle. Intestinal and extra-intestinal amebiasis. Origin and development. Distinctive symptoms. Epidemiology of amebiasis: Routes of transmission of the parasite. Factors affecting transmission. Asymptomatic carriers. Main drugs used against the parasite.

Relate:

Location in men and sample used for diagnosis. Main techniques used in the diagnosis of amebiasis.

Life cycle, epidemiology, prevention, and control measures.

## UNIT 6. Subphylum Mastigophora. Order Diplomonadida. Genus *Giardia*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control. Order Trichomonadida: *Trichomonas vaginalis*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.

Knowing / understanding:

*Giardia lamblia*: Geographical distribution. Size. Morphology (emphasizing on the structures of diagnostic interest). Life cycle. Characteristic symptoms of giardiasis. Epidemiology of the disease: Routes of transmission of the parasite. Factors affecting transmission. Main drugs used against the



parasite.

Relate:

Location in men with sample used for diagnosis. Main techniques used.

Life cycle, epidemiology, prevention and control measures.

Knowing / understanding:

Order Trichomonadida: differential characteristics.

*Trichomonas vaginalis*: Geographical distribution. Size. Morphology. Life cycle. Characteristic symptoms of trichomoniasis. Epidemiology of the disease: Routes of transmission of the parasite. Factors affecting transmission. Main drugs used against the parasite and treatment recommendations.

Relate:

Location within the human organism and sample used for diagnosis. Main techniques used.

Life cycle, epidemiology, prevention and control measures.

**UNIT 7. Order Kinetoplastida. Genus *Trypanosoma*: Species of greater interest causing diseases in man. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

**Genus *Leishmania*: groups or complexes which include various species. Differential characteristics. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

Differential characteristics of protozoa of the Order Kinetoplastida.

*Trypanosoma cruzi*. Geographical distribution. Morphology and life cycle. Phases in man and in the insect vector. Chagas disease or American trypanosomiasis. Acute and chronic phases. Characteristic symptoms. Epidemiology: Routes of transmission of the parasite to man. Factors affecting transmission. Vectors. Reservoirs. Main drugs used against the parasite.

Relate:

Location within the human organism and sample used for diagnosis. Main techniques used in the diagnosis of the Chagas disease.

Life cycle, epidemiology, prevention and control measures.

Knowing / understanding:

*Trypanosoma brucei gambiense* and *T. brucei rhodesiense*. Geographical distribution. Morphology and life cycle. Phases in the human organism and in the vector insect.

Relate:

Characteristic symptoms of Sleeping sickness or African trypanosomiasis with the location of the parasite in the human organism.

Sleeping sickness phases and samples in which the parasite can be seen for diagnosis.

Knowing / understanding:

Epidemiology: Routes of transmission of the parasite to man. Factors affecting transmission. Vectors. Reservoirs.

Main drugs used against the parasite.

Relate:

Life cycle, epidemiology, prevention and control measures.



Knowing / understanding:

Genus *Leishmania*: Morphology and life cycle. Phases in the host vertebrate and invertebrate.

Clinical manifestations that it produces. Visceral leishmaniasis: Main species involved. Geographical distribution. Organs. Diagnosis. Drugs used.

Cutaneous leishmaniasis. Main species involved. Geographical distribution. Characteristic lesions. Diagnosis. Drugs used.

Mucocutaneous leishmaniasis: Main species involved. Geographical distribution. Characteristic lesions. Diagnosis. Drugs used.

Epidemiology of leishmaniasis: Routes of transmission of the parasite to human. Factors affecting transmission. Vectors. Reservoirs. Current situation of leishmaniasis in Spain.

Relate:

Life cycle, epidemiology, prevention, and control measures

**UNIT 8. Phylum Apicomplexa. Morphology, ultrastructure and general life cycle. Classification. Suborder Eimeriina. Family Sarcocystiidae: *Toxoplasma gondii*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control. Other apicomplexas of interest.**

Knowing / understanding:

Differential characteristics of the Phylum Apicomplexa. General biological cycle.

*Toxoplasma gondii*: Geographical distribution. Life cycle in the human organism. Infective stages. Acquired toxoplasmosis in immunocompetent and immunocompromised individuals. Representative symptoms. Congenital toxoplasmosis. Causes. Factors that influence the disease. Symptomatology.

Diagnosis of toxoplasmosis.

Treatment of toxoplasmosis (immunocompetent, immunocompromised and pregnant women).

Epidemiology of toxoplasmosis: Routes of transmission and infectious stages. Influencing factors. Importance of felines.

Relate:

Life cycle and epidemiology with the prevention and control of toxoplasmosis acquired and congenital toxoplasmosis measures.

**UNIT 9. Suborder Haemosporina. Plasmodiidae family. *Plasmodium*: species causing human malaria. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

Main species of the genus *Plasmodium* that affect humans. Morphology and general biological cycle.

Malaria or malaria: Geographical distribution. Typical symptoms and causes that produce it. Cerebral malaria. Relapse of malaria.

Disease diagnosis. Samples and techniques used.

Antimalarial drugs.

Epidemiology of malaria: Transmission routes. Influencing factors. Main vectors.

Relate:

Life cycle, epidemiology, prevention and control measures. Chemoprophylaxis.

**UNIT 10. Phylum Platyhelminthes. General. Classification. General characteristics of**



**trematodes. Digenea subclass. Study of human monoicos flukes of interest. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

General characteristics of the Phylum Platyhelminthes. Classification.

General characteristics of flukes. Morphology. Phases of the life cycle. Classification.

*Fasciola hepatica*: Geographical distribution. Identifying morphological characteristics. Life cycle. Characteristic symptoms. Epidemiology of the disease: Routes of transmission of the parasite. Factors affecting transmission. Main drugs against the parasite.

Relate:

Location within the human organism and sample used for diagnosis. Main techniques used. False parasitism.

Life cycle, epidemiology, prevention and control measures.

**UNIT 11. Flukes dioecious. Genus *Schistosoma*: parasitic species of man. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

Genus *Schistosoma*. Major producing species of schistosomiasis in human. Geographical distribution. Identifying morphological characteristics. General biological cycle.

Relate:

The life cycle in the human body with symptoms that occur at different stages: penetration of the cercaria, migration and maturation, oviposition.

Location within the human organism and sample used for diagnosis. Main techniques used

Knowing / understanding:

Treatment of schistosomiasis.

Epidemiology of the disease. Species involved. Intermediate hosts. Transmission routes. Factors involved.

Relate the biological cycle, epidemiology, prevention and control measures.

**UNIT 12.- General characteristics of tapeworm parasites. Classification. Pseudophyllidea order. *Diphyllobothrium latum*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

General characteristics of tapeworms. Morphology. Fixing organs. Instruments and systems. Classification. General biological cycles.

*Diphyllobothrium latum*: Geographical distribution. Identifying morphological characteristics. Life cycle. Epidemiology of the disease: Routes of transmission of the parasite. Factors affecting transmission.

Distinctive anemia symptoms of tapeworm.

Relating the location within the human organism with sample used for diagnosis. Main techniques used.

Knowing the main drug against the parasite

Relate the biological cycle, epidemiology, prevention and control measures.

**UNIT 13.- Order Cyclophyllidea. Genera *Taenia* and *Echinococcus*. Study of the morphology,**





**biology, epidemiology, symptoms, diagnosis, treatment, prevention and control. Other tapeworms of interest.**

Knowing / understanding:

*Taenia saginata* and *T. solium*. Geographical distribution. Morphology and life cycle. Epidemiology. Substantial differences between the two species.

Symptoms produced by adult tapeworms in humans. Diagnosis and treatment of teniosis.

Cysticercosis. Etiologic agent. Transmission mechanisms. Main affected tissues and organs. Diagnosis and treatment of cysticercosis.

Relating biological cycles and epidemiology of *T. solium* and *T. saginata* with preventive and control measures for both adults and cysticercosis

Knowing / understanding:

*Echinococcus granulosus*: Geographical distribution. Identifying morphology and biological cycle.

Unilocular hydatid cyst. Development. Main affected organs. Symptomatology. Diagnosis and treatment. Epidemiology: Mechanisms of transmission. Factors influencing epidemiology. The dog as a reservoir.

Relate the biological cycle, epidemiology, prevention and control measures for adult and for the hydatid cyst.

Knowing *E. multilocularis* and establishing core differences with *E. granulosus*.

**UNIT 14. Phylum Nematoda. General characteristics of parasitic nematodes. Classification. Adenophorea class. Genera *Trichuris* and *Trichinella*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

General characteristics of the Phylum Nematoda: Morphology. Devices and systems. Phases of the life cycle. Classification.

*Trichuris trichiura*: Geographic distribution. Identifying morphological characteristics. Life cycle. Distinguishing symptoms. Epidemiology of the disease: Routes of transmission of the parasite. Factors affecting transmission. Main drugs against the parasite.

Relate:

Location within the human organism with sample used for diagnosis. Main techniques used.

Life cycle, epidemiology, prevention and control measures.

Knowing / understanding:

Genus *Trichinella*. Geographical distribution. Identifying morphological characteristics. Life cycle.

Relate:

The life cycle in the human organism that produces symptoms.

Location within the human organism with sample used for diagnosis. Main techniques used

Treatment of trichinosis.

Knowing / understanding:

Epidemiology of trichinosis. Species involved. Transmission routes. Maintenance in nature. Factors involved.

Relate the biological cycle, epidemiology, prevention and control measures.



**UNIT 15. Class Secernentea. Superfamily Ancylostomatoidea: parasitic species affecting humans belonging to the genera *Ancylostoma* and *Necator*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control. *Strongyloides* spp.**

Knowing / understanding:

Hookworms. *Ancylostoma* and *Necator*. *Strongyloides* spp. Geographical distribution. Identifying morphological characteristics. General biological cycle.

Epidemiology of the disease: Routes of transmission of the parasite. Factors affecting transmission.

Relate:

Symptoms produced according to the location within the human organism.

Location within the human organism and sample used for diagnosis. Main techniques used.

Knowing the main drugs used against the hookworm.

Life cycle, epidemiology, prevention and control measures.

**UNIT 16. Superfamily Ascaridoidea: *Ascaris lumbricoides*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

**Visceral larva migrans. Anisakidosis.**

Knowing / understanding:

*Ascaris lumbricoides*. Geographical distribution. Identifying morphological characteristics. Life cycle.

Epidemiology of the disease: Routes of transmission of the parasite. Factors affecting transmission.

Relate:

Symptoms produced according to the location within the human organism.

Locations in the human organism and sample used for diagnosis. Main techniques used.

Knowing the main drugs used against *Ascaris*.

Relate:

Life cycle, epidemiology, prevention and control measures.

Knowing / understanding:

The main producing species for anisakidosis, how can a person become infected, main symptoms that occurs, how it is diagnosed and treated and what preventive and control measures are most effective.

Knowing / understanding:

Concept of visceral larva migrans, main producing species, how can a person become infected, main symptoms produced, how it is diagnosed and treated and what are the most effective preventive and control measures.

**UNIT 17. Superfamily Oxyuroidea: *Enterobius vermicularis*. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

*Enterobius vermicularis*. Geographical distribution. Identifying morphological characteristics. Life cycle.

Epidemiology of the disease: mechanisms of transmission of the parasite. Factors involved.

Relate:

The symptoms that can occur according to the different locations in human.

Locations in the human organism, life cycle and sample used for diagnosis. The Graham test.

Knowing the main drugs used for its eradication.





Relate life cycle, epidemiology, prevention and control measures.

**UNIT 18. Superfamily Filarioidea: characterization of the genera and species of interest. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

**Superfamily Dracunculoidea. Study of the morphology, biology, epidemiology, symptoms, diagnosis, treatment, prevention and control.**

Knowing / understanding:

Identifying morphological characteristics of filarial worms. General biological cycle. Main species infecting human

*Onchocerca volvulus* and onchocerciasis or "river blindness". Geographical distribution. Morphological and biological characteristics identifying the parasite. Distinctive symptoms.

Epidemiology of the disease: Routes of transmission of the parasite. Factors that affect transmission

Relate location within the human organism, life cycle of the parasite and sample used for diagnosis.

Knowing / understanding:

*Wuchereria bancrofti* and lymphatic filariasis. Geographical distribution. Morphological and biological characteristics of the parasite. Characteristic symptoms.

Epidemiology of the disease: Routes of transmission of the parasite. Factors that affect transmission

Relate location within the human organism, life cycle of the parasite, and sample used for diagnosis.

Knowing / understanding:

*Loa loa* and loiasis. Geographical distribution. Morphological and biological characteristics identifying the parasite. Characteristic symptoms.

Epidemiology of the disease: Routes of transmission of the parasite. Factors that affect transmission

Relate location within the human organism, life cycle of the parasite, and sample used for diagnosis.

Knowing the main drugs used against filarial worms.

Relate the biological cycle, epidemiology of filarial, prevention and control measures.

*Dracunculus*. Geographical distribution. Morphological and biological characteristics.

Characteristic symptoms. Epidemiology of the disease: Routes of transmission of the parasite. Factors that affect transmission

Relate location within the human organism, life cycle of the parasite and sample used for diagnosis and with the eradication of the parasite.

Relate the biological cycle, epidemiology, prevention and control measures.

**UNIT 19. Phylum Arthropoda. General characteristics. Classification. Class Insecta. Study of the main parasite species and / or vector.**

Knowing / understanding:

General characteristics of the Phylum Arthropoda. Classification.

General characteristics of the class Insecta. Classification.

Order Anoplura. Study of the parasitic lice affecting man. *Pediculus humanus* and *Phthirus pubis*. Identifying morphological characteristics. Life cycle. Transmission mechanisms.

Symptoms.



Diagnosis. Treatment. Prevention measures. Lice as disease vectors.

Order Diptera. Suborder Cyclorhapha. Screwworm flies producing miasis in man. Identifying morphological and biological characteristics. Miasis types. Diagnosis. Treatment. Prevention and control.

Suborder Nematocera. Main vector species.

Other insects of public health importance.

## **UNIT 20. Class Arachnida. Subclass Acari. Study of the main parasite species and / or vector.**

Knowing / understanding:

Identifying characteristics of mites.

*Sarcoptes scabiei* and scabies. Morphological characteristics. Life cycle. Transmission mechanisms. Symptoms of scabies and most affected areas. Diagnosis. Treatment. Prevention and control measures.

Other mites of interest.

Ticks: hard and soft ticks. Morphological and biological differential features. Species of interest.

Vector role of ticks.

### **PRACTICAL SYLLABUS:**

#### **Seminars / Workshops**

- Exercises, clinical cases and their resolution on programme topics.
- Epidemiology, prevention and control of diseases caused by protozoa of oral-fecal transmission.
- Prevention and control of diseases caused by blood and tissue protozoa.
- Intestinal protozoan drugs.
- Treatment used in diseases caused by flukes and tapeworms and nematodes.

#### **Laboratory practices**

**PRACTICE 1.** Observation of arthropod pests and/or vectors.

*Pediculus humanus*, *Ctenocephalides canis*, *Rhodnius prolixus*, *Glossina* sp., *Anopheles* spp., *Culex* sp., *Phlebotomus* sp., *Rhipicephalus sanguineus*, *Argas* sp.

**PRACTICE 2.** Study the life cycle of trematodes. Observation of parasitic species affecting man.

*Fasciola hepatica*, *Dicrocoelium dendriticum*, *Schistosoma* sp.

**PRACTICE 3.** Study of the life cycle of tapeworms. Observation of parasitic species affecting man.

*Diphyllobothrium latum*, *Taenia* sp., *Echinococcus granulosus*.

**PRACTICE 4.** Observation of adult and larval stages of parasitic nematodes affecting man.

*Trichuris trichiura*, *Trichinella spiralis*, *Ascaris lumbricoides*, *Toxocara canis*, *Enterobius vermicularis*, *Ancylostoma* sp., microfilaria.

**PRACTICE 5.** Observation of parasitic protozoa affecting man



*Entamoeba histolytica*, *Giardia lamblia*, *Trypanosoma cruzi*, *Leishmania* sp., *Trichomonas vaginalis*, *Plasmodium falciparum*, *Isospora belli*, *Toxoplasma gondii*, *Balantidium coli*.

#### READING

- Adroher, F.J.; Campos, M.; Hueli, L. (coord.). 2004. Guía Práctica de Parasitología. Facultad de Farmacia. Universidad de Granada. 175 pp.
- Ash, L.; Orihel, T. 2010. Atlas de Parasitología Humana. 5ª edn. Editorial Médica Panamericana.
- Beaver, P.C.; Jung, R.C.; Cupp, E.W. 1990. Parasitología Clínica. Salvat, 880 pp.
- Cook, G.; Zumla, A. (eds). 2003. Manson's tropical diseases. Saunders. 1847 pp.
- Cordero del Campillo, M. et al. 2007. Parasitología General. MacGraw-Hill Interamericana. 162 pp.
- Cordero del Campillo, M.; Rojo Vázquez, F.A. (coord.) 2000. Parasitología Veterinaria. MacGraw-Hill Interamericana de España, 968 pp.
- Diccionario terminológico de Ciencias Médicas. 1990. 12ª edn. Salvat Editores, S.A.
- Guerrant, D. et al. (eds). 2002. Enfermedades infecciosas tropicales. Elsevier Science, 688 pp.
- Markell, E.K.; John, D.T.; Voge, M., 1994. Parasitología Médica. 6ª edn. Interamericana McGraw-Hill, 395 pp.
- Neva, F.A.; Brown, H.W.; 1994. Basic Clinical Parasitology. 6th edn. Prentice Hall International, 356 pp.
- Orihel, T.C.; Ash, L.R. 1995. Parasites in Human Tissues. ASCP Press. 386 pp.
- Peters, V. 1992. A colour atlas of arthropods in Clinical Medicine. Wolfe Publishing Ltd.
- Roberts, L.S.; Janovy, J. 2000. Foundations of Parasitology. 5th edn. WCB, 659 pp.
- Zaman, V. 1998. Atlas color de Parasitología clínica: un atlas de protozoarios, helmintos y artrópodos. 2ª edn. Panamericana, 335 pp.

#### RECOMMENDED INTERNET LINKS

- [http://www.ugr.es/~parasito/otros\\_enlaces.html](http://www.ugr.es/~parasito/otros_enlaces.html)
- <http://www.who.int/tdr/diseases-topics/en/>
- <http://www.cdc.gov/dpdx/>
- <http://www.microbiologybook.org/book/parasit-sta.htm>
- <http://www.atlas-protozoa.com/index.php>
- [http://biblioteca.ugr.es/pages/biblioteca\\_electronica](http://biblioteca.ugr.es/pages/biblioteca_electronica)

