



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Cardiovascular Diseases and Respiratory Sciences

2425-4-H4102D024

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#### Aims

The course aims to provide the basics of physiopathology, semiotics, clinical and treatment of acute and chronic diseases of the cardiovascular and respiratory systems.

#### Contents

Cardiovascular anatomy  
Cardiovascular and respiratory hysiology  
Pharmacology  
Pathology  
Diagnostics  
Cardiology  
Cardiac surgery  
vascular surgery  
Emergency  
Modeling and simulation  
Respiratory sciences

#### Detailed program

##### ANATOMY OF THE HEART AND CIRCULATORY SYSTEM

1. Anatomical concepts related to heart development
2. The heart: basic concepts regarding cardiomyocytes, connective tissue, sinoatrial node, and the conduction

tissue

3. Anatomical concepts related to heart chambers and pericardium
4. Anatomical concepts related to heart valves apparatus
5. Anatomical concepts related to systemic and pulmonary circulation anatomy

#### ANATOMY OF THE CHEST AND THE LUNGS

6. Anatomical concepts related to lung, pleural and chest wall embryology and development
7. Chest wall: anterior and posterior landmarks and anatomic border
8. Mediastinum and Thoracic cavity: landmarks, organs' content and relations
9. Pleural gross and microscopic anatomy
10. The lung: basic concepts regarding normal anatomic structure
11. Normal histology of respiratory system: structure, microscopic anatomy of trachea, bronchial tree and the functional unit of the lung: the secondary pulmonary lobule
12. Anatomical concepts related to lung and tracheobronchial tree, basic concepts of bronchial endoscopy
13. Anatomical concepts related to pulmonary and lymphatic circulation
14. Larynx and nervous system of chest wall, respiratory tree and diaphragm

#### PHYSIOLOGY

15. The heart
    - Structural and functional aspects of cardiac excitation - the electrical cycle (with reference to ECG)
    - Structural and functional aspects of cardiac excitation-contraction coupling and its modulation (inotropy, lusitropy)
  16. The cardiac mechanical cycle (on pressure/time and pressure/volume planes) – definition of “systolic” and “diastolic” functions and their coupling.
  17. Cardiac “mechanical” and “chemical” work - relation to cardiac O<sub>2</sub> consumption (myocardial efficiency)
  18. Cardiac adaptation to preload and afterload changes in health and disease
  19. Principles of cardiac (systolic and diastolic) functional measurements (invasive and imaging).
  20. The systemic circulation:.
    - Large arteries dynamics: windkessel mechanism, pressure pulse and its propagation
    - Small arteries: regulation of peripheral resistance (intrinsic, neural, paracrine)
    - Systemic pressure/flow relationship
    - Determinants of capillary filtration/reabsorption balance – mechanisms of “edema”
    - Mechanisms of venous return (preload maintenance and regulation)
  21. The coronary circulation
    - Subepicardial and intramural vessels
    - Left vs right flow profiles – phasic LV flow
    - Wall stress and extravascular compression- concept of “closure pressure”
    - Coronary flow reserve and its recruitment
    - Paracrine and neural regulation (redundancy and feed-forward)
    - Coronary flow during exercise (consequences of proximal obstruction)
  22. The pulmonary circulation
    - Structure-function peculiarities
    - Pulmonary vascular resistance : definition, regulation and measurement
  23. Regulation of cardiovascular function
    - Pressure / volume homeostasis (neural and endocrine)
    - Adaptation to physiologic demand (exercise, gravity, pregnancy etc)
- #### PHARMACOLOGY
24. General overview of pharmacologic therapy for cardiovascular diseases
  25. Anti-ischemic and antianginal therapies
  26. Anti-hypertensive therapies (Beta-blocking agents, Calcium channel blockers, Inhibitors of Renin-Angiotensin-Aldosterone System, Diuretics)
  27. Antithrombotic agents (acute and chronic anticoagulation, fibrinolytics) - brief overview, as already discussed in the Onco-Hematological diseases
  28. Antiplatelet agents - brief overview, as already discussed in the Onco-Hematological diseases
  29. Lipid-modifying therapies (statins, fibrates, ezetimibe) - brief overview, as already discussed in the Onco-Hematological diseases
  30. Anti-arrhythmic drugs

31. Treatment of acute and chronic heart failure
32. Natural products in cardiovascular medicine
33. Contributory risk and management of comorbidities in chronic heart failure
34. Non-cardiac drugs affecting the heart
35. Treatment of asthma and chronic obstructive pulmonary disease

#### DIAGNOSTICS

36. · Cardiovascular examination
37. · Electrocardiography
38. · Cardiopulmonary exercise testing and pulmonary function tests
39. · Noninvasive imaging modalities: overview and selection
40. · Transthoracic echocardiography and lung ultrasound
41. · Stress and transesophageal echocardiography
42. · Cardiac radiography and computed tomography
43. · Cardiac magnetic resonance
44. · Nuclear imaging and positron emission tomography
45. · Invasive imaging and hemodynamics

#### CARDIOLOGY

46. Arrhythmias
47. Syncope
48. Hypertension
49. Aortic syndromes
50. Valvular heart disease
51. Infective endocarditis
52. Myocarditis
53. Chronic ischemic heart disease
54. Acute coronary syndromes
55. Interventional cardiology
56. Cardiomyopathies
57. Heart failure
58. Pericardial diseases
59. Pulmonary embolism
60. Pulmonary hypertension
61. Right ventricular failure and cor pulmonale
62. Adult congenital heart diseases
63. Cardiac tumors
64. Adaptation of the cardiovascular system to various physiologic conditions (aging, exercise, pregnancy, high altitude)

#### CARDIAC SURGERY

65. Anatomical concepts related to ischemic, valvular and congenital heart diseases.
66. Basic concepts regarding treatment of coronary artery diseases.
67. Basic concepts regarding treatment of mitral, aortic and tricuspid diseases.
68. Basic concepts regarding treatment of congenital heart diseases.

#### VASCULAR SURGERY

69. Atherosclerosis and vulnerable plaques: plaque rupture, embolization and thrombosis.
70. Clinical evaluation of patients with vascular disease. Arterial pulses.
71. Carotid atherosclerosis. Assessment of carotid plaque morphology and rate of carotid stenosis. Definition of symptomatic carotid plaque. Surgical and endovascular treatment of carotid stenosis.
72. Subclavian Steal Syndrome (SSS).
73. Thoracic Outlet Syndrome (TOS).
74. Peripheral artery disease (PAD). Leriche syndrome. Arterial Ulcers. Lower limb revascularization.
75. Hypoperfusion, hypoxia, ischemia and necrosis. Acute limb ischemia. Compartmental syndromes. Ischemia-reperfusion injury
76. Aortic aneurysms. Ruptured abdominal aortic aneurysms. Indication to treatment. Surgical and endovascular treatment
77. Post-catheterization pseudoaneurysms. Traumatic pseudoaneurysm and blunt aortic injury

78. Mycotic aneurysms.
  79. Acute aortic syndromes. Aortic dissections, classification, pathophysiology, management. Intramural hematoma (IMH). Penetrating aortic ulcer (PAU)
  80. Deep venous thrombosis. Triad of Virchow. Superficial venous thrombosis and phlebitis. Venous ulcers.
  81. Chronic venous insufficiency. CEAP Classification. Conservative, elastocompressive, surgical and thermal ablation treatment.
  82. Differential diagnosis of edema, pain and inflammation in lower limbs.
  83. Raynaud's phenomenon
- EMERGENCY**
84. Causes of Cardiocirculatory arrest and treatment: Basic Life Support and Defibrillation (BLS-D), Advanced Cardiac Life Support principles (ACLS). Extracorporeal Life Support principles (ECLS);
  85. Definition and classification of Shocks' types and focus on Cardiogenic Shock, pathophysiology, clinical presentation and treatment;
  86. Obstructive shock: focus on the causes of Cardiac Tamponade, pathophysiology, clinical presentation and treatment;
  87. Causes of Aortic dissection, classification, clinical presentation and medical treatment prior to surgery;
  88. Causes of Pulmonary Embolism, acute cor pulmonale, pathophysiology, clinical presentation and treatment;
  89. Causes of Acute Respiratory Insufficiency and ARDS clinical presentation and principles of treatment
- MODELING AND SIMULATION**
90. Basic concepts of blood fluid-dynamics in vessels.
  91. Properties of blood and vessels.
  92. Pressure drop and viscosity.
  93. Shear stress.
  94. Laws of mass conservation, momentum and energy balance.
  95. Lumped parameter description of blood flow.
  96. Pulsatile blood flow.
- RESPIRATORY SCIENCES**
97. Specific diagnostic tests for respiratory disorders: respiratory endoscopy, pulmonary function tests, imaging of the thorax, acute and chronic respiratory failure, including blood gas analysis interpretation
  98. Prevention and diagnosis of lung infections, including pneumonia and tuberculosis
  99. Chronic pulmonary diseases, including asthma, COPD, bronchiectasis and cystic fibrosis.
  100. Pleural diseases, including pneumothorax, pleural effusion, pleural infections and pleural tumors (mesothelioma)
  101. Basic knowledge on pleural imaging and procedures
  102. Interstitial lung disorders, including sarcoidosis and idiopathic pulmonary fibrosis
  103. Epidemiology, diagnosis and staging of pleural and lung tumors
  104. Principles of smoking cessation and smoking-related pulmonary disease
  105. Principles of palliation in chronic pulmonary diseases
  106. Evidence-based medicine diagnostic guidelines of the main pulmonary diseases.

## Prerequisites

Basic knowledge of fundamentals of biology, genetics, anatomy, histology, physiology and pathophysiology of the cardiovascular and respiratory systems, and general pharmacology.

English language

## Teaching form

Frontal teaching (about 60%) and interaction with the audience (tracing and case discussion, about 40%)

All course activities will be held in English

## **Textbook and teaching resource**

- HUMAN ANATOMY: A CLINICALLY ORIENTATED APPROACH. Edi Ermes
- Goodman and Gilman's The pharmacological basis of therapeutics, 13th ed. (2018) McGraw-Hill Education.
- Kumar V, Abbas A K, Aster J C; Robbins and Cotran Pathologic Basis of Disease Elsevier, 10th ed
- Lilly LS. Pathophysiology of Heart Disease. 6th Edition. 2016 Wolter Kluwer
- Harrison's Principles of Internal Medicine 20th Edition 2018, McGraw-Hill
- Hurst's The Heart 14th Edition 2017, McGraw-Hill
- Piergiorgio Settembrini; Alberto Settembrini "Vascular Surgery - A Clinical Guide to Decision Making" Academic Press, 2021, ISBN: 978-0128221136

## **Semester**

First semester

## **Assessment method**

(1) Written exam with multiple choice quiz comprising 50 questions with only one correct answer (among 4) aimed at evaluating global comprehension of the course program. Each correct answer is scored 1. A minimum score of 30 correct answers is required for being admitted to oral examination

(2) Oral examination (starting from a real clinical case we will discuss on topics covered during the lectures or clinical case analysis)

All assessments will be done in the English language

## **Office hours**

By email appointment at [luigi.badano@unimib.it](mailto:luigi.badano@unimib.it)

## **Sustainable Development Goals**

GOOD HEALTH AND WELL-BEING

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