



Dipartimento di Scienze e Tecnologie

ACADEMIC YEAR 2017/2018

STUDY COURSE IN BIOLOGICAL SCIENCES TEACHING IN GENERAL MICROBIOLOGY

Prof. Pagliarulo Caterina

Introduction to Microbiology. The historical roots of microbiology. Pasteur's Experiments. Koch's postulates. Microbial diversity and general microbiology advent. The modern era of microbiology. Microorganisms and their natural environments. The impact of microorganisms on nature and human. Microorganism applications in biotechnologies.

Prokaryotic cell: structure and function. Cell membranes: structure and functions. Prokaryotic cellular transport systems. Prokaryotic cellular wall. Differences in wall structure and function in Gram-positive and Gram-negative bacteria. The peptidoglycan biosynthesis. The outer membrane of Gram-negative bacteria. Surface structures and cellular inclusions of prokaryotes. Microbial motility. Flagella structure. The cellular motility as behavioral response: chemotaxis and phototaxis. Endospores structure and functions. Bacterial sporulation and germination.

Microbiological techniques. Progress in optics and physics and progress in microbiology. Optical microscopy. Electronic microscopy. Microbial growth control. Physical and chemical methods of sterilization and disinfection. Culture media. Microorganisms isolation and pure culture preparation. Cellular stainings. Gram stain technique. Traditional and innovative techniques for microorganisms identification. Microorganisms preservation.

Bacterial growth. Bacterial cell division. Bacterial population growth. Exponential Growth Mathematics. The growth cycle. Methods for measuring bacterial growth. Direct measurement: total count and vital count. Indirect measurement: the spectrophotometer. Continuous cultures: the chemostat. Environmental factors that influence the microorganisms growth.

Energy and microbial metabolism. The metabolic diversity of prokaryotes. Chemoheterotrophs and chemoautotrophs microorganisms. Photoautotrophs and photoheterotrophs microorganisms. Microbial nutrition. Bioenergetics and enzymes. Electron transport chain. Proton-motive force. The main catabolic pathways. Aerobic and anaerobic respiration. Glycolysis. Alternative fermentative pathways in prokaryotes.

Bacterial genetics. Bacterial chromosome structure. Mutations and recombinations. Genetic transfer. Transformation. Transduction. Conjugation. Plasmids: General Principles. Transposons and insertion sequences. The main strategies for gene expression regulation in prokaryotes. Quorum sensing.

Diversity and microbial taxonomy. Species concept in microbiology. 16S rRNA analysis for taxonomic studies. Main bacterial groups, bacterial phylogenesis. Nomenclature and Bergey's manual.

Antimicrobial agents. Classification and action mechanisms of the main antimicrobial drugs. Mechanisms of bacterial resistance to antibiotics. Antibiotics sensitivity testing methods. Antibiogram. The research of new antimicrobial drugs.



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Virology Elements. General virus properties. Architecture and Classification. Bacteriophages.

Industrial Microbiology. Microorganisms of industrial microbiology. The "scale-up" of the fermentative process. Main products of industrial microbiology. Antibiotics. Vitamins and amino acids. Enzymes. Citric acid and other organic compounds. Microbial bioconversion. Production of microbial polymers. Cellulolytic Microorganisms.

Environmental Microbiology. Microbial ecosystems. Microorganisms role in biogeochemical cycles. Rumen microbiology. Microorganisms and bioremediation. Water Microbiology. Aquatic microbial diseases. Microorganisms and plants interactions. Nitrogen-fixing microorganisms. *Agrobacterium tumefaciens* and vegetal organisms.