UNIVERSITÀ degli STUDI di CATANIA

DEPARTMENT OF DRUG AND HEALTH SCIENCES
Bachelor's Degree in Applied Pharmaceutical Sciences
Academic Year 2016/2017 - 1° Year

MICROBIOLOGY A - L

MED/07 - 6 CFU - 2° Semester

Teaching Staff

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LEARNING OBJECTIVES

To identify the different types of relationship that microorganisms and human parasites determine with the host, differentiating the "infection" from the "disease" phenomenon. To analyze the critical factors that determine the "contagion" and the diffusion of micro-organisms and parasites, correlating them with the relative peculiar biological characteristics. To classify microorganisms and parasites in the various stages of aggregation of living matter (metazoans, prokaryotes, fungi, viruses), correlating the degree of organization with pathogenic action. Within the structural organization of microorganisms and parasites, identify the structures / functions necessary to carry out metabolic processes and replication and to determine the infection / disease in the host. To correlate the phenomenon of variation and mutation of microorganisms and parasites with pathogenic action and resistance to antimicrobial substances. To evaluate the degree of resistance (survival) in the environment of micro-organisms and parasites as a critical factor for the infection of the host. To know the levels of prevention and protection in the production of pharmaceutical and nutraceutical products. To know the basic principles of self-control procedures: Sterility, Disinfection, HACCP etc.

DETAILED COURSE CONTENT

1. **The prokaryotic cell**
    a. The organization of the bacterial cell
        i. The capsule
        ii. The outer membrane and peptidoglycan
        iii. The cytoplasmic membrane
        iv. The pili
        v. Flagella and bacterial movement
        vi. The cytoplasmic organelles
        vii. The membrane transport and secretion systems

viii. Bacterial nucleoid

2. **Fungi, Algae, Protozoa and Helminths**
    a. Fungi
        i. Characteristics of fungi and their metabolism
        ii. The role of fungi in the environment and industry
        iii. Important fungi from the health point of view
        iv. The main antifungal
    b. Algae
        i. Algae Features
        ii. The main phylum of pharmaceutical interest
    c. Protozoa
        i. Characteristics of Protozoa
        ii. The important protozoa from the health point of view
        iii. The main anti-protozoal drugs
    d. Helminths
        i. Characteristics of Helminths
        ii. Flatworms: Flukes and Tapeworms
        iii. Nematodes
        iv. The main anti-helmintic drug
3. **Viruses and sub- viral structures**
    a. The organization of the viral particle
    b. Viral symmetry
    c. Replicative classes
    d. Prions
    e. Viroids and virusoides
    f. The bacteriophage
    g. The antiviral chemotherapy: major agents
4. **Bacterial metabolism**
    a. Bacterial nutrition and nutritional classification of bacteria
    b. The glycolytic pathways
    c. The gluconeogenesis
    d. Sugars alternative to glucose sugars:
        i. Utilization of polysaccharides (starch, glycogen, cellulose etc)
    e. Metabolism of nitrogen compounds
    f. The tricarboxylic acid cycle and glyoxylate cycle
    g. Bacterial respiration:
        i. oxidative phosphorylation
        ii. The anaerobic respiration
    h. Chemiolitotrophy
    i. The fermentative pathways
    j. Features of autotrophic metabolism
    k. Photosynthesis and its diversity
    l. Peptidoglycan synthesis
    m. Protein synthesis
    n. DNA synthesis
5. **The bacterial genetics and cell growth**
    a. The notion of genetic information transfer in prokaryotes
    b. Recombination from eukaryotes to prokaryotes

c. Plasmids
d. Conjugation,
e. Transformation
f. Transduction
g. Transposable elements
h. Mutations
i. The regulation of gene expression: LAC operon
j. The translational attenuation: the regulation of the TRP synthesis

6. **Cell growth and differentiation**
    a. The cell cycle
    b. The bacterial division
    c. Alternatives to "binary fission"
    d. Vital not cultivable status
    e. The microbial biofilms
    f. The spore and spore-forming bacteria
7. **Host parasite relationships**
    a. Bacterial infection
    b. Viral infection
    c. Fungal infection and its classification
    d. Parasitic infection
    e. The host response to infection
    f. Vaccines
8. **Diversity and systematics of the microbial world**
    a. Special Bacteriology (taxonomic classification, main characteristics, pathogenicity, infectious diseases, prevention opportunities, diagnostics and chemotherapy)
        i. The main 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, Rickettsiaceae, Spirochetaceae.*
    b. Special virology (taxonomic classification, main characteristics, pathogenicity, infectious diseases, prevention opportunities, diagnostics and chemotherapy)
        i. The main features of: *Poxviridae, Herpesviridae, Adenoviridae, Papillomavirus e Polyomavirus umani,Parvoviridae, Paramyxoviridae, Orthomyxoviridae, Picornaviridae, Arenaviridae, Bunyaviridae, Caliciviridae, Coronaviridae, Filoviridae, Flaviridae, Reoviridae, retrovirus umani, Togaviridae e Rubivirus, virus delle epatiti (HAV, HBV, HCV, HDV,HEV, HGV)*
9. **Infection control: sterilization, principles and techniques; disinfection, principles and techniques; The principles of antimicrobial chemotherapy**Sterilization, disinfection and antisepsis
    a. Physical methods
        i. The heat
        ii. Radiations
        iii. Filtration
    b. Chemical methods
        i. Alkylating agents
        ii. Oxidizing agents

c. Sterility controls
    i. Physical indicators
    ii. Chemical indicators
    iii. Biological indicators
d. Sterilization applications in the pharmaceutical field and its limits
    i. Parenteral products
    ii. Products non-parenteral
    iii. General consideration
e. Objectives and implementation of the disinfection methods
f. Targets and mechanisms of action of disinfectants
g. Types of disinfectants
    i. Phenol derivatives
    ii. Biguanide
    iii. Surfactant compounds
    iv. aldehydes
    v. Halogens
    vi. Alcohols
    vii. oxidizing agents
h. Methods for assessing the efficacy of disinfectants
i. The main antibiotics: mechanism of action and resistance.

10. **The concept of infectious disease: the spread and prevention - Principles of microbiological diagnostic and susceptibility testing**
    a. The epidemiology of infectious diseases
        i. General concepts
        ii. Epidemiological terminology
        iii. Frequency rate
        iv. Recognition of an infectious disease within a population
        v. Recognition of an epidemic
        vi. The infectious cycle: history of a disease
        vii. Carriers and reservoirs
        viii. Infectious diseases and emerging and re-emerging pathogensx.
        ix. Outbreak control
        x. Clinical and diagnostic methods
        xi. Identification of pathogens
        xii. Susceptibility to antibiotics (susceptibility testing)
11. **Pharmaceutical production and pharmacopeia**
    a. Assessment of pharmaceuticals contamination
        i. Essay of sterility
        ii. Evaluation of microbial contamination of non-sterile products
    b. Pyrogens and bacterial endotoxins
        i. Assay for pyrogens
        ii. Assays for bacterial endotoxins (LAL test)
    c. Microbiological assay
        i. Biological assay of antibiotics
        ii. Interferon dosing
        iii. Control the activity of disinfectants
    d. Microbiological characteristics of pharmaceutical products
        i. Obligatorily sterile pharmaceutical preparations

        ii. Pharmaceutical preparation does not necessarily sterile
    e. Sterilization of pharmaceutical products
        i. Sterilization methods applicable to pharmaceutical products
        ii. Biological sterilization indicators
        iii. Use of antimicrobial preservatives in pharmaceutical preparations
    f. Good manufacturing practice for preparation of medicines
        i. Characteristics of the environment
        ii. Staff
        iii. Raw material
        iv. Preparation of medicines in Pharmacy
    g. Cosmetics products
12. **Self-monitoring and HACCP: food infections - The microbiological quality control and the environment hygiene measures**
    a. HACCP system
    b. Description of the HACCP system
        i. Preliminary phases of the application system
    c. Main features of HACCP system
        i. Principles 1 to 7
    d. Food microbiology
        i. Meaning of microorganisms in food
        ii. Unfermented foods
            1. Meat, poultry, eggs, seafood, vegetables and fruit
        iii. Fermented foods
            1. Fermented Vegetables, bread, cheese, fermented milk, fermented meat products
    e. HACCP in pharmacies according to Legislative Decree 193/07 and s.m.i

Notes on guidelines for the activity of sterilization as a collective protection against biological agents for the operator in health facilities (D.Lgs. 81/2008 e s.m.i.)

a. The sterilization process and its enterprise management
b. People involved
c. Structural and technological requirements.
    i. Large / medium-sized hospitals
    ii. Small hospitals
d. Operating protocols
    i. Harvesting
    ii. Decontamination
    iii. Washing (manual, ultrasound, automated)
    iv. Personal protective equipment [gloves, protective clothing, respiratory protection devices, for face protection (face shield or equivalent)]
e. Rinsing, drying, inspection and maintenance
f. Medical paper, envelopes and rolls in paper-laminated polymeric film, a polymeric material composition of various types usable in sheets, polyolefin and similar materials suitable for use in rolls or tubular, reusable Material: container
g. Sterilization (steam sterilization, with ethylene oxide, with other physical methods, gas plasma of hydrogen peroxide, peracetic acid solutions
h. Controls on environments and the process steps

TEXTBOOK INFORMATION

Prescott et Al. - Microbiologia 7/ed. McGraw-Hill – Vol. 1, 2, 3
Microbiologia Farmaceutica II ed, Edises