HUMANITAS MEDICAL SCHOOL

Course: **CARDIOVASCULAR DISEASES**

Year (1ˢᵗ-2ⁿᵈ-3ʳᵈ-4ᵗʰ-5ᵗʰ-6ᵗʰ): 3rd

Period (1ˢᵗ-2ⁿᵈ semester – annual): annual

Credits: 6

Faculty and Open Faculty: Aliberti, Cao, Chiarito, Civilini, Condorelli, Ferrante, Francone, Inversetti, Mirani, Panico, Renne, Reggiani, Stefanini, Torracca, Tritto

Coordinator: Gianluigi Condorelli

Overview of the Course
This course will focus on some relevant aspects of cardiology, including pathophysiology, functional and structural semeiotics, clinics and therapeutic pharmacology of cardiovascular diseases, including broad concepts of cardiovascular surgery.

Teaching methods: Lectures**,** PBL**,** Case Method**,** Simulation

Evaluation
The evaluation will be based on a written test.
The test will consist of 32 case-based multiple choice questions (22 Cardiology, 5 Pathology, 5 Imaging).
To pass the written exam, students must answer at least 60% of all questions.
To obtain the "lode" they students will need to score >30/30.

Textbooks
   Cardiology
- Pathophysiology of Heart Disease: A Collaborative Project of Medical Students and Faculty- Leonard S. Lilly – Wolters Kluver Ed (recommended**).
- Harrison's Principles of Internal Medicine, McGraw Hill (recommended*)
- Braunwald's Heart Disease, Elsevier (recommended*)

   Pathology:
- Aster, J. C., Abbas, A. K. (2020). Robbins & Cotran Pathologic Basis of Disease. Elsevier.

   Cardiovascular imaging:
- William Herring. Learning Radiology (Third Edition). Elsevier.
- Gunderman et al. Essential Radiology. Thieme

Lessons

Cardiology

1. **Epidemiology and risk factors of cardiovascular diseases (Condorelli)**
Learning goals:
- Introduction to cardiovascular diseases
- Illustrate the global epidemiology of cardiovascular disease.
- Discuss the definition of risk factors and the impact of lifestyle on CV diseases and their prevention.
- Define some strategies for the prevention of risk factors.

2. **The Electrocardiogram (Ferrante)**
Learning goals:
- Describe how to perform an ECG. Theory of bipolar peripheral leads and unipolar pre-cordial leads of the baseline human ECG. Description of the theory of dominant vector orientation and its influence on the surface ECG amplitude and duration waveform
- Describe how to interpret an ECG. At the end of the course, the student will be able to
- distinguish the P wave, the QRS complex and the ST-T wave segments of the baseline ECG
- recognize the fundamental findings associated with bradycardia and with tachycardia syndrome in real life ECG recording
- recognize the fundamental findings associated with ST segment depression/elevation syndrome in real life ECG recording
- correlate the fundamental findings of pathological real life ECG variations with the underlying clinical condition
- identify and describe the fundamental therapies and the expected outcomes in response to the pathological real life ECG variations

3. **Tools for assessing cardiovascular diseases (Stefanini/Francone)**
Learning goals:
- Illustrate the main imaging techniques for the evaluation of cardiac function and for the assessment of cardiovascular diseases.
- Recognize normal cardiac anatomy on chest X-ray and echocardiography.
- Fundamentals on cardiac CT and cardiac MR.
- Imaging findings in common cardiovascular diseases.
- Describe the basic principles of imaging stress tests.

4. **Diabetes mellitus and cardiovascular diseases (Mirani/Stefanini)**
Learning goals:
- Overview on diabetes mellitus
- Discuss the interaction between diabetes mellitus and cardiovascular risk

- Understand the pathophysiological mechanisms of cardiovascular complications in diabetic patients
- Define the clinical management of diabetes mellitus in patients with cardiovascular diseases

5. Arterial hypertension (Condorelli/Panico)
Learning goals:
- Discuss the pathophysiology and clinical impact of arterial hypertension and of the vascular consequences of systemic diseases.
- Discuss the therapeutic approaches for treating hypertension and vascular diseases.

6. Coronary artery diseases 1: pathophysiology and clinical management (Stefanini)
Learning goals:
- Discuss myocardial ischemia: from pathophysiology to clinical presentation.
- Clarify the diagnostic tools for assessing myocardial ischemia.
- Illustrate the invasive diagnostic tools for assessing coronary artery disease and myocardial ischemia.
- Define the basis of therapeutic approaches
- Discuss the treatment options for myocardial revascularization.
- Discuss the indications for percutaneous and surgical myocardial revascularization.
- Discuss optimal medical management after myocardial revascularization.

7. Coronary artery diseases 2: acute coronary syndromes and cardiogenic shock (Stefanini)
Learning goals:
- Basic mechanisms of acute coronary syndromes.
- Different presentations of acute coronary syndromes.
- Discuss risk stratification in patients with acute coronary syndromes.
- Define the management of patients with non-ST-segment elevation and ST-segment elevation.
- Describe the pathophysiology and define the management of cardiogenic shock.

8. Heart failure 1: basic mechanisms and pathophysiology (Condorelli)
Learning goals:
- Discuss the epidemiology and prognosis of heart failure with reduced and preserved ejection fraction.
- Describe the definition of heart failure and recognize the different underlying causes and precipitating factors.
- Discuss the pathophysiology of heart failure and systolic and diastolic dysfunction.

9. Heart Failure 2: clinics and therapeutics (Condorelli)
Learning goals:
- Distinguish acute from chronic HF.
- Understand the bases of acute heart failure treatment
- Understanding the bases of therapeutic options for chronic heart failure treatment
- Understanding the major prognostic components in heart failure.

10. Haemostatis, thrombosis and cardiovascular diseases: venous thromboembolisms, deep vein thrombosis, and pulmonary embolism (Cao/Chiarito)

Learning goals:

- Overview on the role of hemostasis and thrombosis in CV diseases
- Discuss the mechanisms of blood clot formation at the basis of VTE.
- Discuss the pathophysiology, symptoms and diagnosis of VTE and DVT.
- Discuss the complications, its prevention (risk assessment) and the therapeutic options of DVT.
- Discuss the pathophysiology, clinics and therapy of PE.

11. Clinical cases 1 (Cao)

Learning goals:

- Primary prevention
- Coronary artery disease
- Heart failure

12. Cardiac arrhythmias 1: basic mechanisms and pathophysiology (Muser/Tritto)

Learning goals:

- Distinguish the epidemiology, pathophysiology, diagnosis and clinical features of arrhythmias and conduction disturbances.
- Illustrate of the cellular and molecular mechanisms involved in the electrical activity of the heart; the anatomy and physiology of the conduction system; and the electrical vectors throughout the cardiac cycle.
- Indicate how to recognize the characteristic appearances of, and explanation for, the ECG in the main pathological conditions.
- Discuss the classification and definition of bradycardia, tachycardia, supraventricular arrhythmia (including atrial fibrillation and flutter) and ventricular arrhythmia.

13. Cardiac arrhythmias 2: clinics and therapeutics (Muser/Tritto)

Learning goals:

- Present the mechanism of action of the various classes of anti-arrhythmic drugs and their use in the clinic, as related to the classification of arrhythmias.
- Discuss the basic functioning of the pacemaker and its indications.
- Describe the basic functioning of the implantable cardioverter–defibrillator (ICD) and its indications for arrhythmia prevention.
- Discuss the flow-chart of therapeutic options in arrhythmias, with clinical examples

14. Cardiac valve diseases 1: principles of pathophysiology and aortic valve diseases (Stefanini/Cao)

Learning goals:

- Define the pathophysiology and clinical presentation of cardiac valve diseases.
- Discuss the clinical evaluation of cardiac valve diseases.

- The role of multidisciplinary integration
- Discuss the diagnostic tools for assessing aortic valve diseases.
- Discuss the treatment options and indications for intervention for aortic valve diseases.
- Discuss the optimal medical management after interventions for aortic valve diseases.

15. Cardiac valve diseases 2: atrioventricular valve diseases (Stefanini/Cao)
Learning goals:
- Discuss the diagnostic tools for assessing atrioventricular valve diseases.
- Discuss the treatment options and indications for intervention for atrioventricular valve diseases.
- Discuss the optimal medical management after interventions for atrioventricular valve diseases.

16. Clinical cases 2 (Chiarito)
Learning goals:
- Cardiac arrhythmias
- Valvular heart diseases

17. Principles of Cardiovascular Surgery (Civilini/Torracca)
Learning goals:
- Describe the surgical approaches to cardiac diseases .
- Describe the basic techniques for cardiac surgery (coronary artery bypass surgery, valvular replacement/repair, correction of congenital diseases)
- Describe the principles of extracorporeal circulation

18. Clinical and surgical approaches for great vessel disease (Civilini)
Learning goals:
- Discuss the epidemiology, pathophysiology, diagnosis and clinical features of aneurysms and occlusive artery diseases in different anatomical settings.
- Define the basis of clinical management
- Define the basis of open or endovascular therapeutic approaches.
- Introduce planning and sizing for vascular diseases.

19. Clinical and surgical approaches for carotid and peripheral artery disease (Civilini)
Learning goals:
- Discuss the epidemiology, pathophysiology, diagnosis and clinical features of peripheral artery diseases.
- Define the basis of clinical management
- Define the basis of open or endovascular therapeutic approaches

20. Clinical cases 3 (Civilini)
- Aortic aneurysm
- Carotid artery disease

- Peripheral artery disease

21. Grown-up congenital cardiac heart GUCH (Cao/Panico)
Learning goals:

- Discuss the anatomy and the development of the heart, veins and great vessels, their major congenital malformations and the principles of nomenclature.
- Discuss the physiology of the foetal and transitional circulations; aetiology of congenital heart disease, including the developmental anatomy of the heart and vasculature.
- Discuss the pathophysiology, natural history and complications of: valve and outflow tract lesions; septal defects; patent ductus arteriosus; Eisenmenger syndrome; coarctation of the aorta; Ebsteins's anomaly; aortic and pulmonary artery malformations; venous anomalies; transposition of the great arteries (complete and congenitally corrected); tetralogy of Fallot; congenital malformations of coronary arteries; cyanotic congenital heart disease and secondary erythrocytosis; and pulmonary hypertension in congenital heart disease.
- Describe adolescent and adult patients with simple congenital heart defects (grown-up congenital heart disease (GUCH), including those who have undergone cardiac surgery.
- Describe and recognize physical signs of congenital heart disease and its complications.

22. Endocarditis (Ferrante)
Learning goals

- Illustrate the epidemiology and the etiopathogenesis of infective endocarditis.
- Discuss the clinical presentation and complications of infective endocarditis.
- Discuss diagnostic tools for assessing infective endocarditis.
- Discuss antimicrobial therapy for infective endocarditis.
- Discuss the recommendations for prophylaxis of infective endocarditis.
- Discuss the indications for and timing of surgery for infective endocarditis.

23. Myocarditis and diseases of the pericardium (Condorelli)
Learning goals

- Discuss the mechanisms underlying the disease and the pathophysiology of myocarditis.
- Discuss the diagnostic and therapeutic approaches of myocarditis.
- Discuss the mechanisms underlying the disease and the pathophysiology of pericarditis.
- Discuss the diagnostic and therapeutic approaches of pericarditis.

24. Primary cardiomyopathies and inherited cardiovascular diseases (Condorelli/Panico)
Learning goals:

- Review the genetics and basic mechanisms of primary cardiomyopathies
- Discuss the etiology classification and pathophysiology of the diseases
- Discuss the possible therapeutic strategies
- Multidisciplinary integration

25. Kidney and cardiovascular diseases (Reggiani/Panico)
Learning goals:

- Overview on acute and chronic kidney diseases
- Discuss the interaction between kidney diseases and cardiovascular risk
- Understand the risk of acute and chronic kidney diseases in patients with cardiovascular diseases
- Understand the pathophysiological mechanisms of cardiovascular complications in patients with kidney diseases
- Define the clinical management of kidney diseases in patients with cardiovascular diseases

26. Cardiovascular risk in women and cardiovascular diseases during pregnancy (Stefanini/Inversetti)
Learning goals:

- Overview the risk of cardiovascular diseases in women
- Discuss sex-based differences in risk factors
- Understand the pathophysiological mechanisms of cardiovascular diseases during pregnancy
- Define the diagnostic and clinical management cardiovascular diseases during pregnancy

27. Cor Pulmonale - Pulmonary hypertension (Ferrante/Aliberti)
Learning goals:

- Discuss the pathophysiological classification of pulmonary hypertension and the type of investigations used for diagnosis and recognizing the etiology.
- Discuss the medical, surgical and interventional management

28. Clinical cases 3 (Panico)

- Myocarditis
- Cardiomyopathies
- GUCH

Pathology

Lesson 1. Atherosclerosis (Renne)
Learning goals:

- Describe impact of atherosclerosis to the global burden of deaths.
- Illustrate acquired and inherited risk factor of atherosclerosis.
- Define atherosclerosis and list its acute and chronic clinical manifestation.
- Illustrate the pathogenesis of atherosclerosis, describing the *response to injury* hypothesis.
- Define the term xanthoma, intimal thickening, fibroatheroma.
- Discuss how the different cap type might clinically manifest.
- Correlate the site and severity of atherosclerosis to its clinical manifestations.
- Illustrate the complications of atherosclerosis.

Lesson 2. Ischemic Heart Disease & Heart Failure (Renne)
Learning goals:

- Define ischemic heart disease.
- List the clinical presentations of ischemic heart disease.
- Define acute, subacute and healed myocardial infarction.
- Correlate the clinical presentation with the type and the extent of vessel involvement.
- Illustrate the evolution of gross and microscopic changes in myocardial infarction.
- Illustrate the complications of myocardial infarction.
- Define Heart Failure
- Contrast and compare the physiologic and pathological hypertrophy
- Describe the aetiologies of heart failure
- Illustrate the pathogenesis of heart failure
- Describe the morphological features of heart failure
- List the systemic consequences of heart failure
- Define *Cor pulmonale*

Lesson 3. Diseases of the endocardium, myocardium and pericardium (Uccella)
Learning goals:
- Define valvular abnormalities: stenosis, regurgitation, mixed forms.
- Compare types of valvular Involvement: isolated (one valve) and combined.
- Discuss the consequences of valvular diseases: considering the affected valve, degree of injury, and establishment of compensation mechanisms.
- List the causes of valvular diseases: congenital or acquired pathologies, with common examples like aortic stenosis, mitral regurgitation, mitral stenosis, and aortic regurgitation.
- Illustrate the difference between endocarditis: rheumatic disease, infective endocarditis, nonbacterial thrombotic endocarditis, and systemic lupus erythematosus endocarditis.
- Define cardiomyopathies
- Illustrate genetic basis, non-genetic causes, histological features, and treatment options for hypertrophic cardiomyopathy.
- Illustrate causes of restrictive cardiomyopathy and discuss association with systemic diseases such as amyloidosis and sarcoidosis.
- Define myocarditis
- Describe the causes and the clinical presentation of myocarditis
- Define pericarditis
- Describe the causes and the clinical presentation of pericarditis