

Course Unit	Microbiology	Field of study	Health Sciences
Bachelor in	Biomedical Technology	School	School of Technology and Management
Academic Year	2022/2023	Year of study	2
Type	Semestral	Semester	2
Workload (hours)	162	Contact hours	T 30 TP - PL 30 TC - S - E - OT - O -
Level	1-2	ECTS credits	6.0
Code	9600-752-2205-00-22		

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Joana Andrea Soares Amaral, Maria Olga de Amorim Sá Ferreira

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Distinguish and characterize eukaryotic and prokaryotic cells.
2. Know the main groups of microorganisms: bacteria, fungi, protozoan, algae and virus.
3. Understand the kinetics of growth and death of microorganisms. Know the main cleaning and disinfection methods in hospital environment.
4. Recognize the importance of microorganisms as indigenous flora.
5. Recognize microorganisms as etiologic agents of infection in Man. Know the main aspects related to control of hospital infections and rational use of antibiotics.
6. Know the main groups of antibiotics. Know the molecular mechanisms of anti-microbial resistance and its importance.
7. Recognize the main microbial strains as probiotic and producers of biological substances.

### Prerequisites

Before the course unit the learner is expected to be able to:

Know the fundamentals of Molecular and Cellular Biology and Organic Chemistry.

### Course contents

Basic concepts of Microbiology. Distinction of eukaryotic and prokaryotic cells. Main groups of microorganisms. Characterization of Microorganisms. Nutritional Requirements and Culture Media. Cultivation and Growth of Microorganisms. Control of Microorganisms. Notions about cleaning and disinfection in a hospital environment, sterilization and air disinfection. Microorganisms as etiologic agents of human infection. Major groups of antibiotics. Laboratory techniques in microbiology.

### Course contents (extended version)

1. Introduction to Microbiology.
  - Microbiology as a science.
  - Objectives and applications of microbiology.
  - Classification of live organisms. Classification of Whittaker and Woese.
  - Main groups of microorganisms: bacteria, fungi, protozoan, algae and virus.
2. Characterization of Microorganisms
  - Pure culture techniques. Isolation, growth and conservation of pure cultures.
  - Main types of microscopy.
  - The optical microscope. Planning of a preparation of microorganisms for optical microscopy.
  - Staining techniques.
  - Information used for the characterization of microorganisms.
3. The Structure of Prokaryotic and Eukaryotic Microorganisms
  - Distinguish the morphological characteristics of prokaryotic and eukaryotic microorganisms.
  - Recognize and distinguish the ultra-structure of prokaryotes.
  - Properties and chemical composition of the bacteria cell wall. Mechanism of the Gram staining.
  - Latent forms.
4. Nutritional demands and microbiological media.
  - Chemical elements as nutrients.
  - Nutritional classification of microorganisms.
  - Media used for microorganisms growth (enrichment, selective and differential media).
5. Culture and growth of microorganisms.
  - Factors that affect microbial growth (nutrients, temperature, pH, atmosphere, osmotic pressure).
  - Reproduction and growth of eukaryotic and prokaryotic microorganisms.
  - Growth of bacteria culture. Quantitative evaluation of the microbial growth.
  - Growth curve of unicellular microorganisms in a batch system.
6. Microorganisms control.
  - Fundamentals of microbial control. Death pattern in a microbiological population.
  - Conditions that affect the anti-microbial activity.
  - Physical and chemical agents for microorganisms control.
  - Notions on cleaning and disinfection in hospital environment.
7. Main groups of antibiotics.
  - Main groups of antibiotics: chemical characteristics and mode of action.
  - Molecular mechanisms of anti-microbial resistance.
8. Microorganisms as etiologic agents of infection in humans.
  - Main bacterial agents associated with diseases.
  - Nosocomial infections; rational use of antibiotics.
9. Main microbial strains as probiotic and producers of biological substances.
10. Laboratory techniques in microbiology.

### Recommended reading

1. Ferreira, W. F. C. e Sousa, J. C. F. (1998) – Microbiologia Vol. I, II e III, Lidel - Edições Técnicas, Lda.
2. Ferreira, W. F. C. , Sousa, J. C. F. e Lima, L. (2010) – Microbiologia, Lidel - Edições Técnicas, Lda.
3. Benson, H. J. (1998) - Microbiological Applications, Laboratory Manual in General Microbiology. Macgraw-Hill, Boston.
4. Pelczar, M. J. , Chan, E. C. S. e Krieg, N. R. (1997) – Microbiologia – conceitos e aplicações, Vol. I e II. , Makron Book do Brasil Editora Lda, Brasil.
5. Coursera. Antimicrobial resistance - theory and methods.

### Teaching and learning methods

Explanation of theoretical concepts. Analysis and discussion of application examples. Execution of the proposed laboratory experiments. Writing and discussion of the experimental reports. Individual and group study of the course contents.

**Assessment methods**

- Method 1 - (Regular, Student Worker) (Final, Supplementary, Special)
- Intermediate Written Test - 20% (Test regarding laboratory concepts.)
- Reports and Guides - 15% (Preparation of classes and reports on experimental studies conducted in laboratory classes.)
- Final Written Exam - 50% (Test regarding theoretical concepts.)
- Laboratory Work - 15% (Individual exam of laboratorial practice performed during the last week of classes.)

**Language of instruction**

Portuguese, with additional English support for foreign students.

**Electronic validation**

Joana Andrea Soares Amaral	Hélder Teixeira Gomes	José Carlos Rufino Amaro
08-03-2023	21-03-2023	25-03-2023