



SAN RAFFAELE INTERNATIONAL MD PROGRAM

YEAR 1

Academic Year 2013/2014

- Statistics and Bioinformatics
- Medical Physics
- Medical Humanities
- Chemistry and Biochemistry
- Cell and Molecular Biology
- Genetics and Developmental Biology

STATISTICS AND BIOINFORMATICS

Total Credits: 6

Lectures: 48

Practicals: 40

Scientific Discipline Sector: MED/01 – INF/01

Course Instructors:

Prof. Clelia Di Serio Email: diserio.clelia@univr.it **(Coordinator)**
Prof. Elia Biganzoli Email: elia.biganzoli@unimi.it

Teaching Assistants:

Dr. Paola Rancoita Email: rancoita.paolamaria@univr.it
Dr. Filippo Trentini Email: trentini.filippo@hsr.it

Course Description

The course provides an introduction to statistical concepts and quantitative methods used in the Health Sciences. Fundamental concepts in the following fields will be presented: clinical epidemiology, probability, exploratory data analysis, statistical inference. Basic knowledge and tools for data management and data analysis are also provided in the course.

Course Objectives

By the end of the course, students will be able to:

- 1) understand and perform basic statistical data analysis by means of graphical methods and of descriptive statistics for univariate and bivariate variables;
- 2) understand the difference between causality and statistical association, compute association measures between variables, calculate least squares regression and interpret the results,
- 3) perform simple calculations based on the rules of probability (Bayes' Theorem) to interpret diagnostic tests;
- 4) recognize different study designs used in clinical epidemiology and compute measures of treatment efficacy and risk factors impact;
- 5) use statistical models (Binomial, Poisson, Exponential and Normal distribution) to calculate probabilities of events;
- 6) construct and interpret confidence intervals and one-sample hypothesis tests for population means;
- 7) construct and interpret two-sample hypothesis tests and confidence intervals for difference of means;
- 8) understand and use simple statistical methods for analyzing censored survival data;
- 9) read clinical epidemiological papers and interpret the statistical analyses;
- 10) use SPSS statistical software to perform basic statistical analyses.

Practicals:

The practicals will be usually structured in the following way: 1) some exercises will be solved and discussed by the teaching assistant; 2) in-class problems will be assigned and asked to be solved in small groups; 3) the solution of the in-class problems will be discussed. The in-class exercises will allow an active learning and discussion of the related statistical and epidemiological concepts. At the end of each lesson, similar homework exercises will be assigned to provide an opportunity for independent practice. The corresponding complete solutions will be given subsequently for auto-correction. Depending on the topic, also the statistical analysis of some examples of published scientific papers will be discussed.

Readings

Main material:

- Textbook: Biostatistics. Basic Concepts and Methodology for the Health Sciences (9th edition). Author: Wayne W. Daniel. Wiley
- Supplementary Online Material.

Additional material (one of the following):

- Discovering Statistics Using SPSS (Introducing Statistical Methods), 3rd edition, by Andy P. Field (2009)- Sage Publications

- SPSS Survival Manual: A step by step guide to data analysis using SPSS, 4th edition, by Julie Pallant (2010)-Allen & Unwin
- SPSS Programming and Data Management, 4th Edition, by Reynald Levesque; SPSS Inc.

Schedule of the Lectures

| Session | Topics | SPSS LAB/ Practicals |
|---------|---|-------------------------|
| 1 | Introduction, graphical methods for representing data | |
| 2 | Measures of location and spread | |
| | | SPSS LAB1 |
| | | Practical 1 |
| 3 | Bivariate analysis: covariance and correlation | |
| 4 | Bivariate analysis: regression and R-squared | |
| | | SPSS LAB2 |
| | | Practical 2 |
| 5 | Probability, Bayes' Theorem and conditional probability | |
| 6 | Independency and contingency table (chi-square statistic) | |
| | | SPSS LAB3 |
| | | Practical 3 |
| 7 | Introduction to discrete and continuous probability distributions, Binomial distribution | |
| 8 | Poisson and Exponential distributions | |
| | | Practical 4 |
| 9 | Normal distribution | |
| | | Practical 5 |
| 10 | Sampling distribution for the mean and for the difference of means, Central Limit Theorem | |
| 11 | Confidence intervals for the means (variance known and unknown) and for the difference of means, Student's t-distribution | |
| | | SPSS LAB4 |

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|----|---|----------------|
| | | Practical 6 |
| 12 | Introduction to Evidence Based Medicine reasoning based on quantitative statistical evidence Diagnostic tests: screening and diagnosis Test with dichotomous variables: sensibility and specificity, PPV, NPV | |
| 13 | Diagnostic test Test with continuous and ordinal variables, ROC curves Fagan nomogram and practical application in diagnostic testing Information and medical decision making in screening test: examples of early diagnosis | |
| 14 | Introduction to clinical epidemiology Evaluating risk factors Probability and disease risk Measures of prevalence, incidence and association | |
| 15 | Observational vs. experimental studies. Cross-sectional and case-control studies Cohort studies (prospective/retrospective) Inference on odds ratio and relative risks | |
| 16 | Experimental design in clinical research Clinical trial vs. observational studies Phase I, II, III, IV clinical trials | |
| 17 | Randomized Controlled Trials Ethical issues Inclusion criteria Randomization in treatment assignment Measures of treatment efficacy Interaction and confounders | |
| 18 | Hypothesis testing: basic concepts and hypothesis test for the mean (with variance known) | SPSS/Excel LAB |
| | | Practical 7 |
| | Hypothesis testing: hypothesis test for the mean (with variance known and unknown) and for the difference of means, ANOVA | SPSS/Excel LAB |
| | | Practical 8 |
| 20 | Basic concepts of survival analysis | SPSS/Excel LAB |

MEDICAL PHYSICS

Total Credits: 5

Lectures: 40

Practicals: 10

Scientific Discipline Sector: FIS/07 – MED/36

Teaching staff

Prof. Michele Arneodo Email: arneodo@to.infn.it (Coordinator)

Prof. Monika Grothe Email: grothe@mail.cern.ch

The course covers the basic principles of Physics, with emphasis on subjects useful for understanding biological phenomena and biomedical instrumentation. Problem sessions are foreseen.

Prerequisites

Basic high-school mathematics. Knowledge of calculus is not required.

Textbooks

Main reference: “Serway’s Essentials of College Physics”, by Raymond A. Serway and Chris Vuille, Brooks/Cole.

In addition:

“Physics Principles with Applications”, by Douglas Giancoli, Pearson/Prentice Hall;

“Physics” or “General Physics”, by Morton Sternheim and Joseph Kane, Wiley;

“Fundamentals of Physics Extended”, by David Halliday, Robert Resnick, Jearl Walker, Wiley.

Course Syllabus

Mathematical review

Cartesian coordinates, functions and their graphical representation. Linear and logarithmic scales. Significant figures. Scientific notation. Vectors and operations with them: sum, difference, scalar and vector product.

Physics quantities and their measurement

Units. Statistical and systematic uncertainties.

Mechanics

Velocity, acceleration. Uniform straight motion. Constant-acceleration motion. Falling objects. Motion in two and three dimensions. Circular motion: angular and tangential velocity, centripetal acceleration; uniform circular motion.

Force, mass, Newton’s laws; inertial and non-inertial reference frames. Gravitational forces. Friction.

Work, kinetic and potential energy. Total mechanical energy and its conservation. Conservative forces, dissipative forces. Power. Impulse and linear momentum. Momentum conservation; collisions.

Simple harmonic motion; pendulums and springs. Elastic forces, elastic potential energy. Damped and forced oscillations; resonance.

Torque; couples. Equilibrium of rigid bodies. Levers. Centre of gravity. Stability.

Motion of the centre of mass; Newton's law for particle systems. Motion of rigid bodies: angular speed and acceleration. Moment of inertia. Angular momentum and its conservation.

Elasticity. Stress and strain. Young's modulus; Poisson's modulus; shear modulus; bending. Elastic limit, ultimate strength.

Fluids

Archimedes' principle. Flow rate. Equation of continuity. Conservation of energy and Bernoulli's equation. Viscosity; Hagen-Poiseuille's law; flow resistance; Stokes' law; sedimentation velocity; turbulent flow; Reynolds number.

Ideal gases; equation of state; kinetic theory. Real gases. Vapours and gases. Saturated vapour.

Thermodynamics

The first principle of thermodynamics. Specific heat capacity, heat capacity. Heat capacity of an ideal gas at constant pressure or constant volume. Metabolic rate. Second principle of thermodynamics; reversible and irreversible processes; entropy; thermodynamic cycles, Carnot's cycle, efficiency.

Electricity and Magnetism

Electric charge, Coulomb's law, electric field, electrostatic potential energy, potential; electron volt. Relation between field and potential difference. Electric dipole: field lines and behaviour in an electric field.

Conductors and insulators. Polarisation of a dielectric. Electric capacity; capacitor; effect of a dielectric. Relative dielectric constant. Energy stored in a capacitor. Capacitors in series and parallel.

Electric current. Drift velocity of the charge carriers. Electric resistance; resistivity. Ohm's law. Resistors in series and parallel. Electrical circuits. Power in electrical circuits, Joule's law. Ohmic and non-ohmic conductors; the diode.

Direct and alternating current circuits.

Effects of current through the human body. Grounding.

Magnetic field. Lorentz's force; force on a current-carrying wire. Biot-Savart law. Field generated by a wire, field generated by a circular current loop. Solenoid. Magnetic dipoles; magnetic dipole moment; behaviour of a magnetic dipole in a magnetic field. Ferromagnetic materials, permanent magnets.

Magnetic field flux. Faraday's law. Electric generators, transformers.

Cathode ray tube. Linac, cyclotron, synchrotron.

Periodic waves. Wave velocity; period and wavelength. Longitudinal and transverse waves. Fourier analysis. Electromagnetic waves. Antennas. Quantization of energy in electromagnetic waves: the photon.

Generation of X rays: Bremsstrahlung and characteristic lines.

Sound Waves

Nature of sound. Intensity of sound waves. Intensity level; decibels. Doppler effect. Ultrasounds. Reflection and absorption of ultrasounds. Principles of sonography and Doppler sonography.

Geometrical Optics

Refraction index. Reflection, refraction, Snell's law. Total internal reflection. Lenses. Lensmaker equation; thin-lens formula. Accommodation; near and far points.

Modern Physics, Nuclear Physics

The main concepts of special relativity. The main concepts of quantum mechanics. Atomic structure; transitions between atomic orbitals.

Structure of the atomic nucleus. Stable and unstable nuclei. Alpha, beta and gamma decays. Activity; law of radioactive decay. The physics principles of PET.

MEDICAL HUMANITIES

Total Credits: 13

Total Hours: 104

Scientific Discipline Sector: MED/02 – M-FIL/33 – M-FIL/03 – L-LIN/01 – L-LIN/12

Teaching staff

| | |
|-------------------------------|--|
| Prof. Michael John | john.michael@univr.it (Coordinator) |
| Prof. Donatella Lippi | donatella.lippi@unifi.it |
| Prof. Mariagrazia Strepparava | mariagrazia.strepparava@unimib.it |
| Prof. William Cooke | william@maptraining.it |
| Prof. Andrea Moro | andrea.moro@iusspavia.it |
| Prof. Massimo Reichlin | reichlin.massimo@hsr.it |

Aim

The aim of the course is to help students understand that patients are people, and not just a mass of molecules, that not only have an illness, but are also suffering fear and anguish. Doctors must therefore strive to empathize with individuals and not simply distribute medication and drugs to faceless and nameless numbers.

Discussion and active student participation will be paramount to the overall success of the course.

Final evaluation

The students will receive a final mark based upon two **compulsory** end-of-term tests (made up of multiple choice exercises and open questions as defined by each professor at the beginning of the course) and classwork tasks, once again to be defined by each individual professor.

Course objectives

In today's frenetic, high-tech world, where medicine is evidence based and focuses on specialties of all possible kinds, doctors generally have little time to ponder the multifaceted problems of their patients. Indeed, there are innumerable horror stories told by sick people that stem from the uncaring attitudes and the lack of sensitivity shown by many health professionals. Yet medicine should be seen as a caring profession that requires doctors not only to provide valid clinical assistance but, above all, to empathize with patients and their families when they are at their most vulnerable and in need of understanding.

Nowadays, medical school students are encouraged to interact with patients virtually from the beginning of their training and an increasing amount of emphasis is being placed on the teaching of social sciences, ethics and communication skills to help create a new kind of doctor. One way of doing this is by introducing the study of the *Medical Humanities* (literature, music, visual arts, psychology, sociology, philosophy, ethics, history, language, religion etc.) into the medical curriculum. These subjects require imagination, close observation and understanding, which are all fundamental characteristics of a successful and caring doctor.

How otherwise might a 20-year-old medical or nursing student learn about the complexities of the human condition? How would they be able to understand the reactions and feelings of someone with a terminal illness or a crippling disability, let alone a parent who has just lost a child? They certainly will not learn these skills from standard clinical textbooks, where the words fear and anguish do not appear in the index. Yet fear and anguish are at the very center of how a patient faces up to and lives with an illness.

At the end of this course, students will have a greater understanding of:

- *empathy and patient-centered communication*
- *team work and the ability to interact with colleagues and other health professionals*
- *linguistics and use of language*
- *truth-telling and the delivery of bad news*
- *withdrawal of treatment*
- *euthanasia and assisted suicide*

- *treatment of violence and abuse*
- *ethical and legal problems linked to medical errors*
- *ethics committees*
- *conflict of interest and relationship with industries*
- *chronic illness*
- *old age, death and bereavement*
- *cross-cultural conflicts*
- *alternative and complementary health practices*
- *religion and spirituality*
- *ethical problems linked to stem cells, organ donation and transplantation*
- *re-pro ethics and new reproductive technologies*
- *history of medicine and medical education*

CHEMISTRY AND BIOCHEMISTRY
Total Credits: 12
Lectures: 96
Practicals: 96 (divided in groups)
Scientific Discipline Sector: BIO/13- BIO/10

Course Coordinator: Prof. Massimo Degano
Email: degano.massimo@hsr.it
40 hours

Collaborators:
Prof. Mauro Freccero
Email: mauro.freccero@unipv.it
40 hours

Prof. Angelo Corti
Email: corti.angelo@hsr.it
16 hours

Tutorials: 96 hours to be divided in groups/tutors
Dr. Barbara Corsi - Dr. Claudia Minici - Dr. Francesca Giannese – Dr Elisa Sala

Type of subject: Traditional medical discipline

Field: General discipline for the preparation of a doctor: Structure, function and metabolism of molecules of medical interest.

Course objectives:

The Chemistry and Basic Biochemistry course is one of fundamental importance, in which students are presented with the notions of the chemical and biochemical mechanisms necessary to understand the regulation of biological processes of the cell and of the organism.

This course covers classical molecular and cellular biochemistry, cellular physiology, and molecular genetics. Metabolic interrelationships as they occur in the individual will be stressed and related to disturbances in disease states.

The knowledge and understandings provided by the course constitute the foundations for the following semesters both for the molecular analysis of physiological processes and those of pathogenetic mechanisms in disease. The specific field of Chemistry and Basic Biochemistry will focus on the principles of general and organic chemistry with a description of the fundamental chemical reactions for the understanding of biological processes, the structure and function of organic molecules that constitute the building blocks of living matter, and the analysis and structure and function of principle biological polymers, with particular emphasis on the processes of catalytic enzymes.

At the end of this course, students should be able to:

- Solve problems in diagnosis and treatment of human disease by application of biochemical principles.
- Use primary medical and scientific literature as a resource for learning and problem-solving.
- Define, describe and contrast functions of genes and macromolecules in normal and pathologic contexts.
- Define and describe systemic metabolic biochemistry in terms of genes and molecules.
- Deduce therapeutic mechanisms from established molecular mechanisms.
- Interpret new medical discoveries in terms of fundamental principles of biochemistry
- Explain the molecular basis of diseases that affect cellular function or development.

The course is a prerequisite for:

Foundation for "Cellular and Molecular Biology" and "Genetics and developmental Biology".

No.Theme

- 1 Introduction to the course. Chemistry and biochemistry in human physiology
- 2 Atomic Structure. Electron Configuration and the Aufbau Principle. Atomic and Molecular Orbitals. Chemical Bonding - Covalent, Ionic and Metallic Bonds.
- 3 Intermolecular Forces - Dipole-Dipole Forces, Hydrogen Bond, London Forces. Periodic System of Elements. Trends in the Periodic Table. Nomenclature of Inorganic Compounds. Characterization of sp-, d- and f- Elements and their Compounds.
- 4 Classification of Chemical Reactions. Chemical Thermodynamics -the Laws of Thermodynamics, Enthalpy, Entropy, Free Energy. Spontaneity of Chemical Change. Chemical Equilibrium. Equilibrium Constant. Le Chatelier's Principle.
- 5 Chemical Kinetics. Reaction Rates and Factors that Influence them. Activation Energy and the Activated Complex. Catalysts and Mechanism of their Effect.
- 6 Solutions and their Properties. Solubility, Concentration of Solutions. Solutions of Electrolytes, Ionization Constant. Activity (effective concentration). Acids and Bases. The Dissociation of Water. The pH Scale. Salts, Hydrolysis of Salts, Solubility Product. Buffers, Characterization, pH, Capacity. Buffers of the Blood.
- 7 Oxidation-Reduction Processes. Hydrogen and Oxygen in these Processes. Standard Reduction Potentials. Osmosis. Osmotic Pressure. Colligative properties. Importance in Medicine.
- 8 Scope of Organic Chemistry. Formulas, Naming and Classification of Organic Compounds. Resonance, delocalization, conjugation, and aromaticity
- 9 Hydrocarbons and their Derivatives. Alkanes, Alkenes, Alkynes, Cycloalkanes.
- 10 Alcohols
- 11 Ethers, epoxides, and sulfides
- 12 Amines
- 13 Ketones and aldehydes
- 14 Carboxylic acids, esters, amides
- 15 Amino Acids and their Properties. Important Peptides.
- 16 Lactones, lactams and antibiotics
- 17 Phosphoric acids, inorganic and organic phosphates
- 18 Aromatic compounds
- 19 Alpha substitution and condensation of enols and enolate ions
- 20 Synthetic reactions in bioorganic chemistry
- 21 Proteins - Amino Acid Composition, Conformation of Proteins -
- 22 Monosaccharides - Classification, Configuration, Optical Activity, Anomers, Epimers. The Haworth Formulas. Reactions of Monosaccharides. Glycosidic Linkage, Reducing and non-Reducing Disaccharides. Polysaccharides and Glycosaminoglycans, Composition, Properties.
- 23 Types of Bonds and Interactions. Physical and Chemical Properties. Classification of Proteins.
- 24 Carbohydrates.
- 25 Myoglobin and Hemoglobin
- 26 Lipids and Steroids. Classification, Structure, Properties, Chemical Reactions.
- 27 Enzymatic catalysis
- 28 Introduction to the cell, compartments and cellular biochemistry.
- 29 Cell membranes. Introduction to metabolism.
- 30 Enzyme regulation
- 31 Overview of Intermediary Metabolism. Biological Oxidation and Bioenergetics. The Respiratory Chain and its Components. The Mechanism of Oxidative Phosphorylation. Oxygenases and Hydroperoxidases. Free Radicals.
- 32 The Citric Acid Cycle and its Regulation. The Pyruvate Dehydrogenase Complex.
- 33 Protein folding
- 34 Metabolism of Carbohydrates - Metabolism of Glucose and its Regulation. The Pentose Phosphate Pathway. Other Pathways of Hexose Metabolism. Gluconeogenesis. Metabolism of Glycogen and its Regulation. Metabolism of Glycosaminoglycans.
- 35 Protein purification and characterization
- 36 Antibodies
- 37 Metabolism of Lipids and Steroids - Digestion, Resorption and Transport. Lipoproteins and their Metabolism. Biosynthesis and Degradation of Saturated and Unsaturated Fatty Acids. Ketogenesis. Eicosanoids. Metabolism of Acylglycerols and Sphingolipids. Metabolism of Cholesterol. Biosynthesis of Bile Acids and Steroid Hormones.
- 38 Metabolism of Proteins and Amino Acids -Digestion, Resorption and Transport. Transamination, Oxidative

- Deamination and Decarboxylation of Amino Acids. Catabolism of the Carbon Skeleton of Amino Acids. Ammonia Formation and its Removal. Biogenic Amines.
- 39 Nucleosides, Nucleotides and Nucleic Acids. DNA and RNA structure and properties. DNA sequencing.
 - 40 Metabolism of Pyrimidine and Purine Nucleotides.
 - 41 Protein Synthesis.
 - 42 Metabolism of Porphyrins and Bile Pigments. Biosynthesis of Heme and Hemoglobin and their Catabolism. Jaundice.
 - 43 Components of the Blood. Water and Ions Metabolism. Acid-Base Balance. The Lungs and the Kidney in Acid-Base Balance. Disorders of Acid-Base Balance.
 - 44 Metabolism of Erythrocytes. Haemostasis and Blood Clotting.
 - 45 Contractile and Structural Proteins. Mechanism of Muscle Contraction and its Energy Supply.
 - 46 Metabolism of Connective Tissue. Connective Tissue Proteins, Proteoglycans. Process of Mineralization.
 - 47 Metabolism of Adipose Tissue.
 - 48 Metabolism of Liver.
 - 49 Receptors. Hormones.
 - 50 Extracellular and Intracellular Communication. Second Messengers, Protein Kinases.

Suggested textbooks

- Timberlake – General, Organic, & Biological Chemistry. Pearson ed.,
- Voet & Voet – Biochemistry. Wiley eds.

CELL AND MOLECULAR BIOLOGY

Total Credits: 11

Total Hours: 88

Scientific Discipline Sector: BIO/11 – BIO/12 – INF/01

Course Coordinator: Prof. Roberto Sitia

Email: sitia.roberto@hsr.it

18 hours

Collaborators:

Prof. Marco Bianchi

Email: bianchi.marco@hsr.it

10 hours

Prof. Anna Rubartelli

Email: anna.rubartelli@hsanmartino.it

10 hours

Prof. Eelco Van Anken

Email: vananken.eelco@hsr.it

30 hours

Prof. Simone Cenci

Email: cenci.simone@hsr.it

10 hours

Prof. Tiziana Anelli

Email: anelli.tiziana@hsr.it

Tutorials: 5 groups for 15 hrs tutorials each.

Tutors: Drs. Maurizio D'Antonio, Iria Medrano-Fernandez Andrea Orsi, Celine Schaeffer, Edgar Yoboue.

Each group will be given a scientific paper to read, understand, put in context, summarize and present to the whole class.

The interactive lectures are part of the programme. Student will be asked about their content and significance in the final exam.

This part of the programme is meant to show how scientific knowledge is created and disseminated, and to stimulate a critical attitude in our students.

Attending lectures and tutorials

We encourage students to attend to all lectures, as teachers will cover aspects that are absent or hard to find in textbooks. However, attending a lecture means much more than the mere physical presence in the class.

Students are encouraged to read the topics that will be covered in class **before** attending lectures, so that they can raise questions and focus onto the most relevant or controversial issues. Topics are often tackled in a transversal, multidisciplinary manner.

Unfair behaviour, such as for example clocking for others, will not be tolerated. Students found to do so will not be admitted to the exam.

Attending tutorials is mandatory. Those failing to do so will be admitted to the exam only in exceptional cases and their final grade will be $\leq 20/30$.

Type of subject: Biomedical discipline

Field: General discipline: Structure, function and regulation of cells and organisms, and the molecular bases of disease.

Course objectives:

With Chemistry & Biochemistry and Genetics & Developmental Biology, the Cell and Molecular Biology course illustrates the molecular bases of life and poses the bases for understanding the molecular bases of human disease. The Course is both systematic, and problem oriented. Lectures cover the basic principles of cell architecture and function (molecular motors, organelles, mitosis and meiosis, apoptosis etc, see below) whilst in tutorials students are asked to read and present to the whole class a scientific paper on a topic covered by the course.

Lectures and tutorials tackle problems of the past (evolution), present (imaging and 'omics' technologies) and future (new therapeutic strategies; socio-economic implications of novel biotechnologies) and are most frequently connected to pathogenic mechanisms.

The course aims also at explaining the processes of scientific proof, publication and divulgation and fostering the communication skills of our students.

At the end of this course, students should be able to:

- Read, understand and evaluate a scientific paper
- Prepare and deliver a scientific presentation
- Understand the basic cellular or molecular principles so as to understand the bases of human disease
- Design the principles of novel therapies to restore faulty cellular and molecular mechanisms.
- Interpret new medical discoveries in terms of fundamental principles of cell and molecular biology
- Explain the molecular bases of diseases that affect cellular function or interactions.

Introduction to the Course of Molecular and Cell Biology

What is life?

Where do we come from?

What are genes and how do they work?

What are cells

How cells divide

How cells die

How cells know where they are and where to go

How they interact with the environment

How cells differentiate

Molecular bases of disease

Evolution, Darwin and the adaptable cell structure

Prokaryotes, eukaryotes, multicellular organisms

Mitochondria and other successful symbioses

The evolution of specialized tissues

Homeostasis

Cytoskeleton and adhesion molecules

Adhesion molecules

Integrins

Tissue organization

Molecular motors and cell movements

Microtubules, microfilaments, molecular motors

Polarity

Axonal transport

Cytoskeleton

Muscular contraction

Cilia and flagella

Microvilli

Intracellular transport

Three main mechanisms of macromolecular transport:

To and from the nucleus

Membrane translocation

Vesicular transport

Exo, endo, pino, phagocytosis
Transcytosis
Mechanisms of cell polarity

Cell compartmentalization

Specific signals target macromolecules to different organelles.

Protein folding, the second genetic code

Anfinsen's demonstration of the central dogma
Chaperones and protein evolution

Protein degradation

Proteasomes, lysosomes and autophagy

Protein quality control and homeostasis

Stress responses in development and disease

Proteostasis as a signal and pathogenetic mechanism

Mechanisms of proteotoxicity
Molecular and cellular aging

Conformational diseases

Prions, Amyloidoses, Alzheimer & Parkinson

Nuclear structure

Nuclear "organelles". Chromosome territories. Nuclear membrane and lamins. Nuclear pores and transport

Chromatin

Nucleosomes. Histones and histone variants. Histone post-translational modifications, and enzymes that effect them.

Transcription in eukaryotes

RNA polymerases. Promoters & enhancers. General transcription factors. Specific transcription factors. Coactivators and corepressors. How nucleosome position and histone modifications affect gene expression

Gene expression decisions:

Examples of transcriptional regulation and signal transduction

The NF- κ B system
Liver specification

Retroviruses, the genome and RNAi

Retroviruses
miRNA, siRNA, heterocromatin and centromeres

Membrane structure

Architecture, composition, membrane proteins

Energy conversion I

Mitochondria

Energy conversion II

Chloroplasts, genetics of mitochondria & plastids, evolution of electron transport chains.

Cell signaling I

Principles of cell communication

Cell signaling II

G protein coupled cell surface receptors.

Cell signaling III

Enzyme coupled cell surface receptors.

Cell signaling IV

Unfolded Protein Response, determining cell shape.

Manipulating proteins & DNA I

Cloning, cDNA libraries, tagging, PCR.

Studying gene function & expression I

Function prediction, genetic screens, tagged libraries, reporter genes.

Studying gene function & expression II

Reverse genetics, knock-out libraries, RNAi, complementation, epistasis & EMAP, microarray.

Cell cycle 1

Phases and logics of the cell cycle. Experimental approaches. The Cell Cycle Control System. Engineering checkpoints. Significance of G phases. Molecular players: cyclins, cyclin-dependent kinases, Cdk inhibitors.

Visualizing cells I

Standard microscopy techniques

Cell cycle 2

Regulatory strategies: cyclic degradation, post-translational modifications, de novo synthesis. Checkpoints in G1 and G2. Preventing DNA re-replication. Cdc25 and regulation of M-Cdk activity. Rb and E2F: the restriction point and the Skp2 autoinduction loop. The DNA damage checkpoints. p53 and p14/19ARF. Cancer as a cell cycle disease.

Mitosis

Phases and mechanics. Cohesins and condensins. Centrosome, microtubules and the mitotic spindle. Role of motor proteins. Mechanisms of high-fidelity segregation: centromere and kinetochore. Mechanics of anaphase. Functions of chromokinesins. Cytokinesis. Drugs targeting mitosis and their clinical relevance.

Intercellular communication

How cells interact and talk to each other

Cytokines**Unconventional secretion**

Release of proteins outside the conventional exocytic pathway: mechanisms and pathophysiology

Inflammation

Damage and pathogen associated molecular patterns (DAMPs and PAMPs). The inflammasome and the origin of many chronic inflammatory disorders.

Visualizing cells II

Advanced microscopy techniques

A historical perspective

The Luria-Delbruck experiment .

Apoptosis - I

Functional significance: apoptosis vs. necrosis. Methods to study and monitor apoptosis. Functions in physiology and disease. Mechanisms: extrinsic vs. intrinsic apoptosis. Caspases: redundancy, efficiency, velocity. Death receptors and the Death-Inducing Signaling Complex (DISC). Mitochondria as signal integrators and death executors. The Apoptosome. Mitochondrial Outer Membrane Permeabilization (MOMP). The Bcl2 family: sensors/transducers, brakes, and effectors. Inhibitors of Apoptosis (IAPs).

Apoptosis - II

Apoptosis and the integrated stress response. Stress specificity of BH3-onlies. The other functions of Bcl2 proteins: daily jobs of night killers. Mitochondria and ER cross-talk. ER calcium homeostasis and apoptosis. Regulation by the unfolded protein response and heat shock proteins. Proteotoxic apoptosis.

Apoptosis- III

Integrating Cell Cycle, Apoptosis, and Cancer. Apoptotic escapes from the cell cycle. Apoptosis from cytotoxic vs. genotoxic stress. Maladaptive thresholds: implications for cancer pathogenesis and therapy. Alternative forms of eukaryotic cell death: autophagy, paraptosis, pyroptosis. Autophagy in physiology and disease.

A DNA driven world

Science and the future of human society

COURSEBOOKS:

Textbooks

Alberts, Bray, et al. *Molecular biology of the cell*

Alberts, Bray, et al. *Essential cell biology* www.garlandscience.com/textbooks/081533480X.asp

Lewin, Cassimeris et al. *Cells*

Lodish et al. *Molecular cell biology* www.whfreeman.com/lodish4

Pollard & Earnshaw *Cell Biology* www.us.elsevierhealth.com/.../book/.../Cell-Biology/

As the above books contain all the essential notions, differing primarily in the style of presentation, we do not recommend one in particular and leave the choice to the students' tastes and opportunities.

Suggested readings

We encourage our students to read on science, medicine and society. Below are a few tips.

M. Perutz. *Is science necessary?* and/or *I wish I made you angry before*. Two lovely series of essays on science and scientists.

J. Diamond. *Germs, guns and steel*. A brief summary of the last 13000 years of humans... Why did some civilisations prevail?

J. Monod *Chance and necessity*. A Nobel Prize winner in Medicine tackles fundamental philosophical issues

J.D. Watson. *The double helix*. Watson tells the story of how the structure of DNA was solved, with the pace of a crime fiction novel.

P. Medawar. *Advice to a young scientist*. Some tips for those tempted to become a physician scientist. Thoroughly enjoyable

USMLE REQUIREMENTS

Biology of cells

- adaptive cell responses and cellular homeostasis
- intracellular accumulations
- mechanisms of injury and necrosis
- apoptosis
- mechanisms of dysregulation
- cell biology of cancer, including genetics of cancer
- general principles of invasion and metastasis, including cancer staging
- cell/tissue structure, regulation, and function, including cytoskeleton, organelles, glycolipids, channels, gap junctions, extracellular matrix, and receptors

Molecular biology

- gene expression: DNA structure, replication, exchange, and epigenetics
- gene expression: transcription
- gene expression: translation, post-translational processing, modifications, and disposition of proteins (degradation), including protein/glycoprotein synthesis, intra/extracellular sorting, and processes/functions related to Golgi complex and rough endoplasmic reticulum
- structure and function of proteins and enzymes
- energy metabolism

GENETICS AND DEVELOPMENTAL BIOLOGY

Total Credits: 12

Total Hours: 96

Scientific Discipline Sector: BIO/13 – MED/03

Course Coordinator: Prof. Giorgio Casari

Email: casari.giorgio@hsr.it

32 hours

Collaborators:

Prof. Giangiacomo Consalez

Email: consalez.giangiacomo@hsr.it

32 hours

Prof. Luca Rampoldi

Email: rampoldi.luca@hsr.it

32 hours

Tutorials: 5 groups for 15 hrs tutorials each.

Tutors: Drs. Maltecca Francesca, Croci Laura, Cassina Laura.

Topics covered by the course

Mendelian and non-Mendelian genetics

Course introduction_ The Human Genome Project.

Mendelian Inheritance (I)_Definition of gene, locus, allele. The first Mendel's law.

Mendelian Inheritance (II)_The second and third Mendel's laws. Segregation and independent assortment.

Exceptions to Mendelian inheritance_Incomplete dominance, co-dominance. Penetrance and expressivity.

Exceptions to Mendelian inheritance_Sex-related effects. Pleiotropy. Pedigree design_2

Chromosomes/mitosis/meiosis_Chromosome structure (telomeres, centromere) and segregation during mitosis and meiosis. Crossing-over.

Chromosome structure. Chromatin structure and function. Histones and nucleosomes. Chromatin remodelling.

Recombination/mapping (I)_Molecular basis of recombination.

Recombination/mapping (II)_Recombination as a measure of genetic linkage. Mapping in bacteria and Drosophila.

Non-Mendelian inheritance (I)_Gene conversion.De-novo mutations.Mosaicism (X-inactivation).

Non-Mendelian inheritance (II)_Epigenetic control of gene expression. Imprinting.

Dynamic mutations (I)

Dynamic mutations (II)

Mitochondrial Inheritance

Chromosome mutations

Cytogenetics

CGH

DNA/RNA structure

Transcription/translation_Gene structure and transcription. The genetic code, structure of tRNA and ribosome.

Translation. Mechanisms of splicing

RNA interference_miRNA, siRNA, shRNA. Discovery and applications.

Point mutations and repair_Spontaneous and induced mutations. Repair of mutations and recombination.

Nonsense mediated decay

Complex mutations/polymorphisms/CNVs

Mutation detection techniques

Deep sequencing

Effect of mutations (gain/loss-of-function)_Gain-of-function and loss-of-function effect of mutations. Negative dominance.

Effect of mutations (ESE)

Genetic markers_DNA markers (microsatellites, SNPs). Genetic maps. Haplotype maps

(the HaploMap project).

Genetic Mapping (I)_Linkage analysis in human pedigrees. LOD score calculation.

Genetic Mapping (II)_Linkage analysis in human pedigrees. Haplotype analysis.

Probability_Bayes' theorem, application for risk calculation in human pedigrees.

Examples of linkage/positional cloning

Examples of functional cloning

Quantitative Trait Loci

Population genetics_1

Population genetics_2

Molecular Evolution (I)

Non-parametric linkage analysis/association studies

Jolly

Embryology and developmental biology

This part of the course will cover the essentials of normal human development and of its main aberrations, providing information on some recognizable patterns of human malformation.

General Embryology

Gametogenesis: Conversion of Germ Cells into Male and female gametes

First Week of Development: ovulation to implantation

Second Week of Development: Bilaminar Germ Disc

Third Week of Development: Trilaminar, Germ Disc

Third to Eighth weeks: The Embryonic Period

Third Month to Birth: The Fetus and Placenta

Systems-based Embryology

Skeletal System

Muscular System

Body Cavities

Digestive System

Cardiovascular System

Respiratory System

Urogenital System

Head and Neck

Central Nervous System

Ear and eye development

Tegumentary System

COURSEBOOKS:

Langman's Medical Embryology / Edition11,

Thomas W.Sadler, ED. Lippincott Williams & Wilkins ISBN: -13: 9780781790697

Human Molecular Genetics ^{3rd} Edition,

Tom Strachan, Andrew Read - ED: Garland Science - ISBN:0-8153-4184-9

USMLE REQUIREMENTS

Human development and genetics

- principles of pedigree analysis
- inheritance patterns
- occurrence and recurrence risk determination
- population genetics: Hardy-Weinberg law, founder effects, mutation-selection equilibrium
- principles of gene therapy
- genetic testing and counselling
- genetic mechanisms



SAN RAFFAELE INTERNATIONAL MD PROGRAM

YEAR 2

Academic Year 2013/2014

- Human Morphology
- Physiology
- Principles of Pharmacology
- Introduction to Surgery

HUMAN MORPHOLOGY

Total Credits: 30

Lessons: 240 h

Practicals: 44 h

SSD BIO/16, BIO/17, MED/36, MED/37, MED/33

Course Coordinator: Ottavio Cremona

Email: ottavio.cremona@univr.it

Professors Teaching:

| | |
|--------------------|---|
| Stefano Cappa | Email: cappa.stefano@hsr.it |
| Giuliano Cerulli | Email: g_cerulli@tin.it |
| Giangiaco Consalez | Email: consalez.giangiacomo@hsr.it |
| Michele De Palma | Email: michele.depalma@epfl.ch |
| Andrea Falini | Email: falini.andrea@hsr.it |
| Luigi Naldini | Email: naldini.luigi@hsr.it |
| Giuseppe Peretti | Email: giuseppe.peretti@hsr.it |
| Mario Rende | Email: rende@unipg.it |
| Marco Vitale | Email: marco.vitale@univr.it |

Tutors:

| | |
|-----------------------|---|
| Di Giacomo Giuseppina | Email: digiaco.giuseppina@hsr.it |
| Angelo Lombardo | Email: lombardo.angelo@hsr.it |

Goals

Aim of the course is to provide the morphological basis of the various functions and pathologies of the human body. Approaches to morphological education include the acquisition of foundational knowledge in microscopic observation and in dissection with the aim of correlating structure with function and pathology. Our course emphasizes clinical aspects by integrating radiologic imaging techniques, effective peer teaching and the use of electronic resources to facilitate the understanding and memorization of morphological data. The study of tissue and organ architecture by different microscopic techniques is structured to provide the structural basis for tissue and organ function; principles of tissue development and homeostasis, cellular turnover, isolation and properties of stem cells will be given as a priming for tissue pathology.

Pre-Requisites

Although there are no formal restrictions to the access to the final exam, we strongly advise students to have solid foundations in:

- Cell Biology and Cytology
- Developmental Biology

Knowledge of these disciplines was acquired during the 2nd semester of the past academic year.

Evaluation

Final marks will be the results of in-course and end-of-course exams, including:

- An oral histology exam including observation tests at the microscope
- A multiple-choice exam on "Dynamics of Movement"
- A final written exam covering the remaining part of the program

Program

1st semester:

INTRODUCTORY MORPHOLOGY

1. Introduction to Tissues
2. Epithelial Tissue .
3. Connective Tissues
4. Adhesion & Matrix
5. Cell Migration
6. Anatomical Position & Terminology

MORPHOLOGY OF ORGAN SYSTEMS

➤ *Support and Movement*

i. Skin

ii. Skeletal Tissues

1. Histology of the skeletal muscle
2. Histology of Muscle, Bone & Cartilage
3. Bone remodeling
4. Dynamics of Movement
 - Upper limb
 - Lower limb
 - Thorax
 - Rachis

➤ *Transportation & Defense*

i. Blood

1. Blood.
2. Hematopoiesis
 - ii. Cardiovascular system*
3. Heart.
4. Structure of Vessels
5. Major Vessels. General Organization.
6. Major Vessels.
 - Head and neck.
 - Thorax.
 - Abdomen.

iii. Lymphatic system

7. Overview and structure of the system
8. Major lymphatic vessels

iv. Immune system

9. General overview of the Immune system
10. Immune organs (MV)

➤ *Respiratory System*

1. Nasal Cavity & pharynx
2. Larynx, trachea & bronchi
3. Lung & Pleura

➤ *Digestive System*

1. Oral Cavity.
2. Teeth
3. Esophagus & topography of the mediastinus
4. Peritoneum
5. Stomach
6. Small Intestine
7. Large intestine & rectum
8. Gut stem cells
9. Liver
10. Gallbladder & Pancreas

➤ *Urinary System*

1. Kidney
2. Urinary tract
3. Topography of the abdomen.
4. Topography of the pelvis
5. Perineum

➤ *Endocrine System*

1. Pituitary gland
2. Thyroid & Parathyroid glands
3. Adrenal glands
4. Topography of head and neck

➤ *Reproductive Systems*

i. Male reproductive system

1. Testis
2. Reproductive tract
3. Accessory reproductive glands & Supporting structures

ii. Female reproductive system

4. Ovaries & Uterine tubes (OC)
5. Uterus & placenta (OC)
6. Vagina, Vulva & Breast (OC)

[Human Morphology book list](#)

Suggested textbooks (kindle versions are strongly recommended and indicated with ASIN numbers):

Gray's Anatomy for Students by Richard L. Drake, A. Wayne Vogl and Adam W. M. Mitchell

ISBN: 9780443069529, **ASIN:** B005YZX32I

Atlas of Human Anatomy by Frank H. Netter **ISBN:** 9781416059516, **ASIN:** B005IXCCD2

Neuroanatomy: An Atlas of Structures, Sections, and Systems by D.H. Haines. **ISBN:** 9781605476537 or **ASIN:** B00838KNNK

Neuroanatomy: Text and Atlas by John Martin **ISBN:** 978-0071603966, **ASIN:** B0088NGYY2

Histology: A Text and Atlas by [Michael H. Ross](#) and Wojciech Pawlina **ISBN:** 978-0781772006, **ASIN:** B0080KAXS6

Reference textbooks:

Gray's Anatomy: The Anatomical Basis of Clinical Practice by Susan Standring. **ISBN:** 978-0443066849

Clinically Oriented Anatomy by Keith L. Moore **ISBN-13:** 978-0781775250

Neuroanatomy through Clinical Cases by Hal Blumenfeld **ISBN:** 978-0878930586

Atlas of Anatomy (Thieme Anatomy) by Anne Gilroy, Brian MacPherson, Lawrence Ross and Michael Schuenke **ISBN:** 978-1604060621

Junqueira's Basic Histology: Text & Atlas by A. Mescher **ISBN:** 978-0071630207

PHYSIOLOGY

Total Credits: 17

Lessons: 136 hrs

Practicals: 130 hrs

SSD: BIO/09

Course Coordinator: Antonio Malgaroli

Professors Teaching:

Fausto Baldissera Email: fausto.baldissera@unimi.it
Carley Benton Email: benton.carley@hsr.it
Jacopo Lamanna Email: lamanna.jacopo@hsr.it
Antonio Malgaroli Email: malgaroli.antonio@hsr.it
Maddalena Ripamonti Email: ripamonti.maddalena@hsr.it
Eugenio Rapisarda Email: rapisarda.eugenio@hsr.it
Adrian Sculptoreanu Email: sculptoreanu.adrian@hsr.it
Vincenzo Zimarino Email: zimarino.vincenzo@hsr.it

Tutors

Mattia Ferro Email: ferro.mattia@hsr.it
Giovanni Montesano Email: giovmontesano@tiscali.it
Gabriella Racchetti Email: racchetti.gabriella@hsr.it

COURSE INTRODUCTION

The purpose of this course is to provide a complete training in biophysics and human physiology. This course is designed to promote learning by practice, with a particular emphasis on stimulating student experimental creativity and interdisciplinary approaches. We all know that *Physiology* is the investigation of cell and body functions, hence the major goal is to understand and be able to predict the acute and adaptive responses of the body to external stimuli but also to understand how the body can maintain a stable set of internal conditions while the external environment is constantly changing. Physiology can be studied at many different levels including biophysics, cell physiology, organ physiology and systems physiology. In this course you will be exposed to all of these levels, initially to the biophysical and cellular physiology level, then quickly moving up to the organ and system levels. In the mainframe of this M.D. program, clearly Physiology and Anatomy must be closely related subjects. To fully appreciate the physiology of a given system it is necessary to first know its anatomy, therefore much coordination work has gone into ensuring that each topic will be presented sequentially, first in the Anatomy and then in the Physiology Course. Indeed, in most cases true understanding of physiology can only take place if structure and function are concurrently learned. A complete and in depth understanding of physiology would be essential to appreciate in subsequent courses how the human body might be functionally altered by diseases (pathophysiology) and also to predict the response of the body to pharmacological therapies or drugs.

SPECIFIC GOALS AND OBJECTIVES

The goals of this M.D. Course in Physiology are to train students to:

1. be able to demonstrate comprehensive understanding of biophysics and physiology as well as the integration of these with basic and applied disciplines;
2. understand the molecular and cellular mechanisms of physiological processes, in order to provide a foundation for understanding pathophysiology and therapeutics in subsequent courses;

3. integrate knowledge and concepts from cellular physiology and organ physiology to understand the integrative body functions, e.g., maintenance of blood gas levels; responses to stresses; regulation of fluid volumes and compositions; digestion; reproduction, etc.;
4. use and develop adequate knowledge of the most current developments in basic and medical sciences as related to biophysics and physiology;
5. acquire skills in research methodologies used in biophysics and physiology to be able to understand experimental research more effectively;
6. plan and run simple biophysics and physiology experiments utilizing standard equipments, including the evaluation and interpretation of experimental results; demonstrate competence in basic concepts of research methodology; effectively use the statistical methods for data analysis;
7. develop communication skills by frequent in-class discussions;
8. understand scientific papers dealing with physiological results;
9. function as a productive member of a student team engaged in learning and designing experimental strategies to understand structure-function problems;

DETAILED PROGRAM

Biophysics and Cell Physiology

1. Historical grounds of physiology; Units and Scales in physiology; The concept of homeostasis
2. Cellular Membranes and Transmembrane Transport of Solutes and Water
3. Thermodynamics of membrane transport
4. Mechanisms of carrier-mediated transport: facilitated diffusion, cotransport, and countertransport. Sodium pump function, Na⁺ - Ca²⁺ exchange currents
5. Diffusion and permeability
6. Osmosis and regulation of cell volume
7. Intracellular pH Regulation
8. Ionic Equilibria and the concept of equilibrium potential.
9. Origin of resting membrane potentials. The driving force for ionic-fluxes.
10. Gibbs-Donnan equilibrium potentials. Intracellular chloride regulation
11. Patch-clamp techniques and analysis of cell currents and ion channels
12. Ion channel families
13. Structure-function of voltage-gated ion channels
14. Electrogenesis of membrane excitability
15. Generation and conduction of action potentials
16. Cable properties and propagation of action potentials
17. Derivation of the Cable Equation and the AC length constant
18. Effects of toxins, drugs, genetic diseases of ion channels and variation in extracellular ions concentration on resting membrane potential and membrane excitability

Muscle Physiology

19. Introduction to Skeletal muscle physiology
20. Membrane excitability of skeletal muscle cells
21. Excitation-contraction coupling in skeletal muscle; regulation of Ca²⁺ release from sarcoplasmic reticulum
22. Muscle metabolism and energetics
23. Role of muscle mitochondria and regulation of ATP production
24. Response to exercise and muscle fatigue
25. Smooth Muscle Physiology
26. Smooth muscle metabolism and signalling

27. Introduction to Cardiac Muscle Physiology

Renal Physiology

- 28. Elements of Renal Function
- 29. The Nephron; The ultrafiltration process
- 30. Solute and Water Transport Along the Nephron. Tubular Function
- 31. Feedback mechanisms and autoregulation of the kidney function
- 32. Control of Body Fluid Osmolality and Extracellular Fluid Volume
- 33. Potassium, Calcium, and Phosphate Homeostasis
- 34. Intracellular pH Regulation and role of the Kidneys in Acid-Base Balance

Physiology of the Respiratory System

- 35. Overview of the Respiratory System
- 36. Mechanical Properties of the Lung and Chest Wall
- 37. Ventilation, Perfusion, and Their Relationship
- 38. Oxygen and Carbon Dioxide Transport
- 39. Control of Respiration
- 40. Nonrespiratory Functions of the Lung

Physiology of the Cardiovascular System

- 41. Overview of the Circulation, Blood, and Hemostasis
- 42. Electrical Activity of the Heart
- 43. Natural Excitation of the Heart and the pacemaker ion channels
- 44. Cardiac Pump
- 45. Regulation of the Heartbeat
- 46. Hemodynamics
- 47. Arterial System
- 48. Microcirculation and Lymphatics
- 49. Peripheral Circulation and Its Control
- 50. Control of Cardiac Output. Coupling of the Heart and Blood Vessels
- 51. Special Circulations
- 52. Interplay of Central and Peripheral Factors in Control of the Circulation

Physiology of the Digestive System

- 53. Introduction to the digestive system
- 54. Nutrition and energy metabolism
- 55. The enteric nervous system
- 56. Motility of the Gastrointestinal Tract
- 57. Gastrointestinal Secretions
- 58. Digestion and Absorption for lipids, carbohydrates, proteins

Physiology of the Nervous System

- 59. Cellular and functional organization of the nervous system
- 60. The functional organization of cerebral cortex
- 61. Introduction to synapses

62. Synaptic transmission and ligand-gated ion channels
63. Synaptic transmission and release of neurotransmitter molecules
64. Synaptic transmission and transporters for neurotransmitter molecules
65. Quantal analysis of synaptic transmission
66. Synapses as targets for toxins, drugs, and genetic diseases
67. Associative and non-associative forms of synaptic plasticity
68. The organization of the sensory nervous system
69. The visual system
70. The auditory system
71. The central organization of the motor system and the motor pathways
72. The spinal reflex and locomotor activity centers in the spinal cord
73. Motor function and the role of brainstem, basal nuclei and cerebellum
74. Activation of the brain, sleep and wakefulness; EEG recordings
75. Higher Functions of the Nervous System: memory, consciousness, language, emotions.
76. The autonomic nervous system and its control

Physiology of the Endocrine System

77. General Principles of Endocrine Physiology
78. Whole-Body Metabolism
79. Hormones of the Pancreatic Islets
80. Endocrine Regulation of the Metabolism of Calcium and Phosphate
81. Hypothalamus and Pituitary Gland
82. Thyroid Gland
83. Adrenal Cortex
84. Adrenal Medulla
85. Overview of Reproductive Function
86. Male Reproduction
87. Female Reproduction

FORMATIVE ASSESSMENT AND EXAMS

The assessment is continuous as well as end-of-term. The former is based on the feedback from teachers and tutors and a series of theory exams (eight written tests on theory, one at the end of each section of the course). End-of-term assessments are held at the end of each semester. The performance of students during theoretical lectures and experimental sessions will be monitored throughout the course and duly recorded in log books as evidence of the ability and daily work of the student. Final marks should be allotted out of 100 as follows:

Continuous Formative Assessment (20):

1. Personal Attributes (10)

Behavior and emotional stability, motivation and initiative, honesty and integrity, interpersonal skills in the class and leadership quality.

2. Homeworks (10)

Punctual and prompt response to home assignments, dedicated, hardworking, competent in practical work.

Intermediate and end of term theory examinations (80)

The format of the intermediate test and end of term examination will be multiple choice and/or multiple-choice which might include numerical questions or small exercises (a pocket calculator with log and exp is needed). The students are expected to know the proper names and spelling of channels, transporters, receptors, reactions, structures, cells, currents, etc. as presented in class or in textbooks. Regarding the exercises, not only the procedures but also the final results should be accurate.

SUGGESTED BOOKS AND READINGS

- 1) Course Syllabus and other reading material provided on the intranet (course page)
- 2) E. R. Kandel, J.H. Schwartz e T.M. Jessel: Principles of neural science V ed. McGrawHill, 2012
- 3) Berne & Levy Physiology, Bruce M. Koeppen and Bruce A. Stanton, Mosby-Elsevier VI edition, 2010

OTHER BOOKS

Aidley D.J. The Physiology of Excitable Cells. Cambridge Univ Press, IV ed., 1998.
Hille, B. Ionic channels of excitable membranes. III Edition, Sinauer, Sunderland, 2001
Johnston D., S. Miao_Sin Wu, S. Maio_Sin Wu. Foundations of Cellular Neurophysiology. MIT, 1995.
Katz, B. Nerve, Muscle and Synapse, McGraw Hill, 1966
Sheperd G.M. The synaptic organization of the brain. Oxford, V edition, 2004
Sperelakis N. Cell Physiology Source Book: Essentials of Membrane Biophysics. III edition, Academic Press 2001

PRINCIPLES OF PHARMACOLOGY

Total Credits: 9

Lessons: 72 hrs

Practicals: 44

Scientific Discipline Sector: BIO/14

Teaching Staff

Course Coordinator: Prof. Daniele Zacchetti Email: zacchetti.daniele@hsr.it
Prof. Riccardo Fesce Email: riccardo.fesce@uninsubria.it

Tutors:

Barbara Bettegazzi Email: bettegazzi.barbara@hsr.it
Daniele Caretoni Email: daniele.carettoni.dc@axxam.com
Romina Macco Email: macco.romina@hsr.it
Ilaria Prada Email: prada.ilaria@hsr.it

Seminars:

Addis Antonio Email: agmaddis@googlemail.com
Giulia Chiesa Email: giulia.chiesa@unimi.it

The course of Principles of Pharmacology, offered to the students already at the IV semester, is one of the unique features of our MD course. Pharmacology is the science that studies the effects of the exogenous substances to the physiology and pathology of the organism. Within the traditional Italian MD curriculum, pharmacology is proposed after the other basic science disciplines, being thought to introduce concepts and instruments not emendable to the practical use of drugs (in diagnostics, anesthesia and, most importantly, therapy). For this reason this course in the other Italian Universities is still offered at the IV year, being addressed to the students already being exposed to Clinics and that have already acquired topics such as General Pathology and Microbiology. In the last years, however, this way of teaching has started to show its limitations. On one side the comprehension of the mechanisms of drug actions and the new therapeutic perspectives have been developed in an extraordinary way thanks to the knowledge at the molecular, cellular, genetic and physiological levels; on the other side the relationship between pharmacology and the clinics has tightened, due to the fact that drugs are not anymore "magic bullets", rather disease-modifying instruments and tools to understand pathology. The aim of our discipline has now widened in both operative and didactic-cultural terms. Teaching pharmacology at the boundary between basic topics and clinical courses is not anymore suitable for a modern School of Medicine. For this reason at the "Vita-Salute" San Raffaele University Pharmacology has been divided in two parts. This course, Principles of Pharmacology (coordinator Prof. Daniele Zacchetti), is offered together the other basic science courses and allows to recall and highlight, under a different point of view, information and basic biological concepts, opening them to problems that lead to clinics and therapeutics. The specific pharmacological issues known as Therapeutics (responsible Prof. Flavia Valtorta) is now integrated within the clinical courses and allows putting the pharmacological topics in the specific issues as a fundamental tool for the approach to the patient. This is an important example of the integration, between basic and clinical teaching, that is a specific feature of our MD course. The two aspects of Pharmacology are so tethered that they make use to the same textbook, i.e. the Goodman and Gilman's, the classical compendium, known to all the physicians and that, not by chance, is entitled 'The Pharmacological Basis of Therapeutics'.

How is the course organized?

The aim of the course on Principles of Pharmacology is to provide the tools to understand drugs and their effects, answering a long list of questions such as 'why a drug has got one (or several) effect(s) and another molecule, possibly almost identical at the molecular level, has got a completely different profile of action?' up to "How a new drug is being developed?". Most of the concepts that will be provided are somehow new for the students of the second year, in the sense that they will be proposed from a different perspective; moreover, the topic of drugs is by itself comprehensive since it involves the entire organism. For this as well as several other reasons academic lessons are being held aimed to the explanation of concepts and issues. Presentation from groups of students might be also organized on specific topics. Last, the course is implemented with an experimental part represented by tutorials in which the techniques employed in pharmacological research are presented and explained. Pharmacology does not

have its own techniques but, rather, employs the methods of the other disciplines. The point of view of Pharmacology is anyway often specific and there is always a lot to discuss, to critically analyze and to understand.

DIDACTIC MATERIAL

The textbook of reference is the Goodman e Gilman's, XII edition, published in English at the end of 2010 (mind! Of this book there are obviously 11 editions before this one, published every 5 years, approximately; Pharmacology is a discipline in fast development!).

Goodman & Gilman's

The Pharmacological Basis of Therapeutics, XII Edition

Ed. McGraw Hill, 2010

Meetings with students

Meetings with the coordinator of the course on Principles of Pharmacology can be organized by appointment organized by email (zacchetti.daniele@hsr.it) or calling the 02-2643.4817

Evaluation procedures

The exam is based on two steps: a test with 8-10 open questions, to be completed within 30 min and aimed to highlight students still far from an adequate knowledge of the discipline; then, an oral exam based on the critical discussion of wide and important topics, all included in then teaching program, on the basis of which the final grade will be established.

Program of the course

The Course is organized in the following topics. In details we will deal with

1. Introduction to the course, definitions, drugs and their molecular and biological properties.
2. Pharmacokinetics, i.e. the journey of the drug within the organism, the time-dependence of drug effects and the process that are responsible for them:
 - Absorption and distribution of drugs: way of administration, proteins of the plasma;
 - Drug elimination: drug metabolism, excretion, kinetic aspects.
3. Pharmacodynamics, i.e. the features and the quantification of the drug effects:
 - Drug effects, dose-dependency
 - Dose-effect curves.
4. Pharmacogenetics, pharmacogenomics and mechanisms of resistance.
5. Molecular targets of drugs – the receptors and their transduction mechanisms:
 - Surface receptors;
 - Circulation of receptors;
 - Intracellular receptors.
6. Effects of drugs on cellular signaling:
 - Second messengers – spatial coordination;
 - Cross-talk among transduction pathways.
7. Pharmacology of the peripheral nervous system as a paradigm for the drug action:
 - Sympathetic system; α and β adrenergic receptors;
 - Direct and indirect agonists, receptor antagonists;
 - Parasympathetic system and neuromuscular transmission;
 - Muscarinic e nicotinic receptors;
 - Cholinergic agonists; cholinesterase blockers;
 - Antagonists: ganglioplegics and curare.
8. Autacoids, specific endogenous factors that act locally, and their pharmacology:
 - the arachidonic acid cascade;
 - the nitric oxide;
 - histamine, serotonin, bradykinin, cytokines;
 - ATP; adenosin.
9. General pharmacology of the central nervous system:
 - neurons and glia, the synaptic signalling;
 - excitatory and inhibitory transmissions; drugs of abuse;
 - neurodegeneration.
10. Introduction to chemotherapy (bacteria, viruses, tumors):
 - introduction to antibacterial drugs;
 - introduction to antiviral drugs;
 - growth and death of cells. antitumoral drugs.
11. Principles of pharmacognosy, toxicology and biologic therapy.
12. Principles of Pharmacovigilance and Pharmacoeconomy

13. Development of new drugs: history, rules and future of pharmacology.

INTRODUCTION TO SURGERY

Total Credits: 3

Lessons: 24 hrs

Practicals: 30 hrs

Scientific Discipline Sector: MED/18 – MED/19

Course Coordinator: Prof. Braga Marco

Professors Teaching:

Braga Marco Email: braga.marco@hsr.it

Gianotti Luca Email: gianotti.luca@hsr.it

Tutors:

Stratta Gregorio Email: stratta.gregorio@hsr.it

Pecorelli Nicolò Email: pecorelli.nicolo@hsr.it

Capretti Giovanni Email: capretti.giovanni@hsr.it

Course aims

Course aims

Many surgical skills – except operating skills – are part of general medicine. A doctor has to deal with health problems on a daily basis, for which the solution implies the knowledge of illnesses pertaining to surgical subjects, but also the ability to carry out diagnostic and treatment procedures.

The course represents an approach to these issues, which will be followed consistently and completed in the other surgery courses.

The aim of the course is to learn about some pathological situations, know about some simple surgical procedures and know about performance and hospital issues in the surgical field.

Introduction to Surgery book list: Textbook of Surgery - Sabiston



SAN RAFFAELE INTERNATIONAL MD PROGRAM

YEAR 3

Academic Year 2013/2014

- Basic Pathology and Immunology
- Microbiology and Mechanisms of Infectious Diseases
- Clinical Laboratory Medicine
- Cardiovascular Diseases
- Principles of Surgery
- Digestive System Diseases
- Respiratory, Ear, Nose and Throat Diseases
- Clinical Rotations

Basic Pathology and Immunology

Total Credits: 13

Total hours: 104

Scientific Discipline Sector: MED/04 - MED/08 – MED/09

Teaching staff

Course Coordinator: Prof. Guido Poli Email: poli.guido@hsr.it
Prof. Ruggero Pardi Email: pardi.ruggero@hsr.it
Dr. Matteo Iannacone Email: iannacone.matteo@hsr.it
Dr. Anna Mondino Email: mondino.anna@hsr.it
Dr. Maurilio Ponzoni Email: ponzoni.maurilio@hsr.it
Dr. Patrizia Rovere-Querini Email: rovere.patrizia@hsr.it

Course Description

The BPI course will be articulated in two parts. The first part (composed of 32 frontal lessons) aims at providing the fundamental knowledge on the most relevant aspects of human pathology and immunology, including cell and tissue pathology, the mechanisms underlying acute and chronic inflammation, wound repair and the process of neoplastic transformation. Immunology lessons will provide state of art information on both innate and adaptive immune responses to pathogens and transformed cells as well as on key immunologically mediated diseases, such as immunodeficiencies, allergy and autoimmunity.

In the second part of the course, the student will be directly involved in interactive modules (IM) revolving around theoretical or actual clinical cases. Each IM will start from the medical and histopathological description of a clinical case with the goal of identifying its etiology and reconstructing the fundamental pathogenic steps leading to overt clinical disease. This inductive process will be enriched by elements of epidemiology, genetics and pre-clinical models (when available). Since, on average, each module will span over two lessons (i.e. 4 h), the second part of the course foresees 10 IM covering the main areas of human pathology.

Overall, the course aims at providing a solid base on the fundamental principles underlying human pathology while training the students to exert their creativity and acquired knowledge to probe the field of human diseases.

Textbooks:

Robbins Basic Pathology: with STUDENT CONSULT Online Access, 9e (Robbins Pathology)

Cellular and Molecular Immunology: with STUDENT CONSULT Online Access, 7e (Abbas, Cellular and Molecular Immunology)

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Microbiology and Mechanism of Infectious Diseases

Total Credits: 7

Total hours: 56

Scientific Discipline Sector: MED/07 - VET/06 – BIO/14

Teaching staff

| | | |
|----------------------------|------------------------|---|
| Course Coordinator: | Prof. Massimo Clementi | Email: clementi.massimo@hsr.it |
| | Prof. Nicasio Mancini | Email: mancini.nicasio@hsr.it |
| | Prof. Pistello Mauro | Email: mauro.pistello@med.unipi.it |
| | Prof. Nicola Clementi | Email: clementi.nicola@hsr.it |

Course Description

Bacteriology

The purpose of this course is to give to students a thorough grounding in the comprehension of microbial structure, physiology and in the interplay between humans and microbes in different body sites and conditions. This will be achieved by studying microbial resident flora (microbiota), with particular attention to its composition, its changes during infectious diseases and to its role in the diffusion of resistance to antibiotics.

Following this perspective, students will be introduced to all of the basic structural, physiological and metabolic principles of medical bacteriology including the following points:

- Cell structure of prokaryotes
- Structure and function of endospores
- Microbial metabolism
- Microbial genetics
- Virulence and pathogenicity of bacteria
- Transmission of bacterial infection
- The immune response to bacteria
- Techniques for the diagnosis of bacterial infections
- Novel techniques for the study of resident flora (the "human microbiome project")

The detailed knowledge of the microbiota and its composition will also allow a better comprehension of the role played by specific bacterial genera and species, important in medical microbiology, that will be studied in details. Here it follows a punctual list of the bacterial genera and species that students should understand by the end of the course:

- *Staphylococcus* spp
- *Staphylococcus aureus*
- Coagulase-negative staphylococci
- *Streptococcus* spp
- *Streptococcus pyogenes*
- *Streptococcus agalactiae*
- *Streptococcus pneumoniae*
- Viridans streptococci
- *Enterococcus* spp
- *Enterococcus faecalis*
- *Enterococcus faecium*
- *Bacillus* spp
- *Bacillus anthracis*
- *Bacillus cereus*
- *Clostridium* spp
- *Clostridium difficile*
- *Clostridium perfringens*
- *Clostridium botulinum*
- *Clostridium tetani*
- *Corynebacterium* spp
- *Corynebacterium diphtheriae*
- *Corynebacterium striatum*

- *Listeria monocytogenes*
- *Actinomyces* spp
- *Nocardia* spp
- *Enterobacteriaceae*
- *Escherichia coli*
- *Klebsiella pneumoniae*
- *Proteus mirabilis*
- *Enterobacter* spp
- *Serratia marcescens*
- *Salmonella* spp

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- *Shigella* spp
- *Pseudomonas aeruginosa*
- *Stenotrophomonas maltophilia*
- *Burkholderia* spp
- *Acinetobacter* spp
- *Vibrio cholerae*
- *Campylobacter* spp
- *Helicobacter pylori*
- *Haemophilus* spp
- *Haemophilus influenzae*
- *Moraxella catarrhalis*
- *Bordetella pertussis*
- *Brucella* spp
- *Francisella tularensis*
- *Yersinia pestis*
- *Yersinia enterocolitica*
- *Pasteurella multocida*
- *Neisseria* spp
- *Neisseria meningitidis*
- *Neisseria gonorrhoeae*
- *Legionella pneumophila*
- *Bartonella* spp
- *Bacteroides* spp
- Mycobacteria
- *Mycobacterium tuberculosis*
- *Mycobacterium avium* complex
- Spirochetes
- *Mycoplasma* and *Ureaplasma*
- *Rickettsia*, *Ehrlichia*, *Anaplasma* and *Coxiella*
- *Chlamydia* and *Chlamydophila*

The microbiota-oriented perspective will also be followed in the study of the available prophylactic and therapeutic anti-bacterial approaches:

- Sterilization, Disinfection and Antisepsis
- Modes of action of the main biocides used for disinfection and antiseptics
- Mechanisms of resistance to biocides
- Antibiotics: bacterial targets of available molecules and mechanisms of resistance
- Genetic bases of antibiotic resistance
- Genetic bases of the diffusion of antibiotic resistance
- Multi-drug resistant bacteria
- Passive immunoprophylaxis
- Anti-bacterial vaccines

Virology

The general purpose of this course is to give a robust introduction to basic medical virology, correlating the molecular features of each viral agents to the associated clinical syndromes. The dramatic advances in the comprehension of the different phases of the viral replicative cycle and pathogenesis will be directly correlated to the practical possibility of developing novel antiviral strategies or of improving the available diagnostic tools.

At the end of the course, the students should be familiar with the following general topics:

- Structure and chemical composition of viruses
- Phases of viral replication
- Transmission of viral infection
- Different types of viral infection
- Pathogenesis of viral diseases according to different sites of replication

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- Viral carcinogenesis
- The immune response to viruses
- Techniques for the diagnosis of viral infections
- Antiviral agent and mechanisms of viral resistance
- Passive immunoprophylaxis
- Antiviral vaccines

These general concepts should be specifically correlated to the specific features of each of the following groups of viruses:

- Parvoviruses
- Adenoviruses
- Herpesviruses
- Poxviruses
- Picornaviruses
- Papillomaviruses and polyomaviruses
- Hepatitis viruses
- Rotaviruses
- Caliciviruses
- Arthropod-borne and rodent-borne viruses
- Orthomyxoviruses
- Paramyxoviruses
- Rubella virus
- Coronaviruses
- Rabies virus
- Human retroviruses
- Lentiviruses
- Non-conventional non-viral pathogens (Prions)

Mycology

At the end of the course, the students will be familiar with the following topics regarding medical mycology:

- Structure of fungal cell
- Yeasts and moulds
- Fungal genera and species present in the human microbiota
- Virulence and pathogenicity of fungi
- Immune control of fungal agents
- Causative fungal agents of superficial, cutaneous and subcutaneous mycoses
- Causative fungal agents of endemic mycoses
- Causative fungal agents of opportunistic mycoses
- Diagnostic laboratory techniques of fungal infections
- Antifungal agents: targets of available molecules and mechanisms of resistance

The students should also be familiar with the main features regarding the following fungal genera and species of medical interest:

- *Candida* spp
- *Candida albicans*
- *Candida glabrata*
- *Candida krusei*
- *Cryptococcus neoformans*
- *Aspergillus* spp
- *Aspergillus fumigatus*
- *Aspergillus terreus*

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- *Fusarium* spp
- Zygomycetes
- *Pneumocystis jiroveci*
- *Histoplasma capsulatum* and other dimorphic fungi

Parasitology

By the end of the course, students should be familiar with the following protozoan and helminthic parasites of medical importance, with particular attention given to associated clinical syndromes and diagnostic laboratory techniques:

- *Giardia lamblia*
- *Cryptosporidium* spp and *Cyclospora* spp
- *Entamoeba histolytica*
- *Trichomonas vaginalis*
- *Trypanosoma* spp
- *Leishmania* spp
- Tissue amebae (i.e. *Acanthamoeba* spp)
- *Plasmodium* spp
- *Babesia microti*
- *Toxoplasma gondii*
- *Enterobius vermicularis*
- *Trichuris trichiura*
- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Strongyloides stercoralis*
- *Trichinella spiralis*
- *Taenia* spp
- *Diphyllobotrium latum*
- *Anisakis simplex*
- *Schistosoma* spp
- Filariae
- *Echinococcus granulosus*

Suggested textbooks

- 1) Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller – Medical Microbiology – 7th ed. Mosby Elsevier.
- 2) Jawetz, Melnick & Adelberg's Medical Microbiology – 26th ed. McGraw-Hill.

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Clinical Laboratory Medicine

Total Credits: 4

Total hours: 32

Scientific Discipline Sector: MED/05 - MED/07 – BIO/12

Course Coordinator: Prof. Maurizio Ferrari Email: ferrari.maurizio@hrs.it
Prof. Ferruccio Ceriotti Email: ceriotti.ferruccio@hsr.it

Course Description Clinical Biochemistry

The purpose of the course is to give to students an overview on the most relevant aspects of clinical laboratory medicine. The course will describe the pathophysiological aspects that influence the results of clinical laboratory tests, the interpretation of tests results and will give some insights on the technologies used in clinical laboratory.

Part of the course will be dedicated to the pre-analytical phase to provide the necessary information on variables that could influence and exert a confounding effect on the analytical results.

The following topics will be covered:

- Pre-analytical phase: description of the laboratory process, sources of pre-analytical variability (patient preparation, specimen collection, processing, transportation and storage)
- Statistical methods in laboratory medicine. Internal Quality control, external quality assessment.
- Laboratory report, units of measurement, reference intervals, decision limits, reference change value
- Analytical Techniques: spectrophotometry, mass spectrometry, immunoassays
- Proteins analysis and interpretation
- Lipids and lipoproteins
- Blood gas and critical care testing,
- Water and electrolyte balance
- Calcium biology and disorders
- Carbohydrate disorders
- Uric acid and iron metabolism
- Methods for DNA amplification
- Methods to detect known mutations
- Methods to detect unknown mutations
- New advanced molecular technologies
- Clinical applications of molecular tests

Suggested textbooks

- Contemporary Practice in Clinical Chemistry, 2nd edition. Edited by William Clarke. 2011. ISBN: 9871594251023
- Tietz textbook of Clinical Chemistry and molecular diagnostics, fifth edition, Burtis, Ashwood, Bruns, Elsevier Saunders, ISBN:9781416061649

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Cardiovascular Diseases

Total Credits: 9

Total hours: 72

Scientific Discipline Sector: MED/11, MED/22, MED/23, MED/36, BIO/14

Teaching staff

Course Coordinator: Prof. Paolo Camici

Dr. Domenico Cianflone

Prof. Flavia Valtorta

Email: camici.paolo@hsr.it

Email: cianflone.domenico@hsr.it

Email: valtorta.flavia@hsr.it

Teaching Assistant:

Dr. Azeem Latib

Dr. Franco Cecchi

Dr. Paolo Della Bella

Dr. Yamume Tshomba

Dr. Francesco Maisano

Dr. Roberto Spoladore

Email: alatib@gmail.com

Email: francocecchi337@gmail.com

Email: dellabella.paolo@hsr.it

Email: tshomba.yamume@hsr.it

Email: maisano.francesco@hsr.it

Email: spoladore.roberto@hsr.it

Course Description

The course is organised in 7 modules:

Cardiac physiology and principles of echocardiography and ECG

This module will provide the basis of cardiac and coronary pathophysiology necessary for the understanding of cardiovascular syndromes. In addition, the module will cover the principles of echo- and electrocardiography with practical examples.

Ischaemic heart disease (IHD)

The pathophysiology and clinical acute and chronic syndromes caused by coronary artery disease will be discussed. Furthermore, this module will provide knowledge relative to the main diagnostic techniques/criteria for establishing the diagnosis of IHD. Finally, both pharmacologic and interventional treatment strategies will be discussed.

Myocardial Diseases

In this module both primary/genetic and secondary forms of cardiomyopathy will be presented along with inflammatory disease of the heart, i.e. myocarditis and pericarditis. Diagnosis and treatment of these conditions will also be discussed.

Arrhythmias

The pathophysiology, diagnosis and treatment of rhythm and conduction disturbances will be presented including illustrative clinical cases.

Valvular heart disease

Congenital, degenerative and inflammatory diseases of the cardiac valves will be presented along with diagnostic and treatment strategies.

Heart Failure

The pathophysiology and clinical features of heart failure of ischemic and non ischemic origin will be presented along with the relevant diagnostic techniques and treatment options.

Congenital heart disease, pulmonary embolism and disease of the large vessels

This module will cover the above topics in conjunction with a special lecture on cardiology in the emergency department.

A questions and answers (Q&A) session will close the course.

Students are expected to demonstrate in depth knowledge of all the topics treated in the 7 modules.

Copies of lessons' slides in addition to reference papers will be made available on the University website.

The text suggested is "Harrison's-Principles of Internal Medicine" McGraw-Hill. We also advise reading the textbook "Coronary microvascular dysfunction" Crea, Lanza, Camici eds.- published by Springer. Finally, we strongly advise to download and consult the European Society of Cardiology ESC Clinical Practice Guidelines available at <http://www.escardio.org/guidelines-surveys/esc-guidelines/Pages/GuidelinesList.aspx>

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Principles of Surgery

Total Credits: 3

Total hours: 34

Scientific Discipline Sector: MED/18

Teaching staff

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|---|-------------------------------------|
| Course Coordinator: Prof. Ferla Gianfranco | Email: ferla.gianfranco@hsr.it |
| Prof. Francesco Cetta | Email: cetta@tim.eu.blackberry.com |
| Dott. Luca Aldrighetti | Email: aldrighetti.luca@hsr.it |
| Dott. Gianpaolo Balzano | Email: balzano.gianpaolo@hsr.it |
| Dott.ssa Paola De Nardi | Email: denardi.paola@hsr.it |
| Dott. Fabio Ferla | Email: fabioferla.hotmail.com |
| Dott. Alberto Marassi | Email: marassi.alberto@hsr.it |
| Dott.ssa Elena Orsenigo | Email: orsenigo.elena@hsr.it |
| Dott. Andrea Tamburini | Email: tamburini.andreamarco@hsr.it |
| Dott. Andrea Vignali | Email: vignali.andrea@hsr.it |

Course Description

The aim of this course is to provide the essential theoretical knowledge to deal with the surgical patient. The student will focus on the epidemiological and physiopathological aspects of the main surgical diseases, on its diagnostic and treatment algorithms. In this course, the basic diseases concerning general surgery will be systematically introduced and discussed in a multidisciplinary setting, including medical, radiological and surgical technical features.

Course Program

Perioperative management

- Preoperative assessment, analysis of risk factors.
- Intraoperative factors influencing recovery.
- Postoperative care, enhanced recovery after surgery protocols.

Transplant Surgery

- History and definitions
- Matching of donor and recipient, principles of immunosuppression.
- Organ preservation.
- Organ transplants (heart, liver, kidney, pancreas, intestine).
- Living donor.

Metabolic surgery

- **Bariatric surgery:** indications, principles of surgical technique, metabolic results, prognosis.

Abdominal wall surgery

- Abdominal wall hernias and incisional hernias.

Thyroid and Parathyroids

- **Surgical anatomy of thyroid and parathyroid**
- **Thyroid nodule and multinodular goiter:** symptoms, differential diagnosis, treatment algorithm.

- **Thyroid tumors:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithms, prognosis.
- **Parathyroid tumors:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithms, prognosis.

Breast

- **Surgical anatomy of the breast and axilla**
- **Benign breast disease:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithms, prognosis.
- **Breast cancer:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithms, prognosis.

Esophagus

- **Gastro-esophageal reflux disease and hiatal hernia:** symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithm.
- **Esophageal diverticula:** definitions, epidemiology, classification, physiopathology, symptoms, diagnosis, treatment algorithm.
- **Achalasia:** surgical therapy and principles of technique, endoscopic therapy.
- **Esophageal cancer:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, endoscopic palliation, treatment algorithms, prognosis.

Stomach

- **Surgical anatomy of the stomach**
- **Peptic ulcer:** symptoms, diagnosis, treatment algorithms.
- **Stomach cancer:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, endoscopic palliation, treatment algorithms, prognosis.

Small intestine

- **Surgical anatomy of the small intestine**
- **Small bowel obstruction:** causes, symptoms, diagnosis, surgical therapy and principles of technique.
- **Inflammatory bowel disease (IBD)**
 - Crohn's disease: symptoms, diagnosis, complications, surgical therapy, treatment algorithm, prognosis.
 - Ulcerative colitis: symptoms, diagnosis, complications, surgical therapy, treatment algorithm, prognosis.

Colon and Rectum

- **Surgical anatomy of the colon and rectum**
- **Diverticular disease:** symptoms, diagnosis, complications, surgical therapy, treatment algorithm.
- **Colorectal cancer:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, endoscopic therapy and palliation, treatment algorithms, prognosis.

Anus

- Hemorrhoids.
- Fistula in ano.
- Anal fissure.
- Rectal prolapse.

Spleen

- **Surgical anatomy of the spleen**

- **Spleen trauma:** epidemiology, symptoms, diagnosis, treatment algorithm, surgical therapy and principles of technique.
- **Spleen lesions:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithms, prognosis.

Adrenal glands

- **Surgical anatomy of the adrenal glands**
- **Adrenal gland disease:** epidemiology, pathology classification, pathophysiology, symptoms, diagnosis, surgical therapy and principles of technique, medical therapy, prognosis.

Biliary tract

- **Surgical anatomy of the biliary tract**
- **Cholelithiasis and choledocholithiasis:** symptoms, diagnosis, complications surgical therapy and principles of technique, endoscopic and percutaneous approaches, treatment algorithms.
- **Biliary tract tumors:** epidemiology, pathology classification, symptoms, diagnosis, surgical therapy and principles of technique, endoscopic and percutaneous palliation, treatment algorithms, prognosis.

Liver

- **Surgical anatomy of the liver**
- **Benign tumors of the liver:** epidemiology, pathology classification, predisposing factors, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithms, prognosis.
- **Primary malignant liver tumors:** epidemiology, pathology classification, predisposing factors, symptoms, diagnosis, medical therapy, percutaneous approaches, surgical therapy and principles of technique, treatment algorithms, prognosis.
- **Metastatic liver disease:** clinical scenarios, diagnosis, medical therapy, surgical therapy and principles of technique, treatment algorithms, prognosis.
- **Portal Hypertension:** definitions, classification, pathophysiology, symptoms, complications, diagnosis, medical therapy, endoscopic and percutaneous treatment, surgical therapy and principles of technique, treatment algorithms, prognosis.

Pancreas

- **Surgical anatomy of the pancreas**
- **Acute pancreatitis:** definitions, epidemiology, symptoms, diagnosis, severity classification, complications, surgical therapy, treatment algorithm.
- **Exocrine and endocrine tumors of the pancreas:** epidemiology, pathology classification, symptoms, diagnosis, endoscopic and percutaneous palliation, surgical therapy and principles of technique, treatment algorithms, prognosis.

Surgical emergencies

- **Gastrointestinal bleeding:** epidemiology, symptoms, diagnosis, endoscopic, percutaneous and surgical therapy, treatment algorithms.
- **Acute abdomen:** causes, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithm.
- **Appendicitis:** classification, symptoms, diagnosis, surgical therapy and principles of technique, treatment algorithm.

Suggested textbook:

- 1) Sabiston Textbook of Surgery, 19 edition

Digestive System Diseases

Total Credits: 8

Total hours: 64

Scientific Discipline Sector: MED/12 – MED/18 – MED/29 – MED/36 – BIO/14

Teaching staff

Course Coordinator: Prof. Pier Alberto Testoni

email: testoni.pieralberto@hsr.it

| | | |
|------------------------------|-----------------------|---|
| Prof. Giulia M.Cavestro | Gastroenterology | Email: cavestro.giuliamartina@hsr.it |
| Dr Mario Guslandi | Gastroenterology | Email: guslandi.mario@hsr.it |
| Dr Paolo Giorgio Arcidiacono | Gastroenterology | Email: arcidiacono.paologio@hsr.it |
| Dr Paola De Nardi | Gastroenterology | Email: denardi.paola@hsr.it |
| Prof. Francesco De Cobelli | Diagnostic Imaging | Email: decobelli.francesco@hsr.it |
| Prof. Flavia Valtorta | Pharmacology | Email: valtorta.flavia@hsr.it |
| Prof. Claudio Doglioni | Human Pathology | Email: doglioni.claudio@hsr.it |
| Prof. Marco Braga | Surgery | Email: braga.marco@hsr.it |
| Prof. Gianfranco Ferla | Surgery | Email: ferla.gianfranco@hsr.it |
| Prof. Carlo Staudacher | Surgery | Email: staudacher.carlo@hsr.it |
| Dr Giuseppe Cardaropoli | Odontology | Email: giuseppe.cardaropoli@mac.com |
| Dr Paolo Cappare | Maxillofacial surgery | Email: paolocappare@gmail.com |

Teaching Assistant: (Gastroenterology Unit)

Dr Alberto Mariani

Dr Edi Viale

Dr Lorella Fanti

Dr Maria Chiara Petrone

Course Description

The course has been designed as a multidisciplinary teaching module and aims to give to students a thorough grounding in the comprehension of diseases of the entire digestive system, including mouth, gastrointestinal tract, liver, biliary system, and pancreas.

The integrated course has the purpose to provide to students a general practitioner level knowledge in gastrointestinal, pancreas, and liver diseases.

This will be achieved by including in the course, beside gastroenterology, some notions of odontology and maxillofacial surgery, pharmacology, radiology, human pathology, surgery, and laboratory testing in an integrated fashion.

As regards surgery, the digestive system diseases course will run head-to-head with the course of general surgery, that will include a number of topics specifically addressed to gastroenterological surgical problems, complementary to the gastroenterology.

As regards the specific gastroenterology program, students will be introduced to basic physiology of the systems and organs, and physiopathology, clinical presentation, natural history, diagnostic work-up, and basic therapeutic notions of the diseases.

Within the course four clinical case presentation sessions will be included, allowing an interactive discussion between teachers and students in a practical approach to outpatients.

At the end of the course, the students should be familiar with the following topics:

Esophagus:

- normal motility and primary motility disorders

- gastroesophageal reflux disease (typical and atypical symptoms)
- complications of gastroesophageal reflux disease, with particular focus on Barrett's esophagus
- esophageal cancer
- surgical approach to functional disorders and cancer

Stomach and duodenum:

- gastric secretion, motility, gastric barrier
- functional dyspepsia
- chronic gastritis, with particular focus on Helicobacter pylori infection
- peptic ulcer disease
- precancerous condition and cancer
- oncological management and surgery

Small bowel:

- digestion, absorption and motility
- celiac disease and other enteropathies, including food intolerance and hypersensitivity
- motility disorders, including obstruction
- definition and classification of diarrhea

Colon and rectum:

- chronic inflammatory bowel diseases and their complications
- diverticular disease and its complications
- irritable bowel syndrome
- precancerous conditions and cancer
- oncological management and surgery
- diseases of anus and functional disorders of pelvic floor

Liver and biliary tract:

- metabolism and laboratory testing
- bile secretion, cholestasis and jaundice
- chronic cholestatic diseases
- bile stone disease and its complications
- Vater's papilla organic and functional diseases
- non alcoholic fatty liver disease
- chronic hepatitis, with particular focus on virus-related infections
- hepatic cirrhosis and hemochromatosis
- portal hypertension and its complications
- tumors of liver and biliary system

Pancreas:

- exocrine and endocrine secretion
- acute pancreatitis
- local and systemic complications of acute pancreatitis
- chronic pancreatitis and its complications
- cystic lesions and neuroendocrine tumors
- cancer

Gastrointestinal bleeding

Suggested textbooks

- 1) Harrison's Principles of Internal Medicine – 18th edition
McGraw-Hill
- 2) Sleisenger and Fordtran's Gastrointestinal & Liver Disease – 8th edition
Saunders
- 3) Yamada T. Textbook of Gastroenterology – 4th edition
Lippincott Williams & Wilkins

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Respiratory, Ear, Nose and Throat Diseases

Total Credits: 7

Lessons: 28 (2 hours every lesson)

SSD: MED/10, MED/36, MED/31, MED/21

Course Coordinator: Piero Zannini

Email: piero.zannini@hsr.it

TEACHERS

| | |
|------------------|---|
| Mario Bussi | Email: bussi.mario@hsr.it |
| Angelo Carretta | Email: carretta.angelo@hsr.it |
| Paola Ciriaco | Email: ciriaco.paola@hsr.it |
| George Cremona | Email: cremona.george@hsr.it |
| Antonio Esposito | Email: esposito.antonio@hsr.it |
| Giulio Melloni | Email: melloni.giulio@hsr.it |
| Giampiero Negri | Email: negri.giampiero@hsr.it |
| Piero Zannini | Email: zannini.piero@hsr.it |

TUTORS

| | |
|---------------------|---|
| Alessandro Bandiera | Email: bandiera.alessandro@hsr.it |
| Antonio Foresi | Email: antonio.foresi@aovimercate.org |
| Gabriella Gambaro | Email: gambaro.gabriella@hsr.it |
| Armando Puglisi | Email: puglisi.armando@hsr.it |
| Matteo Trimarchi | Email: trimarchi.matteo@hsr.it |

COURSE INTRODUCTION

“Respiratory, Ear, Nose and Throat Diseases” is a course that provides information on the morphology, physiology, pathophysiology, clinical aspects, diagnosis and principles of treatment of the diseases of the upper aerodigestive tract, and of the respiratory and auditive system.

During the course the morphology and physiology of the upper aerodigestive tract and of the respiratory and auditive system will be reviewed in order to introduce the students to the pathophysiology and pathogenesis of potential diseases. Clinical aspects, semeiotics and diagnostic procedures will be explored in depth and the principles of management will be presented. Students will have the opportunity to attend clinical Departments in order to gain practical experience of the diagnostic features and clinical evolution of the diseases.

SPECIFIC GOALS AND OBJECTIVES

The goals of the M.D. Course in Respiratory, Ear, Nose and Throat Diseases are to enable the students:

- 1) to deepen their knowledge of the macroscopic and microscopic morphology of the upper and lower respiratory system and of the ear, nose and throat.
- 2) to deepen their knowledge of the physiology of the upper and lower respiratory system and of the ear, nose and throat.
- 3) to learn about the pathophysiology of the diseases of the upper and lower respiratory system and of the ear, nose and throat.
- 4) to learn the techniques of collecting patients' medical history and of carrying out a physical examination of the upper and lower respiratory system and of the ear, nose and throat.
- 5) to gain knowledge of the most frequent diseases of the upper aerodigestive tract, the lower respiratory system, the ear, nose and throat including aetiology, pathogenesis, pathophysiology and relevant medical treatment.

DETAILED PROGRAM SECTIONS

Respiratory Medicine

Teacher: Prof. George Cremona

Respiratory Medicine is one of the systems-based courses covering all of the systems of the body. This course covers basic physiological, pharmacological and pathophysiological aspects of diseases of the respiratory system. Faculty from the Units of Respiratory Medicine, Pharmacology, Radiology and Surgery teach in the course. By the end of the course students will be able to describe the pathology and pathophysiology of infectious inflammatory and immunologic, metabolic and systemic disorders, trauma, and neoplasms affecting the respiratory system. Students will be able to recognize the differences between the normal and disease states, select diagnostic tests, and understand the pharmacological and non-pharmacological therapies. The course uses lectures to present material, case-based tutorials to reinforce key concepts, and a simulation exercise to link basic science material to clinical medicine. Assessment will consist of written multiple choice test and oral examination at the end of the course.

Radiology

Teacher: Antonio Esposito

1. Introduction to imaging of the upper and lower respiratory system:
the first and second level techniques for the assessment of respiratory system will be presented remarking the principles at the basis of image formation and the main indication for each technique.
2. Imaging in the inflammatory disease of the respiratory system:
the role of imaging in the diagnosis, clinical assessment and management of inflammatory disease will be discussed differentiating upper airways from lungs and pleura
3. Imaging of interstitial lung diseases/pulmonary fibrosis/Chronic Obstructive Pulmonary Disease:
the role of HRCT (high resolution computed tomography) in the assessment of diffuse lung diseases will be explain showing the most common patterns of disease
4. Imaging of throat tumours:
role of imaging techniques in the diagnosis and staging of pharynx and larynx tumors will be presented
5. Imaging of lung cancer:
detection of lung cancer; differential diagnosis; screening programs; lung cancer staging
6. Imaging of pleural tumours:
detection; differential diagnosis; staging
7. Imaging of pulmonary thromboembolism
Imaging techniques involved and main signs of PE
8. Imaging of thoracic trauma
Role of imaging in the assessment of blunt chest trauma or penetrating thoracic lesions in emergency

Otorhinolaryngology

Teacher: Prof. Mario Bussi

Tutor: Matteo Trimarchi

1. Anatomy and physiology of the upper aerodigestive tract: nose and paranasal sinuses, oral cavity, pharynx, larynx, salivary glands, external and middle ear.
2. Pathophysiology of the nose and paranasal sinuses: classification, symptomatology, diagnosis and treatment of the sinonasal diseases (acute and chronic flogoses, benign and malignant neoplasms, traumas, epistaxis).
3. Pharynx pathophysiology: acute and chronic flogoses, tonsillitis, pharynx tumors (symptomatology, diagnoses, treatment).
4. Salivary glands pathophysiology: acute and chronic flogoses, syaloadenoses and tumors.
5. Pathophysiology of the larynx: acute and chronic laryngitis, benign lesions, benign and malignant neoplasms (symptomatology, diagnoses, treatment).
6. Main aspects and clinical features of neck pathologies.

7. Pathology of the external and middle ear: symptoms, diagnosis and treatment of otitis, otosclerosis, congenital malformations.

Thoracic Surgery

Teachers: Prof. Piero Zannini, Prof. Giampiero Negri, Dr Giulio Melloni, Dr Angelo Carretta, Dr Paola Ciriaco

Tutors: Armando Puglisi, Alessandro Bandiera

1. Pleura. Spontaneous pneumothorax and pleural effusion

Pleural effusion: definition, incidence, classification, pathogenesis, pathophysiology, symptoms and signs, treatment. Pleural mesothelioma: epidemiology, pathology, diagnosis and management.

Pleural Empyema: definition, incidence, classification, pathogenesis, pathophysiology, symptoms and signs, treatment.

Spontaneous pneumothorax: definition, incidence, classification, pathogenesis, pathophysiology, symptoms and signs, treatment.

2. Lung cancer.

Epidemiology, risk factors, pathology, diagnosis and staging, symptoms and signs, surgical principles and management.

3. Trachea.

Endoscopic and surgical treatment of benign and malignant diseases.

Post-intubation stenosis, idiopathic stenosis, primary and metastatic tumours, trauma: symptoms and signs, diagnosis, surgical principles and management. Tracheoesophageal fistula: definition, pathogenesis, diagnosis, surgical principles and management.

4. Trauma

Trauma to the chest wall and to the lung: incidence, diagnosis, symptoms and signs, management.

PRACTICAL SESSIONS AND LABS

I. Activities in Thoracic Endoscopy Service: diagnostic and operative fiberoptic endoscopy

II. Activities in Thoracic Surgery Department: chest drainage (indications to, positioning and management)

III. Activities in ENT department: pre-operative and post-operative patient's management

IV. Activities in ENT practice: vestibular and audiologic evaluation, diagnostic endoscopy, oncologic follow-up,

V. Activities in ENT operating theatre

FORMATIVE ASSESSMENT AND EXAMS

Multiple choice questions and clinical cases discussion.

SUGGESTED BOOKS AND READINGS

Sabiston Textbook of Surgery Saunders Company

Pearson's Thoracic and Esophageal Surgery Churchill Livingstone Elsevier 2008

Grillo Surgery of the trachea and bronchi BC Decker

Gibbons's Surgery of the Chest, Saunders Company

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Medical Semiotics Internal Medicine I – 3 Credits
Internal Medicine and Surgery I - 5 credits
SSD: MED/09, MED/18

Course coordinator: Prof. Lorenzo DAGNA, MD, FACP
Contacts: lorenzo.dagna@univr.it - 02-2643-6096/4683

"The true mystery of the world is the visible, not the invisible." (Oscar Wilde, 1854-1900)
"He who studies medicine without books sails an uncharted sea, but he who studies medicine without patients does not go to sea at all." (William Osler, 1849-1919)

Aims

The practice of modern medicine is a balanced combination of science and art. The role of science in medicine is clear: science-based technology and deductive reasoning are the basis for the solution of most clinical problems. The scientific advances in the basic sciences, genetics, biochemistry, imaging, laboratory medicine and therapeutics provide the physician of the third millennium with unprecedented tools. In addition to sound scientific basis, however, there is a medical art which is a combination of medical knowledge, intuition, observation and critical judgment which is equally needed by the doctor to practice of medicine.

The most striking example of these nearly artistic skills that the doctor should have is medical semiotics, the ability of understanding and describing physical signs and symptoms. With careful observation, with appropriate and timely questions, with simple gestures, the expert physician can reach incredibly precise deductions about the disease of a patient. For centuries, doctors diagnosed diseases using only their senses, observing, palpating, percussing, listening. Modern technology has undoubtedly radically changed all this. However it is not at all unusual that complex and expensive tests or imaging studies are performed to get the same information that a well performed thorough physical examination and a proper and well conducted history taking could provide.

The course of General Semiotics aims to provide students with the theoretical and practical bases necessary to effectively collect a thorough history and perform a complete physical examination. At the end of the course there will be a short rotation in the medical wards of the hospital to put into practice what students have learned during the course. The results reached during these activities will be strengthened in the following semesters, thanks to more and more prolonged periods of rotation in clinical departments, and as a result of systematic study of different medical subspecialties/blocks.

Objectives

This practical/theoretical course is designed first to provide the student with the correct medical terms and the general signs and symptoms of disease. Then we will analyze the most typical signs and symptoms of the different organs and systems.

At the end of the course the student will be able to take a thorough history and perform a physical examination and to detect the most frequent pathological findings.

Interactive teaching activities

Since this course will be the first direct contact of the students with sick patients admitted to an hospital wards, the course will begin with a seminar to explain all the procedures that are needed in order to preserve their own health and patients' safety.

Then interactive lectures will be held in which, starting from the physiology and pathophysiology of each organ/system, the normal and more common abnormal findings will be analyzed and discussed, in order to provide students with all the skills needed to perform a complete physical examination. Time will be spent to discuss specific techniques commonly used to collect a complete and thorough medical history.

During classes a lot of time will be given for interaction and discussion. The last class of the theoretical part of the course will be devoted entirely to review what was discussed in class and clarify any doubts of the students.

In the practical part of the course (last 2 weeks), students will be attending the general medical wards of our hospital in wards, dealing with real patients, collecting their histories and practicing in physical examination under the supervision of the clinic's doctors. REMEMBER THAT, DUE TO PATIENT ETHNICITY, INTERACTION WITH PATIENTS WILL BE IN ITALIAN.

Teaching materials

Suggestions on possible textbooks will be provided at the first lesson of the course.

Slides used in classes will be uploaded in the course on-line folder after each class.

Final assessment/exam

Student **MUST ATTEND** the **INTRODUCTORY SEMINAR** and **ALL THE PRACTICALS**. Attendance to lectures will be checked and recorded electronically (badge scanning) and/or with roll calls. At the end of the course there will a written test (20 short open questions). Passing the written test will be necessary in order to sit for the subsequent practical test. The practical test will be done in the clinic, at the bedside of a real patient, checking for the ability to interact with patients, to collect history and to perform a complete physical examination. The combined evaluation of these tests will result in passing/failing the course.

Course program

General principles of the history taking and physical examination

History taking

- Reason for assessment
- Past medical history
- History of present complaint
- Family history
- Physiological
- Work history
- History taking in special situations

Evaluation of the general parameters and vital signs

Assessment of the behavior and mental status

Physical examination of skin, hair and nails

- Physical examination of the head and neck (eyes, eyelids, visual acuity, ears, the auditory acuity, Weber and Rinne tests, sinuses, mouth, lips, oral mucosa, tongue, pharynx, neck, thyroid)
- Chest examination (inspection, palpation, percussion, auscultation)

Physical examination of the cardiovascular system (inspection, palpation, auscultation)

Physical examination of the breast and axillae

Physical examination of the abdomen (inspection, palpation, percussion, auscultation, Giordano's, Blumberg's, Murphy's, McBurney's, Rovsing's signs)

Physical examination of the vascular peripheral (pulse features, Raynaud's phenomenon, Allen test, deep vein thrombosis and Homans' and Bauer's signs, signs of venous insufficiency, Trendelenburg's and Perthes' tests)

Physical examination of the lymphatic system and lymphnodes

Physical examination of the male genitalia and evaluation of hernias

Physical examination of the female genital

Physical examination of the perineum, rectum and prostate

Physical examination of the musculoskeletal system

Brief neurological physical examination (mental status, cranial nerves, muscle tone and strength, coordination tests, Romberg's test, examination of sensory system, skin and deep tendon reflexes, Lasegue's, Babinski's, Kernig's, Brudzinski's signs)

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SAN RAFFAELE INTERNATIONAL MD PROGRAM

YEAR 4

Academic Year 2013/2014

- **Endocrine and Metabolic Diseases**
- **Nephrology and Urology**
- **Oncology**
- **Haematology**
- **Musculoskeletal Diseases**
- **Neurological Sciences**
- **Psychiatry and Clinical Psychology**
- **Ophthalmology**
- **Infectious Diseases**
- **Clinical Rotations: Internal Medicine & Surgery II**

Endocrine and Metabolic Diseases

Total Credits: 6

Total hours: 48

Scientific Discipline Sector: SSD Med/13, Bio/14

Teaching staff

Course Coordinator: Emanuele Bosi

Francesco Bandello

Federico Furlan

Rosangela Lattanzio

Marco Losa

Rossini Alessandro

Andrea Salonia

Scavini Marina

Flavia Valtorta

Gianpaolo Zerbini

Email: bosi.emanuele@hsr.it

Email: bandello.francesco@hsr.it

Email: furlan.federico@hsr.it

Email: lattanzio.rosangela@hsr.it

Email: losa.marco@hsr.it

Email: rossini.alessandro@hsr.it

Email: salonia.andrea@hsr.it

Email: scavini.marina@hsr.it

Email: valtorta.flavia@hsr.it

Email: zerbini.giampaolo@hsr.it

Goals

The overall objective of this course is to provide the student with the theoretical and practical skills for selecting the appropriate diagnostic procedures and implementing recommended treatment for endocrine and metabolic diseases. The specific aims of this course are those included in the Unità Didattiche Elementari (UDE) of the Endocrine and Metabolism chapter within the Core Curriculum of the Magistral Doctorate in Medicine (Medicina e Chirurgia 18: 629-693, 2002 UDE 936-965; <http://www.gruppoeidos.it/unimed/>). Thematic content (knowing, knowing to do, knowing to be), level of knowledge (theoretical and mnemonic, general and in depth), expertise (mnemonic, interpretational, decisional) and skills (manual, practical, professional, decision making and problem solving) will be treated and pursued as indicated in this document (see also Course Description).

Evaluation

Written exam based on multiple choice assessment, with the students' choice of an additional oral examination.

Course Description

The different topics are treated in a systematic way, i.e., by individual endocrine gland or group of endocrine tissues, using an integrated approach encompassing morphology, pathophysiology, clinical medicine, pharmacology and therapy. Specific focus is devoted to the molecular bases of hormone action and pathogenetic mechanisms, prerequisites to a in depth understanding of the clinical aspects of endocrine and metabolic diseases and appropriate diagnostic and therapeutic procedures. The course also aims at introducing the theme of Endocrinology and Metabolic Diseases as a discipline of Internal Medicine, with emphasis on the general underlying clinical context with the multiple pathophysiological endocrine and non-endocrine interactions typical of these diseases.

The course includes frontal lectures on: hypothalamus and pituitary (synthesis, secretion and mechanism of action of hypothalamic and pituitary hormones, panhypopituitarism, hyperprolactinemia, acromegaly, diabetes insipidus); thyroid (secretion and mechanism of action of thyroid hormones, hypo and hyperthyroidism, thyroiditis, thyroid nodules and malignancies, ultrasound diagnostics); parathyroids (calcium homeostasis, hypo and hyperparathyroidism, osteoporosis); glucose metabolism and diabetes mellitus (insulin secretion and mechanism of action, classification, epidemiology, type 1 diabetes, type 2 diabetes, acute and chronic diabetic complications, hypoglycemia); obesity and metabolic syndrome; dyslipidemia; adrenal (secretion and mechanism of action of steroid hormones and catecholamines; hypo and hypercortisolism, hypo and hyperaldosteronism, pheochromocytoma); gonads (male and female hypogonadism, hyperandrogenism, adrenogenital syndromes). Moreover, there is the opportunity for

students to attend the inpatient and outpatient facilities of the General Medicine, Diabetes and Endocrinology Unit at the San Raffaele Hospital, and the laboratories of the Diabetes Research Institute. The participation to daily clinical rounds and periodic research seminars is also welcome.

Textbook

Harrison's Principles of Internal Medicine, part on Endocrinology and Metabolism. McGraw-Hill

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Nephrology and Urology

Total Credits: 7

Total hours: 56

Scientific Discipline Sector: Med/14, Med/24, Bio/14

Teaching staff

Course Coordinator: Paolo Manunta

Email: manunta.paolo@hsr.it

Course Coordinator: Francesco Montorsi

Email: montorsi.francesco@hsr.it

Chiara Lanzani

Email: lanzani.chiara@hsr.it

Marco Simonini

Email: simonini.marco@hsr.it

Flavia Valtorta

Email: valtorta.flavia@hsr.it

Daniele Zacchetti

Email: zacchetti.daniele@hsr.it

Goals:

Prerequisites:

Evaluation:

Course Description

UROLOGY

The course is dedicated to the urological topics of greatest epidemiological and clinical-surgery impact.

In this context, IMDP students will have the opportunity of attending the clinical and surgical activities throughout the morning timetable. Therefore, students will take part to the daily operating theatre activities looking at open, endoscopic and robotically assisted procedures for benign and oncologic urological disorders. Likewise, students will closely follow the outpatient clinical activities (i.e. ultrasounds assessments, cystoscopy, multichannel urodynamic evaluation, etc) and the inpatient unit activities during the preop- and the postoperative periods. Similarly, students will have the opportunity to closely follow the on duty/on call urologist during the daily activities.

Moreover, during the afternoon timetable on a daily basis IMDP students will attend a formal lesson dedicated to the major functional and uro-oncological themes, thus including

1. Benign Prostate Hyperplasia/Lower Urinary Tract Symptoms
2. Prostatitis and urinary tract infections
3. Prostate cancer
4. Kidney cancer
5. Bladder and upper urinary tract urothelial carcinoma
6. Penis and testis cancer
7. Male and female urinary incontinence
8. Paediatric urology
9. Male sexual dysfunction; Couple's infertility
10. Urolithiasis

NEPHROLOGY

Educational Goals and Objectives

This course is designed to provide the student with a complete understanding of the optimal management of chronic kidney diseases. The focus of this course will be to discuss the pathophysiologic and clinical advances in the major areas of Nephrology including glomerular disease, fluid and electrolyte disorders, hypertension, dialysis, and renal transplantation. Well recognized medical complications and recommendations for optimal care will be discussed.

The material will be presented in several formats including frontal lectures and case based workshops.

In particular: students must understand the epidemiology, pathophysiology and management of common renal disorders and electrolyte and acid base disturbances including: Sodium and water imbalance,

Potassium imbalance, Simple and mixed acid-base disturbances, Hypertension, Renal tubular acidosis, Glomerulonephritis, Renal vasculitis, Nephritic & Nephrotic Syndrome, Calcium & phosphorus metabolism, Pre-renal causes of renal failure, Obstructive Uropathy, Nephrolithiasis, Renal failure in a patient with liver failure, Acute tubular necrosis, Interstitial nephritis, Chronic kidney disease, Diabetic nephropathy and main principles of dialysis and extra corporal procedures.

As renal diseases are often complex pathologies with different interindividual outcomes the course will also give students the tools and the basic notions of genetic involvement in kidney morbidities.

Educational resources

- Harrison's Principles of Internal Medicine (ed: Mc Graw Hill)
- Goodman & Gilman's The Pharmacological Basis of Therapeutics

Suggested Reading

- Textbook of Nephrology SG Massry, RJ Glasscock 2001

Evaluation methods

Multiple choice question test (50 quizzes) at the end of the course. Oral examination can be performed for students who have not sustained written test or have reached a bad evaluation. Examinations data will be communicated by official secretary of school of Nephrology.

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Oncology

Total Credits: 5

Total hours: 40

Scientific Discipline Sector: MED/06, BIO/14, MED/36

Teaching staff

Course Coordinator

Andrés J. M. Ferreri

E-mail: ferreri.andres@hsr.it

Teaching Assistants

Vanesa Gregorc

E-mail: gregorc.vanesa@hsr.it

Antonio Esposito

E-mail: esposito.antonio@hsr.it

Daniele Zacchetti

E-mail: zacchetti.daniele@hsr.it

Collaborators

Cesare Cozzarini

E-mail: cozzarini.cesare@hsr.it

Italo Dell'Oca

E-mail: delloca.italo@hsr.it

Claudio Doglioni

E-mail: doglioni.claudio@hsr.it

Luca Gianni

E-mail: gianni.luca@hsr.it

Antonio Lambiase

E-mail: lambiase.antonio@hsr.it

Gino Pepe

E-mail: pepe.gino@hsr.it

Maurilio Ponzoni

E-mail: ponzoni.maurilio@hsr.it

Vincenzo Russo

E-mail: russo.vincenzo@hsr.it

Course Description

The course of Oncology consists of practical and academic activities regarding all the clinical, therapeutic, molecular, biological, radiological and pharmacological aspects of cancers. Attendants will discuss notions of the epidemiology of cancer as well as molecular mechanisms involved in the biological processes that led to cancer development, growth control and dissemination. The course covers classical concepts related to suspicion, diagnosis and staging of the most relevant solid tumours and lymphomas. An important part of course regards molecular knowledge of conventional and innovative therapeutic targets as well as the related pharmacological and radiological therapies used in current practice and experimental trials. A detailed discussion of anticancer drugs, their pharmacodynamic and pharmacokinetics as well as other knowledge with relevant therapeutic implications is included. This section includes also supportive care, therapeutic side effects and diagnosis and management of the most common complications as well as late effects in cancer survivors. An important part of the course regards cancer investigation, with a detailed analysis of the different phases of clinical research.

Objectives

The aim of this course is to provide the essential theoretical and practical knowledge to deal with the diagnostic and therapeutic management of cancer patients. The student will focus on the epidemiological and pathophysiological aspects of the main solid tumours and lymphomas and, at the end of the course, will be able to develop a systematic and multidisciplinary approach to the studied malignancies, including modern laboratory, radiological and therapeutic tools currently used in oncology. Students will analyze methods and strategies of basic and clinical cancer research as well as understand the cancer as public health problem and global phenomenon. In practice, at the end of the course, the student will be able to take a thorough history and perform a physical examination, to understand lab and radiological exams, to indicate and construe staging procedures, hypothesize therapeutic alternatives, and interpret trial results.

Final assessment/exam

Attendance to lectures will be checked and recorded electronically. At the end of the course there will be an oral test focused on the course contents and clinical cases discussion.

SUGGESTED BOOKS AND READINGS

- 1) DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology – Lippincott, Williams and Wilson – 9th edition - ISBN-13: 978-1451105452
- 2) Longo D., Fauci A., Kasper D.: Harrison's Principles of Internal Medicine - McGraw-Hill – 18th Edition - ISBN 9780071748896
- 3) Abeloff M, Armitage J, Niederhuber J, Kastan M, McKenna W: Abeloff's Clinical Oncology - Churchill Livingstone – 4th edition - ISBN: 9780443066948

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Haematology

Total Credits:4

Total hours: 32

Scientific Discipline Sector: Med/15

Teaching staff

Course Coordinator: Claudio Bordignon

Email: bordignon.claudio@hsr.it

Teaching Assistants

Chiara Bonini

E-mail: bonini.chiara@hsr.it

Fabio Ciceri

E-mail: ciceri.fabio@hsr.it

Maurilio Ponzoni

E-mail: ponzoni.maurilio@hsr.it

Collaborators

Attilio Bondanza

E-mail: bondanza.attilio@hsr.it

Clara Camaschella

E-mail: camaschella.clara@hsr.it

Nicoletta Cieri

E-mail: cieri.nicoletta@hsr.it

Armando D'Angelo

E-mail: dangelo.armando@hsr.it

Claudio Doglioni

E-mail: doglioni.claudio@hsr.it

Andres Ferreri

E-mail: ferreri.andres@hsr.it

Fabio Giglio

E-mail: giglio.fabio@hsr.it

Maria Teresa Lupo Stanghellini

E-mail: lupostanghellini.mariateresa@hsr.it

Sarah Marktél

E-mail: marktél.sarah@hsr.it

Sara Mastaglio

E-mail: mastaglio.sara@hsr.it

Silvano Rossini

E-mail: Silvano.Rossini@OspedaleNiguarda.it

Luca Vago

E-mail: vago.luca@hsr.it

Goals:

The goal of this course is to initiate the student to the fundamental principles of hematology and to provide the student with the theoretical and practical skills for selecting the appropriate diagnostic procedures and implementing recommended treatment for hematological diseases. To this aim we will couple academic lessons to case report discussion.

Special emphasis will be provided to the pathogenesis of haematological diseases and to the growing role of molecular biology in the clinical management of patients with haematological diseases. Based on the pivotal role of hematopathology in hematology, we include practical lessons "at the microscope", to be held in small groups. An important part of course will be held in collaboration with the course of Oncology, with the purpose, for the student, of getting acquainted with the basis of preclinical and clinical investigation in hemato-oncology.

Evaluation/Final assessment/exam

Attendance to lectures will be checked and recorded electronically. At the end of the course there will be an oral test focused on the course contents and clinical cases discussion.

Course Description:

Lessons held in collaboration with the Course of Oncology are in bold.

- **Stem cell biology and Hematopoiesis**
- **Clonal dynamics and Leukemic stem cells**
- **Cancer stem cells, tumor microenvironment, metastasis**
- **Epidemiology, eziopathogenesis in oncology**
- **Imaging in Hemato-oncology**
- **Current diagnostic Technologies in Hematology and Oncology**
- **Staging, Clinical trials, quality of life, performance status, prognostic scores**
- Anemia definition, classification, Approach to Anemia in the adult and child
- Hemoglobinopathies

- Disorders of iron metabolism: Iron deficiency and Iron Overload. Megaloblastic anemias
- Basis of Transfusion Medicine
- Hemostasis, Thrombosis, Hemophilia
- Hemorrhagic syndromes. Hereditary and acquired disorders of platelets and coagulation.
- **Lymphoproliferative disorders, Non Hodgkin Lymphoma, Hodgkin Lymphoma**
- **Multiple Myeloma, Amyloidosis**
- Myeloproliferative syndromes
- Acute Leukemias
- **Chemotherapy, Radiotherapy, targeted therapy, supportive care**
- **Long term effects, management of Long term survivors**
- **Hematopoietic stem cell transplantation, cancer immunotherapy, cancer gene therapy**
- At the microscope (small groups)

Textbooks:

Essential Haematology
A.V, Hoffbrand / P.A.H. Mosso Wiley-Blackwell
6th Edition 2011.

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Musculoskeletal Diseases

Total Credits: 2

Total hours: 16

Scientific Discipline Sector: Med/33, Med/34

Teaching staff

Course Coordinator:

Celeste Scotti

Email: celeste.scotti@grupposandonato.it

Goals: The goal of this course is to provide the students with an overview on the fundamental principles and practices of Orthopaedic and Trauma Surgery. The course will be focused on the most relevant musculoskeletal disorders with hints on the newest advances on Adult Reconstruction Surgery, Arthroscopy, Sport Trauma and Regenerative Medicine. At the end of the course, the students will be able to deal with the spectrum of orthopaedic and trauma conditions and will be confident with the modern Orthopaedic and Trauma practice.

Prerequisites: None

Evaluation: The exam will consist of an oral examination. Exam will be focused on topics covered during the classes and clinical cases discussion.

Course Description

This course is conceived to instruct the students in the pathophysiology, clinical examination, investigation and modern management of the most common musculoskeletal conditions. Typical clinical scenarios will be illustrated and discussed. The lectures will cover the following topics:

- INTRODUCTION: Brief History of Orthopaedics; Clinical Evaluation
- TRAUMA: generalities on trauma, most common trauma and related treatments. Emergencies and Complications.
- METABOLIC DISORDERS & OSTEOPOROTIC FRACTURES
- OSTEOARTHRITIS: Primary and secondary OA; related disorders; principles of Total Joint Replacement.
- PEDIATRIC ORTHOPAEDICS: Developmental Dysplasia of the Hip, Club foot, Scoliosis, and other common pediatric conditions.
- FOOT&ANKLE: Hallux valgus, flat foot, diabetic foot and other common foot&ankle conditions.
- SPORT TRAUMA: Shoulder & Elbow; Hip impingement, Articular Cartilage, Knee & Ankle.
- NEURO ORTHOPAEDICS: Adult Spine & Peripheral Nerve
- TUMORS: Benign and Malignant Tumors of Bone and Soft Tissues, Metastatic Bone Disease.
- INFECTIONS: Chronic and Haematogenous Osteomyelitis, Arthritis, Post-Traumatic and Post-Operative Infections
- REGENERATIVE MEDICINE: Cartilage, Bone and Tendon regeneration, Joint Homeostasis, Orthobiologic treatments.

Textbooks:

Louis Solomon, David J. Warwick, Selvadurai Nayagam. *Apley's Concise System of Orthopaedics and Fractures, Third Edition*. Hodder Arnold Publication.

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Neurological Sciences

Total Credits: 14

Total hours: 112

Scientific Discipline Sector: Med/08, Med/26, Med/27, Med/32, Med/37, Bio/14

Teaching staff

Course Coordinator: Giancarlo Comi

Mario Bussi

Claudio Doglioni

Andrea Falini

Massimo Filippi

Pietro Mortini

Flavia Valtorta

Letizia Leocani

Email: comi.giancarlo@hsr.it

Email: bussi.mario@hsr.it

Email: doglioni.claudio@hsr.it

Email: falini.andre@hsr.it

Email: filippi.massimo@hsr.it

Email: mortini.pietro@hsr.it

Email: valtorta.flavia@hsr.it

Email: leocani.letizia@hsr.it

Goals: The aim of this course is to help students acquire an understanding of the fundamental principles of clinical neurology. Students should be able to obtain a careful history of the disease, through a neurological examination and to understand the main neurological signs and symptoms. Students should demonstrate their ability to organize and integrate clinical data in order to produce a correct diagnosis, to learn about the diagnostic tests and understand their values and limitations. They should acquire a knowledge of nervous system development, functions and pathogenesis of neurological diseases, focusing on acute illness with an increased risk of death such as cerebral haemorrhage, intracranial hypertension, stroke, acute paralysis that requires urgent diagnosis and treatment. At the end of the course students should be able to provide an accurate diagnostic evaluation and treatment.

Prerequisites: None

Evaluation: The Commission is usually composed of three teachers of the course. The exam will consist of a multiple-choice test with 50 questions and an oral examination. The result of the multiple-choice test will condition access to the oral test and the final mark.

Course Description: This course will allow students to learn about the main neurological diseases related to the central and peripheral nervous systems. Lessons will start focusing on teaching the anatomy and physiology of the nervous system through imaging and neurophysiological techniques, which is of fundamental relevance to produce a specific diagnosis. Other lessons will consider neuromuscular diseases, epilepsy, cerebrovascular diseases, movement disorders, multiple sclerosis, and brain tumours: students will learn how to provide diagnostic evaluation and treatment. Some seminars with other specialists (neurosurgeons, neuroradiologists, oncologists, pathologists and pharmacologists) will be organized to investigate the pathogenesis of the diseases.

Textbooks:

Greenberg DA, Aminoff MJ, Simon RP
Clinical Neurology - McGraw-Hill

Allan H. Ropper, Martin A. Samuels
Adams & Victor's Principles of Neurology, 9e - McGraw-Hill

L Pinessi, S Gentile, I Rainero: Neurology book– Edi-Ermes

CG Goetz: Textbook of Clinical Neurology, Saunders, III edition

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Psychiatry and Clinical Psychology

Total Credits: 7

Total hours: 56

Scientific Discipline Sector: Med/25, Med/39, Bio/14, M-Psi/05, M-Psi/08

Teaching staff

Course Coordinator: Cristina Colombo

Francesco Benedetti

Cesare Maffei

Zanardi Raffaella

Barbini Barbara

Locatelli Marco

Rossini David

Cavallaro Roberto

Email: colombo.cristina@hsr.it

Email: benedetti.francesco@hsr.it

Email: maffei.cesare@hsr.it

Email: zanardi.raffaella@hsr.it

Email: barbini.barbara@hsr.it

Email: locatelli.marco@hsr.it

Email: rossini.david@hsr.it

Email: cavallaro.roberto@hsr.it

Goals: This course will provide an introduction to the clinical features and scientific understanding of the major mental health disorders that characterize medical practice

Prerequisites: none

Evaluation: Evaluation: Classroom performance, written final exams (multiple choice test).

Course Description . Lectures and group discussions will focus on the psychiatric interview, the mental status examination, and major psychiatric disorders including Mood Disorders, Schizophrenia, Anxiety Disorders, Trauma and Personality Disorders. Students will learn to assess the clinical aspects of a range of psychiatric disorders, with the aid of didactic presentations of case material in lectures, review of patient write-ups, and live or videotaped patient interviews with members of the faculty and senior residents as preceptors.

Clinical clerkship goals can be summarized as making psychiatry real, through practical care-centered teaching and clinical exposure to fundamental issues in psychiatry.

Textbooks: Textbook of psychiatry. Kaplan and Saddock IX edition

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Ophthalmology

Total Credits: 3

Total hours: 24

Scientific Discipline Sector: Med/30

Teaching staff

Course Coordinator:

Francesco Bandello

Email: bandello.francesco@hsr.it

Teaching Assistant

Maurizio Battaglia Parodi

Email: battagliaparodi.maurizio@hsr.it

Ugo Introini

Email: introini.ugo@hsr.it

Rosangela Lattanzio

Email: lattanzio.rosangela@hsr.it

Elisabetta Miserocchi

Email: miserocchi.elisabetta@hsr.it

Luisa Pierro

Email: pierro.luisa@hsr.it

Giuseppe Querques

Email: giuseppe.querques@hotmail.it

Monica Stoppani

Email: stoppani.monica@hsr.it

Course Description:

The purpose of the course is to give to students an overview on the most relevant diseases in Ophthalmology

The student should achieve a comprehensive understanding of the basic concepts of ocular normal and pathological anatomy

Following this perspective the course will describe the pathophysiological and clinical aspects of the main ocular diseases in order to provide a comprehensive knowledge regarding the pathophysiology, semiotics, clinics and treatment of all the ocular diseases

Students will learn to recognize the signs and symptoms of ocular pathologies to report directly to the specialist ophthalmologist

Furthermore, this module will provide knowledge relative to the main diagnostic techniques/criteria for establishing the diagnosis of ocular diseases

Finally, both pharmacologic and interventional treatment strategies will be discussed.

Suggested textbooks:

Clinical Ophthalmology

Kanski J.J., Bowling B.

7th edition – Saunders

2011 ISBN 9780702040931

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Infectious Diseases

Total Credits: 6

Total hours: 48

Scientific Discipline Sector: Med/17

Course Coordinator: Adriano Lazzarin

Teaching staff: Paola Cinque, Giuseppe Tambussi

Email addresses: lazzarin.adriano@hsr.it
cinque.paola@hsr.it
tambussi.giuseppe@hsr.it

Goals:

- a. To provide information on the clinical aspects of the most relevant infectious diseases
- b. To provide tools for optimal management of infectious diseases, including prevention, diagnosis and treatment

Prerequisites:

University level knowledge in microbiology, pathology and immunology

Evaluation:

Oral examination

Course Description:

The course will be articulated to include both frontal lessons (approximately 75% of total hours) and interactive discussions of clinical cases (approx 25%).

Frontal lessons will aim to provide fundamental knowledge on the most relevant infectious diseases, including epidemiology, pathogenesis, clinical aspects, diagnosis and treatments. In most of the cases - wherever feasible - the diseases will be presented in the context of clinical syndromes.

Interactive discussions of clinical cases aim to start and guide students from clinical symptoms - through diagnostic pathways - towards achievement of diagnosis and establishment of treatment plans.

List of content:

Principles of epidemiology of infectious diseases

Prevention of infectious diseases

Emerging and re-emerging infectious diseases

Respiratory infections

Central nervous system infections

Gastrointestinal infections and viral hepatitis

Skin and soft tissues infections

Sexually transmitted infections

Endocarditis and septic shock

Tuberculosis and other mycobacterial diseases

HIV infection

Infections in the immunocompromised host other than HIV

Health-care associated infections and antibiotic resistance

Tropical infections

Text books:

D. Kasper, A. Fauci, Hauser S, Longo D, J Loscalzo, J. Jameson. Harrison's Principles of Internal Medicine, 18th Edition. McGraw Hill.

G.L. Mandell, J.E. Bennett, R. Dolin . Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases, 7th edition, Churchill Livingstone (for consult only)

The lessons (slides kits and additional material) will be made available online.

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Clinical Rotations: Internal Medicine & Surgery II APRO

Total Credits: 4

Total hours: 100 (practicals)

Scientific Discipline Sector: Med/09, Med/18

Activity Coordinator: Prof. Lorenzo Dagna
Prof. Gianfranco Ferla

Email: lorenzo.dagna@univr.it
Email: ferla.gianfranco@hsr.it

Goals: The primary focus of these clinical rotations is to increase the capacity of students to act as a caring, increasing independent but always supervised physician on an interdisciplinary inpatient internal medicine and surgical team.

These clinical rotations have been designed for further developing the students' fundamental skills of physical exam and history taking that they have approached last year. Time will be given to improve the ability to listening to and communicating with patients, to increase their practical knowledge of medicine through the daily work with residents and faculty as well as self-directed study and research.

Prerequisites: none

Evaluation: pass/fail, based on attendance and on tutor's evaluation

Course Description: students will be working under a tutor's supervision in a general internal medicine and surgical ward and will be involved in all the daily activities of the department.

Textbooks (reference):

- Harrison's Principles of Internal Medicine, 18th Edition (Eds. Dan Longo, Anthony Fauci, Dennis Kasper and Stephen Haase), McGrawHill 2012
- Sabiston Textbook Of Surgery – The Biological Basis Of Modern Surgical Practice, 19th Edition (Eds. Courtney M. Townsend, Jr., R. Daniel Beauchamp, B. Mark Evers, Kenneth L. Mattox); Saunders 2013

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