PARASITOLOGY
THE COURSE BOOKLET
FOR STUDENTS & STAFF
THE ACADEMIC YEAR 2004-2005
PRE-CLINICAL STAGE

BY
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Introduction

The staff involved in teaching Parasitology welcome you to the course.

Parasitology course should be rewarding and enjoyable, but it requires a strong sense of commitment from students and their active participation and attendance for all aspects of the course. We strongly urge students to take the time to read through this booklet, it contains most of the information that you will need during the year.

While the information contained in the document is correct at the time of printing we reserve the right to make changes. The current version of this booklet is available on the college web site.

Since this course is specifically tailored for students medical professions, details of such aspects of *Parasitology* as classification, nomenclature, are usually omitted although parasite recognition and its morphology is essential.

Because this course is offered before students are acquainted with clinical subjects, the clinical aspects resulting from host-parasite interaction are presented. This would of course be dealt with in full details in subsequent clinical courses.

In the host-parasite relationships, considered pathological conditions do occur. These are covered to some depth in this course although the intricate pathological probing are reserved for the pathology department.

Throughout the *Parasitology* course, attempts are made at emphasizing those parasitic diseases that are of great actual or potential importance to humans.

STATING OBJECTIVES:

The process of stating objectives in behavioral terms places the staff in a situation where staff is called upon to examine what they intend to teach as well as motivation for teaching the content.

Stated objectives serve as criteria for the staff that determines whether they had actually taught and what they intended to teach.

The use of objectives increases the opportunity for decision making. They provide a definition of what is to be covered in the students’ special syllabus.

Aims & Intended Learning Outcomes

**Aims of the Course**

- To equip students with a fundamental understanding of science and competence in parasitological methods.
- To stimulate and foster a sense of excitement in Parasitology as an approach to understanding living organisms.
• To provide advanced knowledge, understanding, and critical judgment appropriate for professional employment in Parasitology or a related discipline
  
  By:
  
  • providing a broad-based knowledge and understanding of Parasitology.
  • providing basic practical skills and experience of laboratory techniques in Parasitology.
  • encouraging the development of skills relating to the systematic acquisition of factual information and data.
  • encouraging the critical analysis, interpretation and discussion of factual information, data and issues in Parasitology.
  • providing opportunities to practice and improve written and oral communication skills.
  • providing training in problem solving and data analysis.

Intended Learning Outcomes of the Course:
At the end of the course the student should be able to:
  * describe in details the life cycle of medically important parasites.
  * define the organs commonly involved in the infection.
  * recall the relationship of this infection to symptoms, relapse and the accompanying pathology.
  * arrange the factors that determine endemicity of the parasite infection
  * state the distribution and epidemiology of the parasites
  * explain the methods of parasite control, e.g. chemotherapy, molluscicides, general sanitation plus describing the advantages and disadvantages of each method.
  * demonstrate a broad understanding of the central facts and the experimental basis of modern Parasitology.
  * solve problems in the context of this understanding.
  * demonstrate practical skills in fundamental parasitological techniques.
  * present and interpret results obtained from using these techniques.
  * present information clearly in both written and oral form.
COURSE GOALS:
The goals of the course are to equip students with a fundamental understanding of parasitology science and competence in relevant recent parasitological techniques. Also providing the future doctors with the advanced knowledge, understanding, and critical judgment appropriate for professional employment in Parasitology or a related discipline.

Course objectives of Parasitology:
Generally the objectives of the course to be developed, a comprehension of the structure, function, and ecology of parasitic parasites should be fulfilled.

Objectives of medical Parasitology are classified into ultimate objectives which to be fulfilled by the end of the course and the sub-objectives which to be conducted during the whole course to achieve the ultimate objectives.

ULTIMATE OBJECTIVES:
The students will aquatint fairly good knowledge about tropical and subtropical problems, its impact upon health in UAE and the universe.

The Sub-Objectives
To achieve the ultimate objectives the following sub-objectives are going to be categorized in units.
Unit 1- Definitions and classifications of Medical Parasitology
Unit 2- Modes of Transmission
Unit 3- Management (clinical ,laboratory diagnosis and treatment).
Unit 4 - Prevention and Control.
Unit -1: Definitions of Medical Parasitology:-
1. Students will be able to define the Helminthology - Protozoology and Entomology
2. Students will be able to recognize the exact definitive and intermediate hosts for parasitic diseases.
3. Students will be able to identify the final habitat of each disease and relate it to the symptoms and signs.
4. Students will be able to describe the specific characters of each parasitic class and its morphological features.

Unit II: Modes of transmission:-
1. Students should be able to identify different modes of transmission of different diseases. Whatever oral ingestion, inhalation, blood transfusion, skin penetrating or inoculation by a vector.
2. Students will acquire the skills regarding preventive measures in parasitic infections.
3. Students will identify different diseases having reservoir hosts and locating them.

Unit III: Management (clinical, laboratory diagnosis and treatment).:-
- Symptoms and signs of parasitic infections (clinical manifestations).
- The proper diagnostic techniques to confirm diagnosis of parasitic infections.
- Drugs of choice in treatment of parasitic infections.
1. Students will understand simple pathological changes caused by the parasite each according to its final habitat.
2. Students will be able to recognize general manifestations and specific ones.
3. Students should stress upon cardinal symptoms and signs in order to differentiate between diseases on clinical basis.
4. Students will distinguish different direct and indirect methods of diagnosis. Acquire skills of selection of easier and proper method.
5. Students will identify different drugs and will be able to select the drug of choice as regards simple way of administration less number of dosages, effective fast results with minimal side effects.
Unit IV: Prevention and Control:-
1. Students will acquire the skills in selecting best point of interference to cut the cycle of infection.
2. Students will be able to describe the best method of health education concerning with personal and public protection.

Outline of the course content:
Students are obliged to attend all scheduled meetings of the class.
Course Structure
The course in Medical Parasitology covers Protozoology, Helminthology and Medical Entomology. Because of the latter subject, Parasitology traverses the fields mentioned above to even include some aspects of arthropod-borne viruses, rickettsieae and bacteria.

Throughout this course, considerable emphasis is laid on the medical aspects of Parasitology including:
1. Identification of parasites.
2. Life cycles.
3. Epidemiological factors.
4. Host-parasite relationships.
5. Immunity to parasites.
6. Recent molecular techniques.
7. The appropriate preventive and control measures.

INSTRUCTION MEDIA AND METHODS OF TEACHING
1. Programmed Lectures:-
   Lecturing program: 55 hours teaching lectures, distributed upon 2 semesters of the 2nd academic year. The first semester there are 35 lectures, and the second semester there are 20 lectures each 1-hour. The lectures are given by senior academic staff, who has experience in teaching, delivers lectures.
   • Participation of students is essential, they are informed previously about the topic of the lecture.
   • In the beginning of the lecture, the teacher inquires about students’ expectation and sets objectives of the lecture.
   • Some important points of the previous lecture are asked about.
   • Students ask about non-clear points and the teacher joins the previous with the new lecture.
   • Teacher proposes some simple problems to be solved by students currently during the lecture.
   • At the end, a summary of the content is presented by 2 or 3 students. Followed by organized summary by the teacher.
• Visual aids like transparencies, power point presentations are used in the lecture.
• Audio-visual video films are also used to illustrate and clarify theoretical lectures and make it easier to remember.

2. **Practical attachment:** Students are going to have practical classes of total 20 hours, in both semesters arranged according to the syllabus each session 2 hours.

3. **Problem solving sessions.** A teacher chairs the sessions and relevant tropical problems are discussed.

4. **Seminar:** Elective Seminar are going to be chosen by students, presented and discussed together with other related department.
Introduction and definitions

Classification:
1. Protozoology.
2. Helminthology.
3. Medical entomology.

Objectives of the Course:
- The course should start by definitions and classifications of parasites.
- At the beginning of the course the students should be able to identify the term *Parasitology*.....that is the area of biology.....etc.
- The second point is classification of the parasites that is either:
  1. Single celled (Protozoan) or:
  2. Helminthes (Worms) or:
  3. Insects (Entomology).
- The third point is the definition of different signs & symptoms of parasitic diseases e.g the student should define dysentery ‘frequent passage of motions with mucus and blood flecked stool’. Also Eosinophilia is the elevation of eosinophilic count above normal levels ……..etc.

Protozoa & Helminthes
The students should describe different criteria concerning each parasite:
1. Explanation of the morphology of the parasite in-order to identify the parasite under the microscope in the laboratory.
2. The habitat or the site of the parasite as in Entamoeba histolytica that inhabits the large intestine.
3. Infective stage and mode of transmission.
4. Definitive host, intermediate host and reservoir host of any parasite.
5. Signs and symptoms of any parasitic infection.
6. Laboratory diagnosis and treatment parasitic diseases.

Helminthology

*Class trematoda (flukes)*:
1. *Fasciola gigantica & Fasciola hepatica* (Liver flukes).

Objectives:
The students should recognize the morphology of the worms, their life cycle, pathogenesis, diagnosis & treatment.
**Pre-requisites:**
They should recall the anatomy, structure & function of the liver. They should name also the anatomy, structure & function of the intestine.

In addition they recognize the pathological changes in the liver and intestine in those parasitic diseases.

3. **Human Schistosomes.**
4. **Snails of medical importance.**

**Objectives:**
The students should name those blood flukes (Schistosomes) that inhabit the venous plexuses draining the urinary bladder, large intestine & small intestine. All about Schistosomes should be discussed such as the morphological features, clinical picture, diagnosis, treatment, and ways of the prevention and control.

Regarding the snails of medical importance the student should be able to identify different snails and their pathogenicity.

**Pre-requisites:**
The students should recognize the pathology of both urinary and intestinal bilharziasis that causes severe pathology and complications.

*Class Cestoda (tape worms):*
1. *Diphyllobothrium latum.*
2. *Taenia saginata.*

**Objectives:**
The student should recognize the three cestoda worms concerning the differences in morphology, life history, pathogenesis, clinical presentation of the disease, its diagnosis & treatment.

**Pre-requisites:**
Those worms inhabit the small intestine, so the intestinal lesion which is caused by worms plus B_{12} deficiency anemia caused by *D. latum* should be covered in pathology.

Human larval cestode (cysticercosis) that affect the, brain, skin, eye or musculo-skeletal system of man should be covered in the pathology subject.

5. *Dipylidium caninum.*
7. *Hymenolypis nana.*
Objectives:
As regard Echinococcus granulosus the larval stage (hydatid cyst) is present in tissues of man. It produces a fatal condition known as hydatid disease, so the student should cover all the points of the structure of the parasite, life cycle clinical picture, pathogenesis as well as the treatment measures that may extend to surgical interference.

Pre-requisites:
The pathology department should cover very well the pathological aspects of hydatid disease since it is one of the prevalent diseases.

Class Nematoda (round worms):
1. Ascaris lumbricoides.
2. Toxocara canis and cati.
3. Entrobius vermicularis.
4. Strongyloid stercoralis.
5. Tchinella spiralis.
6. Trichocephalus.
8. Filarial worms.

Objectives:
Ascaris lumbricoides is a parasite of small intestine that causes intestinal inflammation which may be complicated by intestinal perforation, peritonitis, obstructive jaundice & appendicitis. Also pulmonary complication. Students should determine all details about this very important round worm.

Toxocara is a parasite of the small intestine of dogs and cats that causes a very severe pathological condition when man ingests the eggs (visceral larva migrans), so, the student should determine the morphology of Toxocara, mode of infection and the pathology of visceral larva migrans.

Strongyloid (dwarf thread round worm) causes intestinal infection in addition to shin manifestation as it has a cutaneous mode of transmission. Furthermore the pulmonary symptoms of the diseases should be considered. The student needs to learn the morphology, life cycle, clinical picture and ways of prevention.

Pre-requisites:
The pathology department should cover the pathological aspects these intestinal diseases, also anatomy and histology of the intestines should be covered.
Objectives:

**Trichiuris (whipworm)** is a parasite of large intestine that causes inflammation of the large bowel & dysentery. So the student needs to recognize the morphology of this worm, how man gets the infection, life cycle, clinical manifestations and management.

Pre-requisites:

The pathology department should cover the pathological aspects this intestinal diseases, also anatomy and histology of the large intestine should be covered.

Objectives:

**Hook worms** cause intestinal infection and iron deficiency anemia so the students should learn different types of anemia caused by other parasites and how to treat it. In addition, modes of transmission, signs and symptoms, diagnosis, treatment and preventive measures.

Pre-requisites:

The pathology department should cover the pathological aspects these intestinal diseases, also anatomy and histology of the intestines should be covered.

Objectives:

**Filarial worms** are very important as they are transmitted to man through the bite of an insect vector and the pathology varies from lymphangitis to lymphatic obstruction and elephantiasis. Also affection of eye with loss of vision, so the students should recognize all about the morphology and distribution of filarial worms. Moreover description of microfilaria in the blood film, types of insect vector that transmits the disease, clinical picture & management of filariasis.

Pre-requisites:

The normal blood film should be covered in histology. The students should be acquainted with the anatomy of lymphatic system. Also pathology of filariasis should be covered well in the pathology lectures.

Protozoa:

Objectives:

1. **Free living Amoeba**e Naegleria and acanthamoeba cause amoebic encephalitis. The students should identify the distribution, morphology, life cycle, pathology diagnosis and treatment of this condition.

Pre-requisites:
They should be able to determine histology of the meninges and pathology of meningitis.

Objectives:
2. *Parasitic amoebae*, E. histolytica that cause amoebic intestinal ulcers and extra-intestinal pathology in the form of amoebic liver abscess & brain Abscess. The students should describe the distribution, morphology, life cycle, pathology, diagnosis and treatment of amoebiasis.

Pre-requisites:
They should name the histology of the large intestine, liver and pathology of Amoebiasis (Amoebic ulcers in the intestine, amoebic liver abscess, lung abscess and brain abscess).

Objectives:
3. *Ciliates (Balantidium coli)*: A protozoan of the large intestine that causes Balantidium dysentery, a lesion similar to Amoebic dysentery. The students should determine the distribution, morphology, life cycle, pathology, how to diagnose and treat balantidiasis.

Pre-requisites:
They should identify the pathogenic inflammation of the large intestine and colon (colitis) & and the other parasitic causes that can cause this lesion and how to distinguish both. Objectives:
4. *Trichomonads (Trichomonas vaginalis)*: is a sexually transmitted protozoan parasite. The students must be able to determine the morphology, mode of transmission, pathology, management and prevention of trichomoniasis vaginalis.

Pre-requisites:
They should identify the pathogenic inflammation of the vagina [vaginitis] & and the other non parasitic causes that can cause vaginitis such as Neisseria gonorrhea, candida albicans and anaerobic vaginosis in Microbiology.

5. *Hemosomatic flagellates: Leishmania and Trypanosoma*:
Objectives:
The students should distinguish the morphology of these flagellates, their shapes in the blood smear and other specimens, their life cycle, pathological features plus diagnosis and treatment of these parasitic infections.

Pre-requisites:
The students should recall the normal blood film from Histology. Also Motility & innervations of GIT in physiology.

Objectives:
6. Malaria which is a parasite of RBCs that causes severe Anemia & splenomegaly. Students should have identify the morphology of malaria parasites, their life cycles, their vector (Anopheles) and pathogenesis.

**Pre-requisites:**
- The students should memorize well the structure of normal blood film, from the histology.
- Different types of Anemia in physiology and pathology should be covered.

**7. Opportunistic parasites:**

**Objectives:**
- *Toxoplasma gondii* that cause encephalitis in AIDS patients and affects severely the pregnant women.
- *Cryptosporidium parvum* and *Isospora belli* that cause severe diarrheal disease in immune-compromised patients (AIDS patients).
- *Pneumocystis carinii* that causes severe pneumonia and respiratory failure in immunocompromised patients.

**Pre-requisites:**
- The students should recognize well the anatomy of the brain and pathology of encephalitis caused by *Toxoplasma gondii*.
- Concerning the *Cryptosporidium* and *Isospora*, they should state the histology of the duodenum and its pathology (duodenitis).
- Immunological status of immune-compromised patients (immunology).

**Arthropods:**

**Arthropods (Insects injurious to man):**
- **Class insecta:** Mosquitoes, flies, bugs, lice and fleas.
- **Class Arachnida:** Ticks, mites and scorpion.
- **Class Crustacea:** Cyclops.

**Objectives:**
Most of arthropods have been accused to transmit or cause serious diseases in humans so the students should identify the medical importance of arthropods plus other important points such as:
- a. Insects’ morphology.
- b. Diseases transmitted or caused by arthropods.
- c. The causative organism.
- d. Incubation period.
- e. Signs & symptoms of the disease.
- f. Treatment and prevention.
Examples of diseases transmitted by arthropods (arthropod borne diseases):

- Sleeping sickness transmitted by Glossina fly.
- Chaga’s disease transmitted by winged bug.
- Malaria transmitted by mosquitoes.

Examples of diseases caused by arthropods (mites):

- Scabies which is a contagious kin disease caused by sarcopes scabii.

Pre-requisites:

The students should recognize and recall different arthropods borne viral and bacterial infections in microbiology.
**Practical Sessions:**
*Practical sessions are very important to confirm the theoretical data that have been taught in lectures, so the practical sessions and the lectures are considered complementary to each other.*
*Practical session is designed to identify different types of parasites & vectors from the morphological point of view.*
*At the end we can consider Parasitology an important subject in medicine as it touches deeply a lot of branches e.g. medical laboratories and tropical medicine.*

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**Examination Procedures:**

**Setting of papers:** Question papers are written and reviewed by internal examiners and checked by the External Examiner in oral examination day.

**Marking:** Answer books are corrected and marked by the internal examiner.

**Board of Examiners:** This committee of both internal and the external Examiner evaluate all students during oral examination.
Students Evaluation Procedure:
Assessment of Parasitology Coursework
The total marks for parasitology subject are 100 marks distributed as follow:

**Year Assessment Marks count for 30% of the final grade:**
- **Class sharing**
  Class sharing counts for 5% of students final grade.
- **Seminars**
  Seminars marks count for 5% of students final grade.
- **Attendance**
  Attendance counts for 5% of students final grade.

**Final Exams Marks count for 70% of the final grade:**
- **Written Papers**
  Written papers count for 35% of students final grade.
- **Oral exam. marks**
  Oral marks count for 15% of students final grade.
- **Practical exam. marks**
  Practical marks count for 20% of students final grade.
NEWLY ADDED TOPICS TO THE OLD SYLLABUS:
(DECEMBER 1998):

- Signs and symptoms of parasitic diseases.
- Free living amoebae.
  - Naegleria fowleri.
  - Acanthamoeba castellani.
- Phylum Apicomplexa.
  **Toxoplasma gondii.**
  **Cryptosporidium parvum**
  **Isospora belli.**
- Pneumocytis carinii.
- Class Trematoda
  **Fasciola gigantica**
  **Metagonimus yokogawi**
  **Snails of medical importance.**
- Immunity to parasites
- Diagnostic methods

NEWLY ADDED TOPICS TO THE OLD SYLLABUS:
(SEPTEMBER 2003):

- Class trematoda:
  1. Capillaria hepatica.
  2. Capillaria aerophila
  3. Capillaria Philipinensis.

NEWLY ADDED TOPICS TO THE OLD SYLLABUS:
(SEPTEMBER 2004):

- Sarcocystis species
- Microspora species

NEWLY ADDED SLIDES, JARS AND SNAILS: TO PRACTICAL SESSIONS

1. Entamoeba histolytica trophozoite.
2. Entamoeba histolytica cyst.
4. Plasmodium falciparum gametocyte, thick blood films.
5. Giardia intestinalis trophozoite.
7. Leishmania donovani, spleen.
8. Balantidium coli trophozoite.
11. Pneumocytis carinii human lung
13. Shistosoma mansoni male.
14. Taenia solium adult.
15. Hymenolepis diminuta adult.
16. Real snails of medical importance.
17. Taenia egg.
18. D. latum mature segment.
19. Encysted metacercaria of heterophyes.
20. Entrobius egg.
22. Hydatid Cyst.
23. Trichina Capsule.
24. Dipylidium caninum Scolex.
25. Fasciola egg.
26. Entrobius male.
27. Ancylostoma mouth.
28. Taenia mature segment.
29. S. Mansoni copula
30. Fasciola cercaria
31. Hymenolepis diminuta mature segment.
32. D. caninum gravid segment.
33. Ascaris egg.
34. Heterophyes egg.
35. Ancylostoma female.
36. A jar for Fasciola gigantica adult.
37. A Jar For Taenia adult.
38. A Jar for Hydatid Cyst liver.
39. A Jar For Ascaris Female.

NEWLY ADDED SLIDES : TO PRACTICAL SESSIONS (October 2004):
1. Diphyllobothrium egg.
2. Trypanoaoma cruzi (blood film).
3. Toxoplasma gondii (blood film).
4. Paragonimus westermani adult worm.
5. Leishmania amastigotes (blood film).
Plan Of Development In Parasitology Department

1. Updating of theoretical power point presentation through updating the information and enriching them with animated life cycle of different parasites. Since the rough estimation of students’ understanding to this portion during the lectures plus their answers in written examinations revealed that this portion needs more clarification. Thus we added the animated life cycles in lecture presentations to simplify the life history and allow the students to follow the parasite since the entrance of its infective stage till its full establishment of adult stage with motion.

2. Updating the lecture notes with addition of more illustrative diagrams and simplification of the information.

3. Stressing more on the case study as to our opinion, it is crucial to the students in the pre-clinical phase. Thus our future plan to direct the teaching method towards case study and problem solving.

4. Since practical sessions are very important to confirm the theoretical information that have been taught in lectures, and they are complementary to each other, we have annual addition of more fixed parasitological slides to the practical sessions plus addition of colored labeled cards for different parasites.

5. Cooperation between our department and parasitology department in Al-Ain university in order to update the syllabus and teaching course of parasitology plus getting teaching aids (Slides).

6. Planned cooperation with Dubai medical center to allow students to prepare and examine fresh smears for different parasite stages.

7. The world wide increase in the incidence of cancer and various types of immunodeficiency have resulted in parallel increases in the incidence of opportunistic parasitic infections and diseases as such we have added the most important and prevalent opportunistic parasites.

8. Our future plan is to provide students of Dubai medical college not only with knowledge in conventional medical parasitology such as life cycles, structure function relationships and clinical disease presentations and classical methods of diagnosis, but also to introduce students to recent developments in serological and molecular understanding of parasitic diseases, application of imaging, serological and molecular technologies for diagnosis of parasitic diseases.

9. We are planning to provide students with a practical book for parasitology. Since estimation of the drawing skills of the students revealed that most of the students skip the drawing questions in the written exams. Thus introducing a practical book with marks will enforce the students to improve their skilled drawings of different parasites and parasite life cycles diagrams.