

1. OVERVIEW

Subject area	Physiology of Exercise
Degree	Bachelor's Degree in Exercise and Sport Sciences
School/Faculty	Exercise and Sport Sciences and Physiotherapy
Year	Third
ECTS	6 ECTS
Type	Compulsory
Language/s	Spanish / English
Delivery mode	On campus
Semester	S5, S6
Academic year	2024/2025
Coordinating professor	Francisco Javier Pardo Gil

2. INTRODUCTION

The Physiology of Exercise is an important branch of Human Physiology that studies how the human body responds and adapts to physical effort. There are many factors that shape these responses and adaptations, such as the intensity, duration or frequency of the physical activity or others such as diet, environmental circumstances or the genetics of each individual. Knowledge of this science is fundamental for the scientific planning of performance-orientated training programmes in order to help improve people's functional abilities and health, to plan the right doses of physical exercise for people living with chronic illnesses, to achieve the desired benefits and to ensure that people are exercising safely. The ability to understand and engage with the third-year subject areas "Sports Training" and "Physical Activity for Health" is heavily dependent on a solid command of this discipline. It is very closely linked to the first-year subject area "Human Anatomy" and, in particular, the second-year subject areas "Human Physiology", "Human Motor Skills" and "Biomechanics of Exercise and Sport".

Knowledge of the physiology of exercise is applicable in three different areas:

- **Sport** – athletes and coaches need to understand the physiology of exercise in order to improve performance.
- **Exercise and Health** – the main aim of exercise is not to improve performance but to bring about adaptations that improve the functionality of different organs and systems, improving a person's functional ability and helping to prevent problems and negative changes.
- **Clinical Medicine** – Exercise is used as a diagnosis tool and a form of therapy, especially in cardiology and pulmonology. Other areas such as endocrinology, rheumatology and neurology also use exercise as a means of therapy.

When we experience acute physical stress, our body responds with a series of temporary physiological changes. If we continually repeat this application of stress or exercise, it will bring about permanent structural and functional changes known as physiological adaptations.

3. SKILLS AND LEARNING OUTCOMES

Basic skills (CB, by the acronym in Spanish):

- CB2: Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.
- CB3: Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.
- CB4: Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

Transversal skills (CT, by the acronym in Spanish):

- CT1: Independent Learning: Ability to choose the most effective strategies, tools and opportunities for independent learning and implementation of what has been learnt.
- CT4: Ability to analyse and summarise: Ability to break down complex problems into manageable blocks; evaluate other options and perspectives to find the ideal solution. Synthesising to reduce the complexity and better understand the situation and/or solve problems.
- CT6: Oral or written communication: Ability to communicate and gather information, ideas, opinions and viewpoints to understand and be able to act, spoken through words or gestures or written through words and/or graphic elements.
- CT12: Critical thinking: Ability to analyse an idea, occurrence or situation from different perspectives and adopt a personal viewpoint based on scientific rigour and objective reasoning, rather than intuition.

Specific skills (CE, by the acronym in Spanish):

- CE4: Ability to analyse and apply physiological, biomechanical, psychological and social principles in different areas of physical activity, sport and recreation.
- CE5: Ability to identify inappropriate practices that pose a risk to health in order to prevent and correct them in different groups of people.
- CE6: Ability to assess levels of physical fitness and motor skills, prescribing and planning health-orientated physical exercises in different age groups.
- CE7: Ability to promote and assess long-lasting and autonomous habits of health-orientated physical activity and sport.

Learning outcomes (RA, by the acronym in Spanish):

- RA 1. To understand fundamental concepts related to how the human body responds and adapts to well-structured and measured doses of exercise
- RA 2. To act professionally when using equipment and following safety protocols for laboratory work, specifically in relation to the physiology of exercise.
- RA 3. To carry out projects that help students understand how to use key literature related to the field of health and exercise
- RA 4. To carry out projects that help students to write and summarise information related to the physiology of exercise

The following table shows how the skills developed in the course match up with the intended learning outcomes:

Skills	Learning outcomes
CB2, CB3, CT1, CT4, CE4, CE6	RA 1. To understand fundamental concepts related to how the human body responds and adapts to well-structured and measured doses of exercise
CB2, CT1, CE5, CE6	RA 2. To act professionally when using equipment and following safety protocols for laboratory work, specifically in relation to physiology.
CB2, CB3, CB4, CT1, CT6, CT12, CE4	RA 3. To produce in-depth analysis and summaries based on searches of key literature about the fundamental aspects of human physiology.
CB2, CB4, CT1, CT4, CT6, CE4	RA 4. To carry out projects that help students to write and summarise information related to the physiology of exercise

4. CONTENTS

Sources of energy for movement
 Movement control.
 Cardiovascular responses and adaptations to exercise.
 Respiratory responses and adaptations to exercise.
 Hormonal responses and adaptations.
 Aerobic capacity. Assessment of biological condition

This content is organised into six learning units, which, in turn, are divided into topics (four or five topics depending on the unit):

Unit 1: Sources of energy for movement

- Bioenergetics and basic concepts of different energy substrates
- Energy value of different foods
- Metabolic pathways and how they interact during physical activity
- Interaction between the different metabolic pathways
- Metabolic adaptations to training
- Endocrine regulation of the metabolism

Unit 2: Assessment of energy expenditure at rest and during physical activity

- Direct and indirect calorimetry
- Methods of quantifying physical activity
- Energy expenditure at rest and associated with physical activity

Unit 3: Movement control

- Nervous system: general structure (brief review)
- Nervous system: control of movement
- Factors that affect the production of force
- Types of muscle fibre and plasticity
- Muscle fibre adaptations to training
- Basic concepts of strength training

- Delayed onset muscle soreness (DOMS)

Unit 4: Cardiovascular responses and adaptations to exercise

- Concept of response and adaptation to exercise
- Cardiovascular system objectives during exercise
- Response of the main cardiac parameters to different types of physical activity: heart rate, stroke volume, cardiac output, blood pressure, double product
- Vascular responses and adaptations to exercise
- Mechanisms regulating the cardiovascular system's response to exercise
- Cardiovascular adaptations to training
- Responses and adaptations in the blood to exercise

Unit 5: Respiratory responses and adaptations to exercise

- Introduction: functions of the respiratory system, pulmonary ventilation: basic concepts, lung volumes and lung capacities (review)
- Respiratory response to exercise
- Mechanisms regulating the respiratory response to exercise
- Respiratory adaptations to training
- Transport of gases through the bloodstream and exercise

Unit 6: Functional capacity. Assessment of biological condition

- Parameters related to functional capacity
- Aerobic potential (VO₂ max)
- Thresholds: lactic threshold, ventilatory thresholds, OLBA, MLSS
- Lab-based measurements of the main parameters used to assess functional capacity: VO₂ max and ventilatory thresholds

5. TEACHING/LEARNING METHODS

The types of teaching-learning methods are as follows:

- Case studies.
- Problem-based learning.
- Simulation environments

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	15
Case studies/workshop activities (on campus)	30

Searching for resources and choosing sources of information (on campus)	26
Tutorials (on campus)	8
Asynchronous lectures (on campus)	5
Essays, text commentaries and critical text analysis (on campus)	35
Case studies (on campus)	25
Debates and discussions	6
TOTAL	150

7. ASSESSMENT

The assessment methods, plus their weighting in the final grade for the course, are as follows:

On campus:

Assessment system	Weighting
Knowledge test	60%
Assessment of reports and written work	10%
Laboratory work	20%
Case study/problem scenario	10%

On the Virtual Campus, when you open the subject area, you'll find details of your assessment activities, including the submission dates and assessment procedures for each activity.

7.1. Ordinary exam period

In order to pass the subject area in the ordinary exam period, the continuous assessment process of the various learning activities must be passed. Students must achieve a **grade of 5 or higher in each assessment block**. The student's final grade will be calculated from the weighted average of the partial grades for each block, as indicated in the table and detailed below. If the student **does not pass** any of the assessment blocks, the grade on record will be that of the block with the lowest mark.

7.2. Extraordinary exam period (resits)

In order to pass the subject area in the extraordinary exam period, all the requirements set out above for the ordinary exam period must be met.

8. TIMELINE

This section presents the timeline and submission dates for the assessable tasks in this subject area.

Assessable tasks	Date
Activity 1. Interpretation of a scientific article	Weeks 3-4
Activity 2. Concept map of energy pathways and physical activity	Weeks 6-7
Activity 3. Midterm objective knowledge test	Weeks 10-11
Activity 4. Laboratory work (heart rate response to exercise)	Weeks 12-13
Activity 5. Laboratory work (metabolism at rest, indirect calorimetry)	Weeks 13-14
Activity 6. Laboratory work (thresholds and VO2 max)	Weeks 15-16
Activity 7. Group work oral presentation	Week 17
Activity 8. Final objective knowledge test	Week 18

The timeline may be subject to change for logistical reasons related to the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The reference material for the subject area is as follows:

- McARDLE W.D., F.L. KATCH, V.L. KATCH, Exercise physiology: Energy, nutrition and Human performance 5^º ed., USA, Lippincott Williams Wilkins, 2001.
- McArdle W.D., Katch F.L., Katch V.L. Fisiología del ejercicio: Energía, nutrición y rendimiento humano 2^º ed. McGraw-Hill –Interamericana. Traducido al español 2004

A continuación, se indica bibliografía recomendada:

- J.L CHICHARRO, A.F. VAQUERO, Fisiología del Ejercicio, 3^º ed., Madrid, Panamericana, 2006. sig biblioteca UEM: QP301.L674
- J. H. WILMORE Y D. COSTILL, Physiology of Sports and exercise, Human Kinetics, 1999
- Winter, Edward M., Jones, Andrew M., Davison, Richard C., Bromley, Paul D.
- Sport and exercise physiology testing guidelines v. 1 Sport testing. ROUTLEDGE LTD. 2006, 384 Págs., ISBN: 978-0-415-36141-5, Inglés, Rústica
- Wilmore, Jack H. Fisiología del esfuerzo y del deporte. Peidotribo ediciones, ISBN: 978-84-8019-916-2. 6^º edición, español cartoné, 2007
- **Complementary bibliography**
- Campbell, B. NSCA's guide to sport and exercise nutrition 2011. Human Kinetics.

- Bouchard, Claude. Genetic and molecular aspects of sports performance 2011 Wiley-Blackwell
- Zaidi, Mone. Molecular and integrative physiology of the musculoskeletal system 2010, New York Academy of Science
- S. K. POWERS AND E. T. HOWLEY, Exercise Physiology: Theory and application to fitness and performance, 4ª ed., Madrid, editorial McGraw Hill-Interamericana, 2001.
- K.L.WASSERMAN ,Principales of exercise testing and interpretation, Lea & Febiger, 1994
- W. E. GARRET, Exercise and Sports Science, Lippincott Williams Wilkins, 2000
- EHRMAN J.K., GORDON P.M., VISICH P.S AND KETEVIAN S.J. Clinical Exercise Physiology. Human Kinetics, 2003.
- Chicharro J.L., Aznar S., F.Vaquero A. L.Mojares L.M, Lucia A. Pérez M. Transición Aeróbica-Anaeróbica: Concepto, metodología de determinación y aplicaciones. Editorial Master-Line. Capitulo 1-2 y 3 pg 11-155, 2004
- METZL, J. Sports medicine in the pediatric office:case-based musculoskeletal teaching. American academy of pediatrics ISBN: 978-1-58110-246-8, CARTONÉ, 2007

Internet resources

- Publications in indexed international science journals (Science Citation Index (SCI) and MEDLINE). Address: <http://www.ncbi.nlm.nih.gov/>
- <http://www.scirus.com/srsapp/> (science-specific search engine)
- <http://www.fecyt.es/fecyt/home.do> (Fundación Española para la Ciencia y la Tecnología)
- <http://www.nature.com/scitable> (Educational website by Nature group)
- <http://ghr.nlm.nih.gov/glossary=contig> (NIH scientific glossary)

10. DIVERSITY AWARENESS UNIT

Students with special educational needs:

To ensure equal opportunities, curricular adaptations or adjustments for students with special educational needs will be outlined by the Diversity Awareness Unit (UAD, Spanish acronym).

As an essential requirement, students with special educational needs must obtain a report about the curricular adaptations/adjustments from the Diversity Awareness Unit by contacting unidad.diversidad@universidadeuropea.es at the beginning of each semester.

11. STUDENT SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degree courses and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the course.

Many thanks for taking part.