# General and Sports Physiology

## Prof. Mauro Marzorati

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

This course is designed:

1. to provide students with an understanding of the function and regulation of the human body and physiological integration of the organ systems to maintain homeostasis;

2. to provide basic information about physiological responses to acute and chronic exercise;

3. to provide cultural resources to critically evaluate one’s professional background;

4. to emphasize the relevant features from a functional and pathophysiological point of view;

5. to emphasize the quantitative features of the fundamental subjects for professional preparation.

At the end of the course, students will be able to describe the cardiovascular, respiratory and metabolic responses to acute and chronic exercise. They will be able to describe how muscles can generate and regulate the force expressed. They will also be able to understand the aspects of muscle energetics and will possess the theoretical bases for choosing and interpreting functional assessment tests.

Students will be able to apply the knowledge acquired in schools and in fitness centre activities and possess the theoretical bases for setting up personalised physical activity programmes, both for healthy subjects (including the elderly) and for patients suffering from cardiovascular or metabolic diseases.

***COURSE CONTENT***

1. Cardiovascular system

– Functional anatomy of the heart.

– Anatomy and physiology of the cardiac pacemaking and conduction system.

– Functional features of the cardiovascular system.

– Features of heart muscle.

– The cardiac pump.

– Measurement and control of cardiac output.

– Dynamics of the peripheral circulation.

– Arterial blood pressure and its regulation.

– Cardiovascular responses to acute and chronic exercise.

– Blood and the plasma proteins: functions and composition of blood.

2. Respiration

– Functional anatomy of the lung.

– Structure-function relationships of the lung.

– Mechanics of breathing.

– Static lung volumes and capacities and dynamic volumes.

– Pulmonary gas exchange.

– Gas transport to the periphery.

– The ventilatory response to exercise.

– Control of ventilation.

3. The muscular system and nervous control of motor activity

– Structure and ultrastructure of skeletal muscle.

– Mechanics of muscle contraction.

– Length-tension relationship of the sarcomere and of the isolated muscle.

– Force-velocity relationship.

– Motor Unit.

– Muscle strength.

– Nervous control of the motor system.

– Acute muscle fatigue.

4. Muscle energetics

– Energy sources for muscle contraction.

– Anaerobic (alactic and lactic) and aerobic metabolism.

– Kinetics of gas exchange and oxygen debt.

– Limiting factors to maximum aerobic power.

– Maximum aerobic power as a function of age and gender.

– Lactate threshold and ventilatory threshold.

5. Metabolism, nutrition physiology and thermoregulation

– Basal metabolic rate.

– Respiratory quotient.

– Substrate utilization at rest and during exercise.

– Glycogen.

– Thermoregulation mechanisms.

6. Exercise at altitude

– Aerobic metabolism.

– Anaerobic metabolism.

– Training at altitude and sea level performance.

8. Diving under water

– Breath-hold diving.

– SCUBA diving.

9. Physical activity, health and aging

– Beneficial effects of physical activity.

– Exercise is medicine.

***READING LIST***

AA.VV., *Fisiologia dell’uomo,* edi-ermes, Milano. 2010.

W.D. McArdle-F.I. Katch-V.L. Katch, *Fisiologia applicata allo sport,* Casa Editrice Ambrosiana, Milano, 2018 (3rd ed.).

1. ***TEACHING METHOD***

Lectures in collaboration with Dr. Francesca Lanfranconi, a sports doctor and researcher of exercise physiology and preventive medicine, Dr. Alberto Dolci and Dr. Giuseppe Bellistri, a sports scientist and fitness data analyst.

The graphs and the pictures projected during lectures will be made available for students at http://docenti.unicatt.it/ita/mauro\_marzorati/.

Students may participate in motor and aptitude assessment tests on athletes or patients in ITB-CNR “Fisiologia dell’Esercizio” laboratory, via Fratelli Cervi 93, Segrate (Milano).

***ASSESSMENT METHOD AND CRITERIA***

Oral examination during which students are requested to draw the main relations between physiological variables. The assessment will consider the relevance of the student's answers, their appropriate use of the specific terminology, the reasoned and coherent structuring of their discourse, and their ability to apply the concepts learned in particular situations.

***NOTES AND PREREQUISITES***

Basic notions of general anatomy and biochemistry and of sport may be referred to in the exam.

A limited number of students may be admitted to attend the ITB-CNR Exercise Physiology Laboratory as a trainee.

Students are accepted for compilation theses. In the latter case, at least 3 months attendance in the laboratory is required, with procedures that will be defined according to the projects.

Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.