FROM CLINICAL TO MOLECULAR BIOLOGY II (ML5202)

1. language

English.

2. course contents

Coordinator: Prof. DELLO RUSSO CINZIA

Year Course: V

Semester: I

UFC: 2

Modules and lecturers:

- PATHOLOGY III (ML5261) - 1 UFC - ssd MED/08
Prof. Esther Rossi, Prof. Guido Rindi

- PHARMACOLOGY III (ML5262) - 1 UFC - ssd BIO/14
Prof. Cinzia Dello Russo

3. bibliography

Robbins & Cotran: Pathologic Basis of Disease. 9th Edition, 2014

Goodman & Gilman's The Pharmacological Basis of Therapeutics. McGraw Hill. 13th Edition.

Both manuals are mandatory in preparation to the final exam.

Materiale didattico integrativo verrà fornito dai docenti (articoli scientifici originali e revisioni della letteratura recente, linee guida per la terapia, riferimenti a 'database' internazionali).

4. learning objectives

The course is divided in two integrated modules that provide students with specific knowledge and competences in the areas of heart and lung pathology and in the field of pharmacogenetics/omics, particularly on issues related to the Module of Pathology III.

Students are expected to work towards meeting the following objectives:

Knowledge and understanding (Dublin 1)*:* Students are expected to gain specific knowledge and understanding, as detailed below.

PATHOLOGY III

Educational goals and Student Skills

- Knowledge of the role of Anatomic Pathology in clinical settings related to heart and lung disease.

- Knowledge of the procedures and the tools for carrying out a macroscopic examination in the above- mentioned clinical settings.

- Knowledge of the pre-analytical and analytical procedure for processing the material in the above- mentioned clinical settings

- Understanding of the principles on which the histological and cytological diagnosis is based in the above-mentioned clinical settings .

PHARMACOLOGY III

Educational goals and Student Skills

- Understanding the fundamental principles of pharmacogenetics/omics and how the patient's characteristics and genetics may affect the response to a particular class of drugs for both efficacy and toxicity.

- Knowledge of the main pharmacogenomic biomarkers and related pharmacogenetic therapeutic guidelines to optimize drug prescription, particularly in the cardiovascular area.

- Knowledge of the main genomic mechanisms underlying drug toxicity and preventive strategies via pharmacogenetic screening tests.

- Understanding the complexity of drug response in the oncological setting, particularly how the patient's genetic background and the genomic heterogeneity within the tumour may influence the outcome of oncological treatments.

- Understanding of pharmacogenomic principles that apply to drug development in oncology (target-therapy), particularly focusing on therapeutic options for lung cancer.

Applying knowledge and understanding (Dublin 2): Students are expected to apply the knowledge/understanding acquired during this course in clinical practise, being able to the followings:

PATHOLOGY III

- Recognizing the morphological and functional differences between normal and diseased tissues, with special focus on morphological characteristic of heart and the lung lesions.

- Understanding the different pathological lesions from a structural, morphological, functional perspective.

- Interpreting data originating from pathology laboratory and applying principles of diagnostic pathology.

PHARMACOLOGY III

- Understanding the genotyping results for the main pharmaco-genes and apply them to guide the prescription of different therapeutics

- Using pharmacogenetic tests to prevent the occurrence or confirm the diagnose of adverse drug reactions, or to select patients for close monitoring

- Recognizing the impact of genomic biomarkers in cancer treatment and use them to select the best option for a specific tumour, focusing particularly on the lung cancer.

Making judgements (Dublin 3): Students are expected to integrate pathological findings with clinical manifestations of diseases and to understand the mechanisms underlying signs and symptoms of diseases. Students are expected to apply the principle of pharmacogenetics/omics to the prescription of drugs commonly used in clinical practise, with particular emphasis in the cardiovascular therapeutic area. They will be introduced to the principles of clinical drug development in oncology and to the use of genomic biomarkers in cancer treatment.

Communication skills (Dublin 4)*:* Students are expected to become familiar with essential terminology related to human diseases and to the concepts of disease aetiology, pathogenesis, morphological characteristics, pharmacological treatment, pharmacogenomic biomarkers, pharmacogenetic testing.

Learning skills (Dublin 5): Students will learn the morphological and functional alterations that pathogens and aberrant stimuli can induce in molecules, cells and tissues and their consequences for the entire organism as well as the basic defence mechanisms in response to them. They will learn how the genetic background of the patient may affect the outcome of different pharmacological therapies and how the use of genomic biomarkers can benefit the patients in different clinical settings, particularly those related to the Module of Pathology III.

5. PREREQUISITES

Knowledge of molecular and cellular biology, microbiology, genetics, clinical medicine; general pharmacology; general pathology.

6. teaching methods

Teaching methods are represented by: classroom-taught lessons with the use of slides and videos, guided activities, textbooks, e-learning, online scientific papers in order to stimulate:

Knowledge and understanding (Dublin 1): Lecturers will show the principal aspects of histopathology by forming the student to use an integrated study method (morphological, biochemical, ultrastructural, molecular). In this way the student will know the functional/physiological aspects and the possible pathological alterations; the student also will perform and improve the ability to observe, to compare and to deduce a correct medical conduct. Lecturers will present with the main topic of pharmacogenetics/omics and the main sources to maintain the knowledge in the filed up to date (international pharmacogenetic/omic database). In this way the student will build a solid knowledge in the field and will gain the ability to search and evaluate novel findings in a rapid expanding field of research and clinical applications.

Applying knowledge and understanding (problem solving) (Dublin 2)*:* the active participation with questions/answers is fundamental, in order to improve the observational and deductive ability, in particular in the professional training in both disciplines, Pathology III and Pharmacology III.

Making judgements (Dublin 3): by observing pathological slides the student will strengthen a critical approach. By accessing the international databases in pharmacogenetic/omics or other relevant sources related to drugs and pharmacotherapy (*i.e.,* the databases of the U.S. Food and Drug Administration, the European Medicines Agency, and the Italian Regulatory agency AIFA) the student will gain the ability to use genomic biomarkers to personalise and optimize specific therapies.

Communication skills (Dublin 4): the question/answer approach will be preferred and encouraged. When the student will get the language wrong, lecturers will correct the student's

work, by stimulating the knowledge of the appropriate technical and scientific terminology

Learning skills (Dublin 5): the classroom-taught lesson will deal with the most important topics of the study program. In addition, text-books, e-learning, and online scientific papers will be proposed.

7. other informations

Students can apply for a 1 year internship in Pathology (1 UFC).

Lecturers are available for personal meeting in order to clarify some topics of the program, doubts or getting additional information.

8. methods for verifying learning and for evaluation

Written test, using computer equipped facilities whenever possible. The test will be taken through the platform *Respondus Lockdown Browser* in case of COVID-related restrictions, to allow the student to access the test remotely.

The written test will consist in 24 multiple choice questions (12 for the module of Pathology III and 12 for the module of Pharmacology III). The final grade is expressed as thirtieth. The pass mark is 5 correct answers for each module, that is a passing grade of 18/30. The top grade is 30/30 *cum laude* and it will be assigned for marks higher than 23 correct answers.

The written test aims to assess that the following skills are completely accomplished:

Knowledge and understanding (Dublin 1)*:* Acquired knowledge regarding pathological changes in lung and cardiovascular tissues. Acquired knowledge on general principles of genetic variability and its impact on pharmacological therapies.

Applying knowledge and understanding (problem solving) (Dublin 2): Acquired ability in analysing images taken under the microscope and the observational, comparative, logical competences. Acquired ability to correctly identify cells and tissues, pathological lesions and to describe them with the appropriate technical language. Acquired ability to apply pharmacogenetic/omic principles to personalized therapy.

Making judgements (Dublin 3): Acquired evaluative autonomy by the ability answering specific questions related to clinical cases.

Communication skills (Dublin 4): Acquired ability to understand and use the scientific and technical terminology related to the fields of Pathology and Pharmacology.

Learning skills* (*Dublin 5): Acquired ability to use the specific knowledge gained through this course in different clinical settings. Acquired ability to use text-books, e-learning, online scientific papers and databases.

9. program

PATHOLOGY III

Pulmonary and respiratory pathology: diseases of the pharynx and larynx – hyaline membrane disease – pulmonary oedema – pulmonary embolism and emphysema – Hypertension of the lung vascular network – diffuse alveolar damage and acute respiratory distress – pneumonia and inflammatory diseases of lung and pleura – pulmonary TB infection – interstitial pneumonia – bronchial asthma – pneumoconiosis - tumours of lung and pleura – tumours of mediastinum

Pathology of cardiovascular system: Ischemic heart disease - atherosclerotic disease***.***

PHARMACOLOGY III

Pharmacogenetics/Pharmacogenomics and Personalized therapy: - Elements of genetics and mechanisms underlying genetic variability - General principles of Pharmacogenetics/omics – Methodology of clinical studies in pharmacogenetics (candidate-gene approach, genome wide-association studies, next generation sequencing) - Applications of Pharmacogenetics/omics in clinical practice – Genomic biomarkers - Main pharmaco-genes (CYP2D6, CYP2C9, CYP2C19, SLCO1B1), genetic testing, main clinical applications and prescription guidelines - Genomics of Adverse Drug Reactions - Pharmacogenetic testing to improve drug safety - Pharmacogenetics/omics applications in clinical Oncology, focus on lung cancer – Companion diagnostic pharmacogenomic tests.