# Biomechanics of Movement

## Prof. Serena Maria Cascini

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

Provide essential knowledge of the physical laws governing biology, which in turn will prove useful for understanding and studying human movement, functional anatomy and the gestures related to sports activities.

In particular, the course aims to explore:

1. mechanics and its laws, especially how they work, and how they are used by the locomotor system;
2. the mechanisms through which the idea of gesture becomes an actual movement;
3. the normal conditions and the biological alterations that can determine mechanical variations.

*Intended learning outcomes:*

At the end of the course, students will be able to:

* use their newly acquired biomechanical knowledge to pursue further studies in this field and get a better understanding of the topics explained during the other courses organised by the faculty;
* identify the best way to use weight-bearing joints in sport and everyday activities, and vary muscular work during the different life stages, according to one’s specific morphology;
* combine biomechanics with physiology and biochemistry in order to conceive movement as a tool to prevent accidents, recover after traumatic events, and, more in general, maintain a positive health status.

***COURSE CONTENT***

– *The basics of human movement:*

 proprioception, the nerve fibres and their contractile function, the factors influencing muscle tension.

*– Biomechanics:*

 Measuring movement: scalar and vector sizes, the build-up and breakdown of forces, barycentre and balance, levers, systems of reference.

 The description of movement and its geometric aspects, the “cinematic”, types of motion, simple machines.

 The study of the forces that determine movement, “kinetics”, Newton’s principles, the three laws of dynamics, impulse, the quantity of motion, work, power, energy, friction.

– *The basics of functional anatomy:*

 the articular structures, their form, elements of stabilization, lubrication; bony tissue, its function and mechanical characteristics.

 Structure and function of the cervical spine, the dorsal spine and thoracic cage, the lumbar spine and intervertebral discs. Factors contributing to the maintenance of a correct posture, lumbar-pelvic rhythm, lumbar loading and lumbar pain suffered in sport.

 Structure and function of the scapular-humeral girdle, the elbow and wrist, the scapular-thoracic-humeral rhythm and conflicting syndromes; stabilising elements and movements of the shoulder and forearm.

 Structure and function of the pelvic girdle, the knee, the ankle and foot, elements of stabilization and movements of the hip, the knee, the tibiotarsal and sub-astragalus joints.

*– Gestures:*

– The cinematic and kinetic characteristics of walking, running, jumping, swimming, kicking and throwing, kicking in swimming, pedalling and skiing.

***READING LIST***

V. Pirola, *Cinesiologia,* *Il movimento umano,* Ermes Publishers, Milan.

I.A. Kapandji, *Anatomia Funzionale,* Ed. Monduzzi, Milano (3 Vol.).

***TEACHING METHOD***

Classroom lessons; Blackboard materials area: notes, presentations, webinars; meetings with industry experts.

***ASSESSMENT METHOD AND CRITERIA***

A self-assessment test based on the goals displayed at the beginning of the course will be carried out at the end of each lectures.

Final written exam (each test consists of 28 questions, 26 multiple-choice and 2 brief open-ended), lasting 60 minutes, with the possibility of a supplementary oral exam.

For the 24 multiple-choice questions, marked as 0 (in the case of errors) or 1 (in case of correct answers), the maximum mark achievable is 26/30. The two open-ended questions in the written exam will carry the same weight, from 0 (in the case of no answer) to 3 (in the case of an exemplary answer). Relevance of answers and appropriate use of specific terminology will contribute to the assessment. The final single mark is based on the sum of the marks obtained in the written exam and (where applicable) the supplementary oral exam.

***NOTES AND PREREQUISITES***

For a better understanding and assimilation of the course contents, students should already possess good knowledge of the topics covered in the Human Anatomy and General Physiology of Sport courses.

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.