COMMON EUROPEAN CURRICULUM FOR DEGREES IN HEALTH SCIENCES
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COMMON CURRICULUM ON MICROBIOLOGY FOR HEALTH SCIENCES

AIM
To provide microbiology teachers of health sciences degrees, with a guide to design their subject-specific teaching programs.
Defining basic ideas about the knowledge to be acquired, and the methods for training professionals who must be capable to deliver microbiology knowledge and practice in the health context.

INTRODUCTION: THE HEALTH CONTEXT
Definition: areas of medical science in which microorganisms matter.
Physiological aspects: the human and animal microbiome.
Microorganisms in health and disease: role of specific microorganisms and microbiomes in health and diseases of human and/or animals. Reservoirs and transmissions pathways.
Diagnostic and disease monitoring strategies: detection and identification of the etiologic agent(s) of infection, evaluation of the microbiome; diagnosis based on the reaction to pathogens (immune response to microorganisms or disease-specific metabolites).
Therapy: knowledge of available strategies to fight infections and minimize the development of antimicrobial resistance (AMR).
Hygiene and Prevention: vaccines and other strategies for the prevention of infectious diseases.
Biotechnology: industrial use of microbes and their products for medical purposes.

OBJECTIVES AND COMPETENCIES
- Objectives:
  Students will be able to:
  - Identify the basic concepts that explain microbial life, the diversity of microorganisms and their evolution.
  - Identify the benefits of the microorganisms-human/animal relationships: understand the role of the microbiota and their genes, the microbiome, in the maintenance of the homeostasis of the human/animal body.
  - Understand the main virulence factors as the microbial strategies involved in the infectious process and derived pathologies.
  - Distinguish basic aspects of the morphology, physiology and genetics of the diverse microbial groups.
  - Distinguish the specific physiological targets in the microbial cell used in the development of antimicrobial drugs and understand the mechanisms of resistance to these drugs.
  - Infer the measures for the control of infections based on the knowledge of pathways and mechanisms for the acquisition and spread of pathogenic agents.
- Understand the fundamentals of vaccines composition, effectiveness and limitations.
- Apply experimental methods for the detection and identification of pathogenic agents.

**Competencies (what we want that the students will be able to do, based on the understanding of contents and after the acquisition of practical skills)**
- Handle basic laboratory material and techniques, especially those used in culture and identification of microorganisms.
- Recognize the main infectious agents and their virulence mechanisms.
- Perform and interpret antimicrobial susceptibility tests.
- Correctly assess the main microbiological diagnostic techniques
- Correctly interpret the results of basic microbiological diagnostic tests.
- Be able to obtain and process a biological sample for its study by means of the different diagnostic procedures.
- Manage antimicrobial products and processes with respect to the basic ideas of the One Health concept.
- Update the knowledge and skills by constant reading and sharing information and experiences (read scientific literature, consult with colleagues, attend scientific meetings, be able to present papers)

**CURRICULUM CONTENT**

**For every section, it would be important to classify the content as follows:**

- **Essential content**: what we consider MUST be in every health sciences microbiology program.
- **Desirable content**: important but not essential in all programs. Perhaps essential in some degrees but not in all (although convenient in most).
- **Dismissible**: additional content of interest. Suggestions for advanced students or as extra content.

**Main Sections**


- **Most important groups of microbial pathogens**: bacteria, eukarya (fungi and protozoa), viruses and other transmissible elements. For each group: most important biological and behavioral characteristics (morphology, size, physiology). Study of the main families, genera and species of human and animal pathogens and their geographical distribution, route of acquisition, strategies to generate disease, pathology caused, methods of diagnosis, treatment and prevention. Priority pathogens: multidrug-resistant and emerging pathogens.

Western blot techniques. Antimicrobial sensitivity tests. Laboratory safety: levels of biological hazard.


- **Biotechnology in health sciences**: use of microorganisms, including recombinant ones, in production of medicines (microbial production of antibiotics, other antimicrobials, alkaloids, hormones, monoclonal antibodies, vaccines, vitamins and coenzymes, probiotics, enzymes, analytical devices including biosensors etc.), in food industry and for environmental control. Recombinant DNA technology for construction of the efficient producers of medicines and diagnostics. Phage display and CRISPR/Cas technologies. Market for antimicrobials and other health-important products obtained by microorganisms.

- **Environmental microbiology and health**: the OneHealth concept. Influence of the environmental conditions on microbial life. Understanding the world-wide impact of antimicrobial resistance. Monitoring and control of potentially dangerous microorganisms in nature and among habitants. Control of biosafety especially of food and water supply. Climate change and its impact on biodiversity and human and animal health. Emergence of new pandemics and their spread.

**METHODS**

Suggestions about the best methods for the acquisition of the defined competencies

Student centered Methods: The teacher as a guide through the sources of knowledge and acquisition of technical skills.

Avoid intense memorizing in favor of understanding.

Inverse teaching (≠ passive attendance). Give the students the chance to discuss the content after they have worked on it. Minimize lectures.

Use of diverse sources of knowledge

Engagement of students through various activities (lectures, laboratory sessions, self-learning activities, problem based-learning or case-based learning…)

**ASSESSMENT**

Suggestions about the best methods to assess the acquisition of the competencies

**Plural** (diversity of tests). Assess all the competencies defined as goals (practical skills acquired; ability to understand concepts; to search updated information; to share
information with others; to choose the main ideas in a context; to solve practical situations…). Employ practical assessment, multiple choice and short answer test; long dissertation; presentations in public; analysis of scientific papers, etc.

**Continuous assessment.** Grade *every activity* that the students are performing during their training. Give appropriate weight to each of them.