



INTRODUCTION

Welcome to the **Foundation of Structure and Function (FSF)** course. It is a four-week multidisciplinary introduction to the human body in health and disease that integrates embryology, anatomy and histology with physiology, radiology and biophysics for 1st year medical students.

First, an overview will introduce the student to the vocabulary, the basic organization and structure of the normal human anatomy (macro- & microscopic) and physiology and the effects of disease, in language that is clear and understandable. Second, anatomical dissection will be link to radiological images. Integrating radiology and anatomy in medical education reinforce the dissection process and provide a modern route to learning. Third, biophysics will consider concepts and methods of physical science applied to biological problems.

The course consists of 32 series of highly-organized interactive lectures covering embryology, anatomy, histology, physiology, radiology, and biophysics, 28 research- or case-based learning seminars, and 5 case studies discussed in small groups.

Course Director: Dr Carlos E de Andrea ([Click for CV](#))

Course Instructors:

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Module 1: Morfología, estructura y función del cuerpo humano.

Topic 1.2: Fundamentos de morfología y función

- **Type of course:** Basic
- **ECTS:** 6
- **Year and bimester:** 1º (2º bimester, first semestre)
- **Language:** English



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- **Degree:** Grado de Medicina
- **Schedule and room:** consultar [aquí](#)

COMPETENCES

BASIC COMPETENCES

CB1 – That students have shown themselves to possess and understand knowledge in an area of study that develops from general secondary education, and is usually at a level that, although requiring advanced textbooks, also includes some aspects that imply knowledge from the forefront of their field of study.

CB3 – That students have the capacity to collate and interpret relevant data (normally within their area of study) in order to express opinions that include reflection on relevant subjects of social, scientific or ethical nature.

CB4 – That students can transmit information, ideas, problems and solutions to specialist and non-specialist audiences alike.

GENERAL COMPETENCES

CG6 – To develop professional practice with respect to other health professionals, acquiring teamwork skills.

CG7 – To understand and recognize the structure and normal function of the human body at the levels of the molecule, cell, tissue, organ and system over the different stages of life and in both sexes.

CG9 – To understand and recognize the effects, mechanisms and manifestations of disease on the structure and function of the human body.

CG10 – To understand and recognize the causative agents and the risk factors that determine states of health and the development of disease.

CG11 – To understand and recognize the effects of growth, development and ageing on the individual and his or her social environment.

CG31 – To know about, to critically evaluate and to know how to use sources of clinical and biomedical information to obtain, organize, interpret and communicate scientific and health information.

SPECIFIC COMPETENCES

CE1 – To know cellular structure and function.

CE6 – Cellular communication.

CE7 – Excitable membranes.



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CE8 – The cell cycle.

CE9 – Cellular differentiation and proliferation.

CE10 – Genetic information, expression and regulation.

CE11 – Inheritance.

CE12 – Embryonic development and organogenesis.

CE13 – To know the morphology, structure and function of the skin, the blood, and circulatory, digestive, locomotor, reproductive, excretory and respiratory apparatuses and systems; the endocrine system, the immune system and the central and peripheral nervous system.

CE14 – Growth, maturation and ageing of the different apparatuses and systems.

CE15 – Homeostasis.

CE17 – To manage basic laboratory material and techniques.

CE19 – To recognize the morphology and structure of tissues, organs and systems with macroscopic and microscopic methods and with imaging techniques.

CE51 – To know about, to critically evaluate and to know how to use sources of clinical and biomedical information to obtain, organize, interpret and communicate scientific and health information.

CE118 – To know the bases of the interaction of radiation with the human organism.

CE119 – Radiological imaging.

CE120 – Basic radiological semiology for the various apparatuses and systems.

CE121 – To know other techniques to obtain diagnostic images.

CE122 – To evaluate indications and contra-indications of radiological studies.

CE123 – To have the ability to apply the criteria of radiological protection during diagnostic and therapeutic procedures with ionizing radiation.

PROGRAM

Week 1: Radiology principles: radiological imaging techniques and radiation protection

Lecture 1.1- **Biophysics**. Basic principles of ionizing and non-ionizing radiation. Radiation sources (natural radiological isotopes). Applications in the creation of images.

Lecture 1.2- **Biophysics**. Radioactivity

Lecture 1.3- **Biophysics**. Interaction of Radiation & Matter

Lecture 1.4- **Biophysics**. Ultrasonic



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Lecture 1.5- **Biophysics**. Electricity and Magnetism

Lecture 1.6- **Radiology**. Radioprotection and legislation

Lecture 1.7- **Biophysics**. MRI

Lecture 1.8- **Radiology**. Radiology and contrasts

Workshop 1.1- **Radiology**. General biological effects of radiation and specific effects on cells and tissues.

Workshop 1.2- **Radiology**. Radio (TC)

Workshop 1.3- **Radiology**. Basic principles of ultrasound. Applications in the creation of images.

Workshop 1.4- **Radiology**. PET-1

Workshop 1.5- **Biophysics**. Dosimetry problems.

Workshop 1.6- **Radiology**. PET-2

Workshop 1.7- **Biophysics**. US problems.

Workshop 1.8- **Radiology**. Basic principles of magnetic resonance imaging. Applications in the creation of images.

Week 2: First weeks of development and Histology and Function of basic tissues (I).

Lecture 2.1- **Embryology**. Gametogenesis, fertilization and implantation.

Lecture 2.2- **Anatomy**. Generalities of the bones and joints. Classification Muscle inserts. Axial and appendicular skeleton.

Lecture 2.3- **Histology**. Connective tissue: Classification and function of fibrillar connective tissues. Adipose tissue: types and functions.

Lecture 2.4- **Embryology**. 2^o/3^o weeks of development.

Lecture 2.5- **Histology**. Cartilage tissue structure and types. Woven bone. General characteristics and components (matrix and cells).

Lecture 2.6- **Histology**. Ossification and bone remodelling.

Workshop 2.1- **Histology**. Epithelial tissue and integumentary derivatives.

Workshop 2.2- **Histology**. General characteristics of epithelial tissue.

Workshop 2.3- **Embryology**. Fertilization and 1st week.



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Workshop 2.4- **Histology**. Connective tissue: general structure and origin.

Workshop 2.5- **Histology**. Connective tissue: Components of the extracellular matrix. Connective tissue cells.

Workshop 2.6- **Anatomy**. Spine.

Workshop 2.7- **Histology**. Macroscopic and microscopic classification of bone tissue.

Workshop 2.8- **Anatomy**. Lower Limb.

TBL 2.1- **Embryology**. Overview of the 1st month of embryonic development

TBL 2.2- **Embryology**. Overview of the 1st month of embryonic development

Week 3: Histology and Function of basic tissues (II). Osteoarticular Anatomy.

Lecture 3.1- **Embryology**. Neurulation.

Lecture 3.2- **Histology**. Histology of the nervous system: types of neurons and their distribution. Types of glia.

Lecture 3.3- **Embryology**. MSK.

Lecture 3.4- **Physiology**. Nervioso.

Lecture 3.5- **Histology**. Muscle tissue: skeletal, cardiac and smooth muscle.

Lecture 3.6- **Physiology**. Neuro-muscular (I).

Lecture 3.7- **Physiology**. Neuro-muscular (II).

Lecture 3.8- **Embryology**. Placenta.

Workshop 3.1- **Histology**. Blood brain barrier. Nerves and nerve fibers. Nerve ganglia.

Workshop 3.2- **Anatomy**. Upper Limb.

Workshop 3.3- **Biophysics**. Electricity I.

Workshop 3.4- **Anatomy**. Bone Review.

Workshop 3.5- **Histology**. Histological structures in muscular contraction mechanism.

Workshop 3.6- **Biophysics**. Electricity II.

Workshop 3.7- **Biophysics**. Electricity II.

Workshop 3.8- **Embryology**. Placenta, embryos.



Week 4: General Anatomy and Biophysics of fluids. Autonomic Nervous System

Lecture 4.1- **Anatomy**. Musc/vascular/lymphatics

Lecture 4.2- **Physiology**. Fluids.

Lecture 4.3- **Anatomy**. Skull.

Lecture 4.4- **Physiology**. Osmolarity (sodium and protein), transport of solutes and water through membranes and body compartments. Starling forces and hair physiology. Edema.

Lecture 4.5- **Biophysics**. Fluids.

Lecture 4.6- **Anatomy**. SNV I.

Lecture 4.7- **Anatomy**. SNV II.

Lecture 4.8- **Physiology**. SNV.

Workshop 4.1- **Biophysics**. Fluids.

Workshop 4.2- **Anatomy & Radiology**. Structural organization of the human body

Workshop 4.3- **Biophysics**. Fluids.

Workshop 4.4- **Anatomy**. Skull.

TBL 4.1- **Anatomy & Physiology**.

TBL 4.2- **Anatomy & Physiology**.

TBL 4.3- **Anatomy & Physiology**. SNV.

TBL 4.4- **Anatomy & Physiology**. SNV.

EDUCATIONAL ACTIVITIES

Methodologies:

- **Lectures (~8 hours per week; 32 hours total):** Each lecture is given to the entire group. Students are expected to attend all the lectures. Each lecture will highlight key issues and provide a basic framework of essential concepts leading to integration and critical thinking. PowerPoint slides and some useful teaching & study materials will be made available as the course progresses.
- **Team Based Learning (TBL) sessions (~2 hours per week; 6 hours total):** they are an interactive and active form of teaching. Each session will facilitate dynamic and long-lasting learning and are designed to expand on the information



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presented in the lectures and to provide an opportunity for students to read and discuss scientific literature. Some TBL sessions are completely student led. Students are often asked to prepare presentations and can sometimes be marked on your spoken contribution to the class.

- **Workshops of Integrated Anatomy (~6-8 hours per week; 26 hours total):** Anatomy & Radiology & Histology. These sessions aim to introduce the basic morphological appearance of human tissue and anatomical structure. Histological images and anatomical models will be used, as well as radiological images, magnetic resonance imaging and/or tomography.
- **Assigned private study (~80 hours):** It may include studying, reading, preparing essays for tutorials, and completing any practical work that was not finished during the timetabled period. Students should study the assigned course material. Being familiar with topics beforehand will allow them to get the most out of the lectures. If any doubts or questions, they should ask the instructors concerned for clarification. Students are encouraged to go to the library as soon as possible, be strict with themselves, and keep up with the work. If students do not study continuously and start lagging behind, it will be increasingly difficult to catch up as consecutive lectures commonly build on one another.
- **Tutorials (2 hours total):** Small-group tutorials are *optional* and involve in-depth discussion of topics being studied. Students are encouraged to prepare for tutorials reading around the recent lecture topics.

ASSESSMENT

Students are expected to attend all the lectures, TBL sessions and workshops of the course to be able to sit all the examinations.

Final Scoring for this course is from 0 to 10.

The final score for the Foundations of Structure and Function is based on performance on (i) continuous evaluations, (ii) final examination (theory and practical skill), (iii) practical skill in Anatomy, and is calculated by **the sum of your three scores (total 10.5)**, as follows (**see critical points below**):

ORDINARY EXAM

1) Continuous evaluations (worth 10% of the final score): it is an ongoing assessment process to evaluate the level of understanding in a specific topic. Each student will be evaluated on knowledge acquisition, reasoning skills, and communication and participation. Continuous evaluation formats can vary between disciplines and will be designed as follows. Examples: *i)* Socratic quizzes during the lectures, *ii)* education and competency assessment in the TBL sessions and "talleres de Anatomía integrada (Anatomía & Radiología)", *iii)* practical exercises in Biophysics on ADI.

Course instructors will be available, if requested, to meet with each student individually to provide feedback on student's performance in the TBL small group sessions. These meetings can occur following the second TBL session, or at any other times deemed necessary.

2) Final examination (worth 85% of the final course score): it will consist of two parts: *i)* **multiple choice questions (MCQ)** comprising single best answers and images (worth 70% of the final examination score). The penalty for an incorrect answer is -0.33 (see explanation



below). *ii*) short-answer questions and long-answer essay questions (worth 30% of the final examination score). They are open-ended questions that require students to create an answer and are used to assess the basic knowledge and understanding.

3) Practical skills in anatomy (worth 10% of the final course score). Practical examinations in anatomy are conducted on specimens in the anatomy laboratory. Identification tags will be attached to specific spots on the specimens and questions asked regarding those identified spots.

Critical points: To **PASS** the Course, you **MUST** get:

1. at least **50%** of the questions correct **on the final examination part** (point 2, see above);
2. at least **~30%** of the questions correct **on each discipline** of the final examination part (point 2, see above). Disciplines comprises of embryology, anatomy, histology, physiology, radiology, and biophysics

The Honours Student (FOR STUDENT GRADES)

- Academic and practical performance rated as exceptional by all evaluators.
Personal and professional qualities outstanding.

Negative Marking

Every question you answer wrongly, you not only get no marks for that particular question but are also deducted extra marks from the total.

Normally, if there is negative marking, then it's best to leave an answer which you are doubtful about unanswered instead of attempting it. This ensures that you don't lose any extra marks for wrong attempts.

Example:

85 question in total, each of one mark 0.117647058823529 points.

The maximum marks that you can score is 10 marks.

So, there is a negative marking of 0.125 marks for every wrong answer.

Suppose you do one question wrong, then you get 9.75735294 marks.

So, $84 \times 0.11764706 = 9.88235294 - 0.125 = 9.75735294$ (final grade).

EXTRAORDINARY EXAM

Extraordinary examination: Students who have failed to pass the course have the opportunity to re-sit the examination. Students will re-sit all the elements of the course. In all other respects, the same conditions as for first-sit candidates apply.

REPEATING STUDENTS

Repeating Students have the opportunity to re-sit all the examinations (mid-term and final examinations). Repeating Students will re-sit all the elements of the course. In all other respects, the same conditions as for first-sit candidates apply.



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Repeating Students should contact the Course Director prior to beginning of the course.

STUDENTS WITH SPECIAL NEEDS

Special assessment arrangements may be possible for students with dyslexia or other disabilities. This must be arranged in advance of the assessment in consultation with Student Disability Services.

OFFICE HOURS

TUTORING

Tutors are available for any student who feels he/she needs help in this course. Please see the Course Director for additional information or contact directly the Course Instructors:

Dra Maria del Mar Cuadrado Tejedor (mCuadrado@unav.es)

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Dr Gorka Bastarrika (bastarrika@unav.es)

BIBLIOGRAPHY AND RESOURCES

Recommended Primary Textbooks & Resources :

Anatomy

1. Textbooks

- Drake, Vogl, Mitchell. Gray's Anatomy for students. 4th ed. Ed. Elsevier. (2020). [Find it in the Library](#)
- Moore, Dalley, Agur. Clinically oriented anatomy. 8th ed. Ed. Wolters Kluwer. (2018). [Find it in the Library](#)
- Mtui et al. Clinical neuroanatomy and neuroscience. Ed. Elsevier [Find it in the library](#)

2. Atlas

- Netter. Atlas of Human Anatomy. 7th ed. Elsevier (2019). [Find it in the Library](#)
- Gilroy y cols. Prometheus. Atlas de Anatomía. 2ª edición. Ed. Panamericana (2014) [Find it in the Library](#)



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- Sobotta. Atlas de Anatomía Humana, 19ª-23ª edición. Ed. Panamericana [Find it in the Library](#)

3. Complementary textbooks

- Feneis y Dauber. Nomenclatura anatómica ilustrada, 5ª edición. Ed. Masson [Find it in the Library](#) (e-book)

Embryology

- Moore, Persaud, Torchia. The developing human: clinically oriented embryology. 11th ed. (2020). [Find it in the Library](#) (e-book)
- Carlson. Human embryology and developmental biology. 6th ed. Ed Elsevier (2014). [Find it in the Library](#) (e-book)
- Sadler. Langman. Medical embryology. 12th ed. Ed. Panamericana. [Find it in the Library](#)

Histology

1. Kierszenbaum A.L. & Laura Tres L. Histology and Cell Biology: An Introduction to Pathology. 4e. [Find it in the library](#)
2. Mescher A.L. Junqueira's Basic histology : text and atlas. 16th ed. 2021. [Find it in the library](#) (e-book)
3. Essential reading will be made available by the course instructor.
4. Histology and Virtual Microscopy at the University of Michigan. Learning

Resources: <http://histology.med.umich.edu>

Physiology

Recommended textbooks:

- Linda S. Costanzo. Costanzo Physiology. 7th edition. Elsevier. [Find it in the library](#) ; [Find it in the library](#) (e-book, Spanish edition). This is a basic reference physiology textbook, easy to read .
- Bruce M. Koeppen y Bruce A. Stanton. Berne & Levy Physiology. 7th Edition. Elsevier. This book is a more extense (and complete) physiology textbook. Can be especially useful for some specific chapters. [Find it in the library](#)

Radiology

1. Fleckenstein P. Anatomía radiológica. [Find it in the library](#) (e-book)
2. Weir J. Atlas de anatomía humana por técnicas de imagen. [Find it in the Library](#) (e-book)