



MICROBIOLOGY - channel 3

MED/07 - 7 CFU - 1° Semester

Teaching Staff

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LEARNING OBJECTIVES

MICROORGANISMS AND PARASITES: INFECTION OF THE HOST

Identify the different types of relationship that microorganisms and human parasites have with the host, differentiating the phenomenon "infection" from that of "disease".

Correlate the virulence mechanisms of microorganisms and parasites with the various "types" of infection and pathological conditions induced.

Analyze the critical factors that determine the "contagion" and the spread of microorganisms and parasites in relation to their unique biological characteristics.

Distinguish different "types" of viral infection; differentiate a viral infection from that induced by other microorganisms and parasites.

BIOLOGICAL ESSENTIAL FEATURES OF MICROORGANISMS and PARASITES RESPONSIBLE FOR HUMAN INFECTIONS

Classify microorganisms and parasites in the various stages of aggregation of living matter (metazoans, prokaryotes, eukaryotes, viruses), correlating the degree of organization with the pathogenic action.

As part of the structural organization of the microorganisms and parasites, identify the structures / functions necessary to carry out metabolic processes and replication, and to determine the infection or disease in the host.

Correlate variation and mutation phenomena in microorganisms and parasites with the pathogenic action and resistance to antimicrobial substances.

THE MICROORGANISMS AND THE ENVIRONMENT

Assess the degree of resistance (survival) in the environment of microorganisms and parasites as a critical factor for the infection of the host.

CONTROL OF INFECTIONS

Chemotherapy:

Define the principle of "selective toxicity" finalizing the therapeutic use of antimicrobials.

Describe and classify the inhibitory mechanisms, the site of action, the antibiotic spectrum of action, as well as for antiviral, antifungal and antiprotozoal substances.

Disclose assumptions biological of antibiotic resistance (genotypic and phenotypic) and the resistance to other antimicrobial agents (anti-viral, anti-fungal, anti-protozoal).

Analyze the limits of antiviral chemotherapy in relation to the biological characteristics of the virus and pathogenesis of viral infection.

Assess the experimental procedures to interfere on the different functions of microorganisms and parasites by use of inhibiting substances.

Antimicrobial vaccines:

Define immunization practices relating it to the prevention of human infections and possibly with the treatment of an infectious disease (vaccine prophylaxis or vaccine therapy).

Define the practice of treatment with immune sera (serum prophylaxis and serum therapy) correlating with the prevention of human infection and the treatment of an infectious disease.

Indicate the composition of a vaccine and of an antimicrobial immune serum.

Identify the meaning and the current limits of the vaccination in the control (or eradication) of bacterial and viral infections.

Evaluate the results and prospects of experimental prophylaxis of fungal infections and parasites.

List the major antimicrobial vaccines currently in use by defining the essential characteristics.

Identify the limitations of vaccination with whole microorganisms (killed or attenuated) by analyzing the theoretical - applicative perspectives arising from the use of new vaccines obtained with molecular biology techniques.

MICROORGANISMS AND PARASITES RESPONSIBLE FOR HUMAN INFECTIONS

Identify the most essential biological characteristics and pathogenicity of microorganisms and parasites for man as preparatory study to clinical microbiology (CI Medical laboratory).

Critically analyze and describe, for each "species": the way of entry into the body, the differentiated spread in the infected, the presence of antigens in the various districts of the organism (blood, secretions, excretions) for the purpose of "contagion" and laboratory diagnosis.

Describe briefly the characteristic features of a single disease and the main injuries for organs and systems.

COURSE STRUCTURE

Lectures

DETAILED COURSE CONTENT

Module of Bacteriology (3 credits)

1. Microorganisms and parasites: infection of the host

- a. Microorganism-host relationships.
- b. The microbial population normally resident in the human body.
- c. Essential characteristics and differences of bacteria, viruses, fungi, protozoa and other parasites known to infect humans.
- d. The pathogenic mechanisms of microorganisms.
- e. The various possibilities of infection and spread of infection.
- f. Infection control: key features of prevention and antimicrobial therapy

2. The prokaryotic cell

- a. Fundamentals of microbial physiology
- b. The organization of the bacterial cell
 - i. Structure and function of the cell wall
 - ii. Cellular components
 - iii. Accessory components (capsule, flagella, pili)
 - iv. Biofilms
 - v. The spore

3. The bacterial genetics and cell growth

- a. Transfer of genetic information in prokaryotes:
 - i. Recombination in bacteria: conjugation, transformation and transduction
 - ii. Plasmids and transposable elements.
- b. The bacterial cell cycle and division

4. The pathogenesis of bacterial infection

- a. The phases of bacterial infection
- b. Pathogenicity and virulence
- c. Mechanisms of pathogenicity
- d. Bacterial toxins
- e. The host response to bacterial infection

5. Infection control

- a. Sterilization, disinfection and antisepsis
- b. The antimicrobial chemotherapy:
 - i. Classification and main characteristic of principal groups of antibiotics
 - ii. Mechanism of action
 - iii. The antibiotic resistance
 - iv. Susceptibility testing
- c. Vaccines

6. The diagnostic principles of bacterial diseases

- a. Microscopic examination
- b. Direct diagnosis
 - i. Culture methods
 - ii. Other methods

c. Indirect diagnosis

i. Serological methods

7. Systematic Bacteriology (taxonomy, main characteristics, pathogenicity, infectious diseases, possibility of prevention, diagnosis and antibiotic chemotherapy)

a. Key Features of: *Staphylococcus*, *Streptococcus*, *Enterococcus*, *Neisseria*, *Branhamella*, *Mycobacterium*, *Streptomyces*, *Nocardia*, *Actinomyces*, *Corynebacterium*, *Lactobacillus*, *Bartonella*, *Listeria*, *Gardnerella*, *Bacillus*, *Clostridium*, *Enterobacteriaceae*, *Haemophilus*, *Pasteurella*, *Vibrio*, *Legionella*, *Brucella*, *Bordetella*, *Acinetobacter*, *Pseudomonas*, *Bacteroides*, *Campylobacter*, *Helicobacter*, *Mycoplasma*, *Ureaplasma*, *Chlamydiaceae*, *Rickettsiales*, *Spirochetales*

Module of Virology (2 Credits)

1. Viruses and sub- viral structures

a. The organization of the viral particle
b. Virus replication
c. Subviral pathogens: prions, viroids, and virusoides

2. The pathogenesis of the viral infection

a. Mode of transmission
b. Types of viral infection: acute and persistent infection (latent, slow, chronic, oncogenic)
c. The host response to viral infection
d. The interferon

3. The control of viral infections

a. The antiviral chemotherapy
i. Classification
ii. Mechanism of action and resistance
iii. Combined therapies
b. Vaccines

4. The diagnostic principles of viral diseases

a. Culture method
b. Culture independent and molecular methods
c. Serological methods

5. Key features of main viruses of medical importance:

a. *Poxviridae*, *Herpesviridae*, *Adenoviridae*, *Human Papillomavirus* and *Polyomavirus*, *Parvoviridae*, *Paramyxoviridae*, *Orthomyxoviridae*, *Picornaviridae*, *Arenaviridae*, *Bunyaviridae*, *Caliciviridae*, *Coronaviridae*, *Filoviridae*, *Flaviridae*, *Reoviridae*, *human retroviruses*, *Togaviridae* and *Rubivirus*, *Rhabdovirus*, Human hepatitis viruses (HAV, HBV, HCV, HDV, HEV, HGV)

Module of Mycology and Parasitology (2 Credits)

1. The Fungi

a. Characteristics of fungi and their metabolism
i. The fungal cell

2. Host-parasite relationships.

a. Mechanisms of pathogenicity
i. Micetism
ii. Mycotoxicosis
iii. Mycosis

- b. Pathogenesis of mycosis
 - c. Mode of infection
 - d. Origin, classification and description of mycosis
 - e. Dimorphism
 - f. The host defense to fungal infections
3. **The fungi responsible for mycosis**
- a. Primary pathogens: Dermatophytes, Dimorphics
 - b. Opportunistic mycosis
 - i. Yeasts: *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*
 - ii. Filamentous fungi: *Aspergillus*, *Fusarium*, *Zygomycetes*
 - c. Fungi responsible for subcutaneous mycosis
4. **The antifungal drugs**
- a. Antifungal drugs
 - i. Classification
 - ii. Mechanism of action and resistance
5. **The diagnostic principles of fungal diseases**
- a. Microscopy and culture isolation
 - b. Molecular methods
 - c. Serological methods
6. **Parasites**
- a. Morphological characteristics and pathogenic mechanism of action.
 - b. Essential characteristics and differences of human infections caused by protozoa and other human parasites.
 - c. The various possibilities of infection and spread of human parasitic infections.
 - d. The main parasites of medical importance
 - i. Protozoa (Flagellates, Amoebae, Coccidia, Microsporidia)
 - ii. Metazoans (Platyhelminthes and Nematodes)
7. **The antiprotozoal drugs**
- a. The main drugs
 - b. Vaccines
8. **The diagnostic principles for parasitic infections**
- a. Blood parasites
 - b. Enteric parasites and urinary tract parasites
 - c. Tissue parasites

TEXTBOOK INFORMATION

More recent edition

1. *Microbiologia Medica* - Murray P. R., Rosenthal K.S., Pfaller M. A. - Casa Editrice EDRA
2. *Principi di microbiologia medica* - Antonelli G., Clementi M., Pozzi G., Rossolini G.M. - Casa Editrice Ambrosiana
3. *Principi di microbiologia medica* - La Placa M. Edises

The books marked with the number 1 and 2 are those annotated at "programming" section. Eventual deepening, not mandatory, will be indicated in the "programming"

The student is free to choose any other textbook
