SUBJECT: STRUCTURE AND FUNCTION OF THE CARDIOVASCULAR, RESPIRATORY AND RENAL SYSTEMS

CREDITS: Total: 13 Theory: 6.5 Practical: 6.5

SPECIFIC OBJECTIVES

• Develop skills in spoken, written and graphic communication related to the course content through the creation and presentation of posters and participation in the discussion forum.

• Develop creative abilities and manual skills by carrying out a research project related to the content of the practical content of the course.

• Develop the habit of consulting bibliographical material through the activities proposed above.

• Develop the ability to give precise definitions and to identify the most suitable definitions from a glossary of terms corresponding to the subject.

• Develop the ability to accurately present and interpret graphs relating functional parameters of the cardiovascular, respiratory and renal systems.

• Develop the ability to establish cause-effect relationships between functional parameters of the cardiovascular, respiratory and renal systems.

• Develop the ability to identify and analyze microscopic preparations of the different organs of the cardiovascular, respiratory and renal systems.

• Develop regular work patterns through continuous assessment.

• Develop self learning capabilities by setting problems to be solved.

• Develop critical reading abilities through the discussion forum.

• Develop critical skills in practical experiments, considering potential limitations of measuring apparatus and sources of error in data acquisition.

The specific learning objectives will be outlined in the subject Teaching Guide which will be distributed at the end of the first semester of the course.

PROGRAMME

Theory

1. The cardiovascular, respiratory and renal systems and homeostasis.
   The cardiovascular, respiratory and renal systems and the internal medium. Functions of the cardiovascular, respiratory and renal systems in homeostasis.

2. Histological structure of the heart, arteries, veins, capillaries and lymph vessels.
3. Genesis and conduction of cardiac electrical activity.

4. Mechanical activity of the heart.

5. Cardiac cycle.
Chronology of the cardiac cycle. Chronological relationship between the electrocardiogram waveform and cardiac cycle. Chronological relationship between the phonocardiogram waveform and cardiac cycle. Pressure and volume variations in cardiac cavities during the cardiac cycle.

Mechanical structure of the cardiovascular circuit. Application of the laws of conservation of mass and energy to blood circulation.

7. Hemodynamic resistance.

8. Effect of vessel elasticity on blood circulation.
Effect of vessel distensibility on resistance. Effect of vessel elasticity on pressure oscillation.

Functions of the arterial system in blood circulation. Circulatory resistances in the arterial system. Functions of the endothelium in the arterial system.

10. Microcirculation.

Functions of the venous system in blood circulation. Determining factors of venous return.

12. Local circulations.

13. Regulation of circulatory function.
Regulation of the cardiovascular system and homeostasis. Nervous regulation of arterial pressure. Regulation of arterial pressure by baroreceptor reflexes. Modifications of arterial pressure through the reflexes of low-pressure system receptors. Modifications of arterial pressure due to stimulation of "chemoreceptors" in the carotid and aortic glomus and cerebral ischemia. Endocrine regulatory mechanisms of arterial pressure. Long-term regulation of arterial pressure through blood volume.

15. **Structure of the respiratory apparatus: the respiratory zone. The pleura.**


16. **Pulmonary circulation.**


17. **Ventilation-perfusion relations.**


18. **Peripheral gas transfer and exchange.**


19. **Respiratory mechanics: static.**


20. **Properties of gases.**


21. **Ventilation.**


22. **Respiratory mechanics: dynamic.**


23. **Alveolar surfactant.**

Functions. Composition; lipids and proteins. Characteristics of the superficial monolayer. Metabolism; stages and regulation mechanisms.

24. **Gas diffusion in the lungs.**


25. **Regulation of respiratory function.**

Respiratory neurons. Afferent and efferent pathways of the respiratory circuit. Regulation of air flow resistances. Regulation of ventilation. Regulation of the secretion of water and electrolytes in respiratory pathways.

26. **Adaptations of the cardiovascular and respiratory systems.**

27. Histology of the nephron and excretory pathways.

28. Physiology of the nephron:

29. Regulation of renal function.

30. Mechanism of dilution and concentration of urine and other renal functions.

31. Determining factors of the hydroelectric balance.
Homeostasis of water and electrolytes. Fluid compartments in the body. Respiratory, hepatic and renal regulation of pH.

32. Determining factors of arterial pressure.

33. Histogenesis of urine.
Urine transport by urinary pathways. Miction reflex.

PRACTICAL TRAINING
1. Electrical cardiac exploration.
2. Exploration of the cardiac cycle.
3. Determination of arterial pressure.
4. Experimental project using the methodology for determination of arterial pressure.
5. Hemodynamic exploration.
7. Analysis of cardiovascular parameters.
8. Role of mechanical parameters of the vascular circuit in equilibrium conditions. Vascular function.
10. Pressure variations during the respiratory cycle.
11. Spirometry.
12. Forced spirometry.
15. Ventilation and CO₂ exchange.
16. Partial pressures blood oxygen content.
17. Microscopic study of renal structures.
LEARNING RESOURCES AND TEACHING METHODOLOGIES

Seminars are aimed at solving numerical exercises and difficulties with the application and development of topics with particular scientific or clinical relevance.

Students will carry out the following tasks in experimental practice:

- Calibrate transducers and measuring equipment
- Obtain data from the experimental process, considering possible sources of error in the measurement process
- Produce graphical representations of the relations between the different measurements recorded
- Derive functional relations between them
- Write a report describing the methods and results

Students will have access to a website (http://www.fisiologia.net) and discussion forum as complementary materials for a part of the programme.