



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Biomedical Sciences 2

2021-1-I0101D005

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#### Aims

Know the basic mechanisms of the onset of disease and the means of defense. Understand the meaning of the laboratory tests and their clinical relevance. Acquire the basics of pharmacology. Acquire the basics of microbiology.

#### Contents

Know the underlying causes and pathogenic mechanisms of human diseases, as well as the etiology of the fundamental alteration of the structures, functions and control mechanisms at different levels of integration and acquire the basic knowledge to understand and deal with functional alteration. Control the appropriate terminology to interact with lecturers and, in perspective, with the multidisciplinary team and with patients to meet their health needs. Use the acquired skills to facilitate the development of additional advancement in clinical disciplines.

Learn the basics of drug administration, their absorption and distribution in the body and their elimination. Know how a compound form become a drug and the mechanism of action into the body.

Learn the meaning of the examination laboratory, his scientific and clinical relevance; the contribution of the laboratory in disease prevention, diagnosis, especially in assessments of organ function and patients monitoring; the foundation for interpreting laboratory tests; the influence of the way to collect, transport and storage biological samples on results of the laboratory tests.

At the end of this course, the student will be able to know: concept of acute and persistent infection, pathogenicity and virulence. The methods of direct and indirect contagion. The way of transmission of infections and their spread. Concept of carrier (eg. HBV). The correct way to collect, storage and transport biological sample from patient to laboratory. Approaches to laboratory diagnosis of bacterial and viral infections: direct and indirect diagnosis. Essential features of the main pathogens agents of clinical interest.

## Detailed program

Concept of disease (acquired, congenital hereditary); areas of general pathology (etiology, pathogenesis). Chronic-degenerative and acute diseases. Immunology. Organs, B and T cells, antibodies. Concept of self and non-self. Complement. Immune reaction, primary and secondary. Hypersensitivity type I, II, III, IV. Etiology. Ionizing and exciting radiations as etiological agents. Diseases from radiation and from high temperatures. Burns, characteristics and pathogenic mechanisms. Freezing. Inflammation. Definition of acute inflammations, vascular phenomena in exudate development. The cells involved in inflammation acute, diapedesis, chemotaxis, phagocytosis, differences between exudate and transudate. Classification of exudates, evolution and complications of acute inflammation. Chronic interstitial inflammation and granulomatous. Cells involved in chronic inflammation. Formation and structure of the granuloma. Examples of granulomatous inflammation (TBC, Lue, silicosis, foreign body). Evolution of the granuloma. Systemic manifestations of inflammation: fever, leukocytosis, acute phase proteins. Repair processes. Wound healing. Regeneration, repair, organization. Granulation tissue and its evolution. Scar tissue. Healing by first and secondary intention. Factors conditioning healing. Complications in wound healing. Fibrosis. Chronic degenerative diseases. Definition of atherosclerosis. Vessels affected by atherosclerosis. Structure of the altered arterial walls. Plaques distribution in the arterial tree. Etiology of atheromatous plaque and complications. Thrombosis, embolism. Functional adaptation. Hypertrophy, hyperplasia, homeostasis, balance and functional failure, organ failure, multiple organ failure and system failure. Growth disease. Pre-neoplastic lesions. Tumors: definition, classification (benign, malignant), nomenclature, malignant cancer features, atypia, TNM. Tumors etiology: chemical, physical and viral (general concepts). Genes involved in neoplastic transformation (general concepts). Concepts of tumor growth and angiogenesis phenomenon. Tumor metastasis, metastatic stages of the process. Biology of cancer cachexia.

Discovery and drug development. Study of drug. Preclinical phase. Clinical research. Evidence-based medicine (EBM). Pharmacovigilance. Pharmacogenetics. What a nurse should know about a drug. Pharmaceutical forms. Ways of administration of drugs. Dosage and influencing factors. Mechanisms of drug absorption. Distribution and transportation. Drug biotransformation. Elimination: main (kidney-biliary) and secondary ways. Main pharmacokinetic parameters (bioavailability, plasma concentrations, volume of distribution, redistribution, half-life, clearance). Drug binding to plasma proteins. Individual variability in drug response (age, sex, ethnicity, patients' conditions and disease). Placebo effect. Adverse drug reactions: hypersensitivity, idiosyncrasy, allergy. Iatrogenic diseases. Tolerance, dependence. Agonists, partial agonists, inverse agonists and antagonists competitive and non-competitive. Dose-response relationship. Therapeutic index. Synergy, additivity, antagonism, indifference. Milk and the unexpected grapefruit. Therapy in child and in the elderly. Drugs in pregnancy and lactation. Sanitizing skin and environmental. Antiseptic-disinfectant. Pesticides.

Role, purpose and limits of Laboratory Medicine. How to ask for a laboratory test. Characteristics of a laboratory examination: biological materials on which are performed laboratory tests; quantities and units; reference values; critical values. Features of laboratory methods. Pre-analytical, analytical and post-analytical mistakes. Precision. Accuracy. Sensitivity. Specificity. Predictive value. Patient preparation, identification collection and preservation of samples for the transportation to the laboratory. Sources of variability in sample collection: patient position, location and type of sampling, disinfectants, tourniquet application, blood amount taken, anticoagulants and preservatives, sample types, time of harvesting. Physiological factors that alter the composition of body fluids. Biological variables controllable: posture, hospitalization and immobilization, exercise, circadian rhythm, influence of food, tobacco smoking, alcohol consumption, drug therapies, patient's medical condition. Uncontrollable biological variables: age, sex, race, environmental factors. Interferences: hemolysis, lipemia, jaundice. The laboratory diagnostic in organ and metabolic functions, in monitoring drug therapies and some process of the disease. Liver: the main laboratory tests used to assess liver function; definition, classification and clinical significance of the aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, gamma-glutamyl transferase, bilirubin, albumin, ammonium, lactic dehydrogenase, alpha-fetoprotein. Kidney: the main laboratory tests used for the evaluation of renal function; definition classification and clinical significance of plasma creatinine, creatinine clearance, estimation of glomerular filtrate by MDRD, Urea plasma, serum uric acid, chemical-physical examination of urine. Carbohydrate metabolism: the main laboratory tests used for the evaluation of glucose metabolism; definition, classification and clinical significance of fasting plasma glucose, postprandial plasma glucose, plasma glucose after oral load (OGTT), glycated hemoglobin, Fructosamine, plasma insulin, Peptide C. Examples of indices of acute

phase assayed in the laboratory: speed of erythrocyte sedimentation rate (ESR); C-Reactive Protein. Monitoring of drug therapies and dosing an overuse of substance: INR and prothrombin activity; measurement of ethanol. The markers of organ failure: tumor markers; markers of myocardial necrosis. Principles of Immunology: the blood groups; finding Antibodies Irregulars; blood components; outline of transfusion reactions.

Diagnosis of microbial infections: specimen collection, direct and indirect clinical diagnosis. Bacterial and viral infections of the respiratory system: streptococcal angina, influenza virus, bacterial and viral pneumonia. Urinary tract infections: cystitis and pyelonephritis. Reproductive diseases: syphilis, gonorrhea, non-gonococcal urethritis, HPV and Herpes. Bacterial and viral infections of the central nervous system: bacterial and viral meningitis, polio, viral encephalitis. Diseases of the gastrointestinal (staphylococcal intoxication, salmonella, E. coli gastroenteritis, pseudomembranous colitis caused by Clostridium Difficile, Helicobacter and peptic ulcers, viral infections (hepatitis, viral gastroenteritis). Microbial infections of the skin and eyes: Bacteria (staphylococcus, streptococcus, pseudomonas), viruses (HPV, herpes virus), fungi (Candida). Sepsis (some examples).

## **Prerequisites**

Positive evaluation in Biomedical Sciences 1.

## **Teaching form**

Lectures through presentations in electronic form of drawings and diagrams explaining concepts and functions of the organism. The lessons of some disciplines will be provided by teledidattica.

In the period of COVID-19 emergency the lessons will be online asynchronous and some events with synchronous videoconference

## **Textbook and teaching resource**

Pontieri G.M. (2007) Patologia generale e Fisiopatologia generale per le professioni sanitarie, II ed., Padova, Piccin; Spector T.D. e Axford J.S. (2007) Introduzione alla Patologia generale, II ed., Milano, Casa Editrice Ambrosiana; Quaglini E., Cavallo F., Forni G. (2010) Le difese immunitarie, I ed., Padova, Piccin;

Page C.P., Curtis M.J., Sutter M.C., Walker M.J.A., Hoffman B.B. (1999) Farmacologia integrata, Milano, Casa Editrice Ambrosiana; Cella S.G., Di Giulio A.M., Gorio A., Scaglione F. (2010) Farmacologia generale e speciale per le lauree sanitarie, Padova, Piccin; Neal M.J. (1999) Farmacologia medica in uno sguardo, Pavia, La Goliardica Pavese;

Rossi A., Biagiotti S., De Francesco D. (1993) Elementi di immunologia, immunoematologia e pratiche trasfusionali, Milano, Sorbona; Melzi D'Eril G. V., Chelazzi G. (1999) Biochimica clinica e immunologia, Milano, Sorbona;

Cevenini R., Sambri V. (2004) Microbiologia e microbiologia clinica - Per i Corsi di Laurea in professioni sanitarie, Padova, Piccin.

## **Semester**

1st Year, 2nd Semester

## **Assessment method**

Written examination: 60 closed quiz with multiple choice answer and one open ended question. The 60 quiz are subdivided for different subjects: 20 for general pathology, 20 for pharmacology, 10 for clinical biochemistry, 10 for microbiology. The examination will be passed with 36 exact answers.

In the COVID-19 emergency the examination will be online with 6 open question that cover the 4 discipline of the course.

## **Office hours**

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