

Anatomy and Physiology of the Nervous System

Code: 101700
ECTS Credits: 6

Degree	Type	Year	Semester
2500893 Speech therapy	FB	1	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

Name: Guillermo García Alias
Email: Guillermo.Garcia@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Josep Reig Vilallonga
Guillermo García Alias
Christelle Serra Le Cheualier

Prerequisites

There are no official prerequisites.

It is convenient to have basic knowledge of cell biology, physics and chemistry.

Objectives and Contextualisation

Anatomy and Physiology of the Nervous System is a first year course aimed to gain knowledge of the general characteristics of the structure and function of the Nervous System and especially of the structures involved in the control, production of voice and speech, and the generation of language.

The objectives of the lectures are to provide an integrated knowledge of the the neural stucutres involved in the production of voice and speech and the generation of language in humans

Competences

- Analyse and synthesise information.
- Demonstrate an understanding and correct use of the terminology and methodology of speech-therapy research.
- Express oneself fluently, coherently and suitably following established norms, both orally and in writing.
- Find, evaluate, organise and maintain information systems.

- Integrate the foundations of biology (anatomy and physiology), psychology (evolutionary processes and development), language and teaching as these relate to speech-therapy intervention in communication, language, speech, hearing, voice and non-verbal oral functions.
- Managing communication and information technologies.
- Present adequate speech production, language structure and voice quality.
- Understand, integrate and relate new knowledge deriving from autonomous learning.
- Understand, interpret and express orally and in writing, in a foreign language, contents within the ambit of health.
- Use the exploratory techniques and instruments pertaining to the profession, and register, synthesise and interpret the data provided by integrating this into an overall information set.
- Working in intra- and interdisciplinary teams.

Learning Outcomes

1. Analyse and synthesise.
2. Correctly interpret the results of an exploration of the nervous system and the organs of voice and speech.
3. Correctly use the nomenclature of cell biology, human anatomy and the main terms of physiology.
4. Demonstrate proper diction and proper syntactic structure and discourse in the public presentations of projects.
5. Express oneself fluently, coherently and suitably following established norms, both orally and in writing.
6. Identify and describe the anatomy of the nervous system and of the organs of voice and speech.
7. Identify and describe the physiology of the nervous system and of the organs of voice and speech, in addition to their molecular and cellular bases.
8. Managing communication and information technologies.
9. Perform a basic examination of voice and speech organs.
10. Search, evaluate, organise and maintain information systems.
11. Understand, integrate and relate new knowledge deriving from autonomous learning.
12. Understand, interpret and express orally and in writing, in a foreign language, contents within the ambit of health.
13. Working in intra- and interdisciplinary teams.

Content

The speech science degree is included within the clinical degrees offered by the University. Introductory basic science courses are necessary to train the students on the understanding of the neural structures responsible for the development and production of language. The lectures must provide the necessary tools for students to succeed in future clinical related courses and in the long term, to allow the speech science professionals to carry out effectively and rigorously their job, based on the scientific knowledge acquired.

Speech therapists are professional who work to prevent, detect, identify, evaluate, diagnose, provide treatment and follow-up people of all ages at risk of speech disorders, voice, language, swallowing and related disorders. Speech therapists also teach, supervise and conducts scientific research programs. Therefore, during their training they must learn to use the scientific methodology to measure and evaluate the effectiveness of their treatment, and to modify them based on their assessment and disseminate the results. Speech therapists must develop all these competences and justifies the importance of this course. And the last but not the least, the speech therapist must know the structure and functioning of the sensory, motor and nervous system in order to be able to understand, diagnose, treat, prevent and investigate the alterations that affects voice, speech and language.

1 ANATOMY OF THE CENTRAL NERVOUS SYSTEM

- 1.1 - Anatomical organization of the nervous system
- Concept and areas of the nervous system
 - Cell elements of the nervous system
 - Central and peripheral nervous system

- Autonomic nervous system: sympathetic and parasympathetic
- The Nervous System Covers: the meninges
- Ventricles and cerebrospinal fluid
- Vascularization of the nervous system
- Techniques for exploring the Nervous System

1.2 - The Telencephalon: The cerebral cortex

- Morphology: grooves, circumsulations and lobes
- General structure of the cerebral cortex
- White matter of the cerebral hemispheres
- Functional areas of the cerebral cortex
- Cortical areas specialized in language and speech
- Other cortical areas related to language and speech
- Anatomical asymmetry and language

1.3 - The Limbic system

- Concept
- The limbic cortex
- Subcortical nuclei

1.4 - The Basal Ganglia

- Classification and fundamental concepts
- Morphology and relations of the basal ganglia
- Functional organization of the basal ganglia
- Dysfunction of the basal ganglia and the implications in language disorders

1.5 - The Thalamus

- Division
- Thalamus: morphology and function.
- Epithalamus
- Hypothalamus

1.6 - The Brain Stem

- Brainstem
- Morphology: bulb, protuberance, mesencephalon
- General structure of the cranial nerves: nomenclature and nuclei
- The Cranial Nerves: description and function
- The Reticular formation
- Functional organization of the brain stem nuclei

1.7 - The Cerebellum

- The Cerebellum
- Morphology and connectivity of the cerebellum
- Functional organization of the cerebellum
- Dysfunction of the Cerebellum and the implications in language disorders

2. ANATOMY OF THE BODIES SENSES

2.1 - Vision

- Anatomy of the eye
- Optical pathways
- Eye related structures: lacrimal structures, eyelids.
- Muscles of the eye

2.2 - Hearing

- Anatomy of the ear
- external ear
- middle ear
- inner ear
- Auditory pathway

3 - PHYSIOLOGY OF THE NERVOUS SYSTEM

3.1 - Functional organization of the nervous system

- Functional modalities of the nervous system: sensory, motor, integrative
- Levels of organization of the nervous system: spinal cord, subcortical and cortical areas
- Electrical phenomena of the neurons: ionic transport by the neuronal membrane. Membrane potentials and action potentials, propagation of the action potential. Nerve conduction
- Synaptic transmission: Organization of chemical synapses. Functional features of the chemical synapse. Neurotransmitters and neuromodulators. Synaptic receptors
- Physiology of neuronal circuits. Reflex arch

3.2 - Physiology of the brain's electrical activity.

- The brain's electrical activity. The Electroencephalogram.
- Metabolism, blood flow and brain function. Self-regulation mechanism of the blood flow. Glucose intake
- Functional study methods of brain activity (PET, etc.)
- Regulation of the brain activity by the reticular systems of the brainstem
- Neuro-hormonal control of brain activity
- Sleep physiology: Phases of and functional characteristics. Physiological effects of sleep.

3.3 - Higher functions of the cerebral cortex: intellectual functions

- Functional organization of the neocortex
- Functions of the frontal lobe: attention, conceptual association, conscience, thought and interpretation of reality, social filter, traits of personality.
- Associative symbolic function of the Wernicke area.
- Functions of the parieto-occipito-temporal (POT) cortex in the dominant and non-dominant hemisphere. Lateral language dominance. Experiences by Roger Sperry.
- Functions of the callous body: inter-hemispheric relation
- Learning and memory.

3.4 - Physiology of the somatosensory system

- Functional organization of the somatosensory system: types of sensory receptors and transduction. Characteristics and classification of sensory nerve fibers
- Physiology of the mechanoreceptors, thermoreceptors and nociceptors
- Physiology of temporomandibular joint receptors
- Somatosensory pathways: physiology of the trigeminal spinal nucleus, of the trigeminal sensitive nucleus and of the trigeminal mesencephalic nucleus. Integration of somatosensory information: primary and secondary somatosensory cortex

3.5 - Motor system physiology: muscle activity and segmentary control

- Functional organization of the skeletal and smooth muscles
- Mechanism of muscle contraction: skeletal muscle vs. smooth muscle.
- Physiology of the neuromuscular joint. Motor unit
- Segmentary control of muscle activity: proprioceptive receptors of the muscles and tendons.

- Reflex Circuits and activity
- Swallowing, sneezing and cough Reflexes
- Reflexes of the head: corneal or palpebral reflex, direct and consensual reflex pupillary, reflex of accommodation

3.6 - Motor system physiology: suprasegmentary motor control

- Motor cortex: functional organization; Planning and execution of voluntary movements.
- Basal Ganglia: functional organization. Planning and execution of automatic movements.
- Cerebellum: functional organization. Coordination of movements.

3.7 - Nervous control of the voice and the speech

- Functional organization of the nervous control of the larynx
- Functional characteristics of the sensory innervation of the larynx
- Functional characteristics of the segmental control of the larynx: the role of the ambiguous nucleus and of the laryngeal premotor nuclei.
- Functional characteristics of suprasegmentary control of the larynx: paper of the gray substance periaqueductal (PAG) and the motor cortex
- Functional organization of the nervous control of speech
- Motor speech program: articulatory and neuronal events
- Paper of the motor cortex, the basal ganglia and the cerebellum in the production of the speech

3.8 - Higher functions of the cerebral cortex: language

- Functional organization of cortical areas involved in language
- Mechanisms of the perception and understanding of language
- Mechanisms of motor control in the emission of the language

4. PHYSIOLOGY OF THE BODY SENSES

4.1 - Sense of vision

- Physiology of the eye. Ocular diopter Power of refringence. Control of the accommodation. Neural control of the pupil's diameter. Visual acuity and Visual field Campimetry.
- Retinal physiology: pigmented epithelium. Photoreceptors and phototransduction. Function of neurons of the retina
- Physiology of the optical pathways: visual characteristics of the parvocellular nuclei and the magnocellular pathway. Role of the lateral geniculate body of the thalamus.
- Central integration of visual information: functional organization of the visual cortex. Movement and position analysis of the. Analysis of the shape. Color analysis. Analysis of the stereoscopic vision.

4.2 - Sense of hearing

- Physiology of the external ear: capture and amplification of sound waves
- Physiology of the middle ear: physiology of the transmission system. Timpanic or stapedia reflex. Tympanometry and impedimetry.
- Internal ear physiology: functional cochlea organization and auditory transduction. Amplifier coclear Endococcal potential. Discrimination of frequencies and sound intensities.
- Physiology of the auditory route: function of the coclear nuclei, of the superior olive complex and colicle lower. Functions of the medial geniculate body of the thalamus
- Auditory cortex physiology: analysis of the frequencies and intensities of the sound waves. Auditory memory
- Exploration of hearing sensitivity. Audiometry.

Methodology

Lectures

These are based on a systemized exhibition of the subject's topics. By attending to the lectures, student acquires the basic scientific knowledge, which will require to be complemented with individual study.

Workshops

Small group classes related to a specific part of the syllabus. The student necessarily need to work collectively to achieve the class objectives

Laboratory

Practical sessions for the observation of the anatomical structures and the practical learning of physiological techniques. Group work and active self-learning are promoted. Preparation and presentation of a review work Based on a set of topics proposed for the subject, students will have to meet in groups of no bigger than four people, and elaborate a review work that will have to be presented

N.B. The proposed teaching and assessment methodologies may experience some modifications as a result of the restrictions on face-to-face learning imposed by the health authorities. The teaching staff will use the Moodle classroom or the usual communication channel to specify whether the different directed and assessment activities are to be carried out on site or online, as instructed by the Faculty

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory classes	15	0.6	5, 9, 2, 4
Lectures	34.5	1.38	1, 7, 6, 3, 8
Workshops	6	0.24	10, 2, 3
Type: Supervised			
Face-to-face and virtual supervision	16	0.64	2
Type: Autonomous			
Oral Workshops	12	0.48	1, 10, 12, 13, 8
Practical classes	9	0.36	10, 12, 5, 13, 8
Self-study	39	1.56	10, 11, 12, 9, 7, 6, 13, 3, 8
Workshops	15	0.6	1, 10, 12, 13, 8

Assessment

This course will be evaluated through a set of exam tests, portfolio, practical cases solutions and work presentations.

The course will be passed when a grade equal to or greater than 5 (scale 0-10) has been reached as an average of the set of EVs, provided that a grade of 5 or higher has been obtained for evidence EV1 and EV3.

Second-chance tests: Students who have not reached the established criteria to pass the subject and who have previously been evaluated in a set of activities, the weight of which may choose to take any of the recovery tests (EV1 and / or EV3) equals a minimum of two thirds of the total grade for the course, as long as the grade for the course is not less than 3.5 points out of 10 will have the chance to have a secondchance test

The students who have not reached at least EVs with a total weight of 40% will be considered as "not

evaluabile"

Second enrollment students may be exempt from participating in practical activities if they have passed EV5 of the previous year. In this case, the grade obtained by the EV5 will be kept, although they will have the right to resign in writing and re-present from the beginning of the course.

The following link lists the faculty assessment guidelines:

<https://www.uab.cat/web/estudiar/graus/graus/avaluacions-1345722525858.html>

Code Denomination Weight Format Authorship Via

EV1 ___ Objective test multiple response on knowledge of Structure ___ 30% ___ written ___ individual ___
face-to-face

EV2 ___ Objective practice test ___ 10% ___ written ___ individual ___
face-to-face

EV3 ___ Objective multiple-choice test on Function knowledge ___ 30% ___ written ___ individual ___
face-to-face

EV4 ___ Objective practice test ___ 10% ___ written ___ individual ___
face-to-face

EV5 ___ Portfolio and cases ___ 10% ___ both ___ both ___ both

EV6 ___ Works ___ 10% ___ written ___ collective ___ both

Format: written, oral or both.

Authorship: individual, collective or both.

Via: face-to-face, virtual or both.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of the portfolio of laboratory and practical classes (EV5)	10	0.5	0.02	1, 10, 11, 12, 5, 9, 7, 6, 2, 4, 13, 3, 8
Test of practical classes (EV2 y EV4)	20	0.5	0.02	1, 10, 11, 12, 5, 9, 7, 6, 2, 3
Preparation and presentation of workshops (EV6)	10	1	0.04	1, 10, 11, 12, 5, 9, 7, 6, 2, 4, 13, 3, 8
Test of answers (EV1 y EV3)	60	1.5	0.06	1, 10, 11, 12, 7, 6, 2, 3, 8

Bibliography

Main Bibliography

1. Anthony Seikel, David G. Drumright, Anatomy and Physiology for Speech, Language, and Hearing. 6th edition. 2019
2. Purves D, Augustine GJ, Fitzpatrick D, Katz LC, LaMantia AS, McNamara JO. Invitación a la neurociencia. Ed Panamericana, 2001.

Complementary Bibliography

1. Crossman AR, Neary D. Neuroanatomía: texto y atlas en color. 3ª edición, Elsevier-Masson, Barcelona 2007.
2. Cuetos F. Neurociencia del Lenguaje. Ed. Panamericana, Madrid. 2012.
3. MacKenna BR, Callander R. Fisiología Ilustrada. 5ª ed. Ed. Churchill Livingstone. 1990.

4. McFarland . Atlas de Anatomía en Ortofonía. Elsevier-Masson, Barcelona, 2008.
5. Rodríguez S, Smith-Agreda JM. Anatomía de los órganos del lenguaje, visión y audición. 2ª edición. Ed. Panamericana. Madrid, 2004.
6. Tortora. Derrickson. Principios de Anatomía y Fisiología. 11ª edición. Ed. Panamericana. Madrid, 2006.
7. Webb WG, Adler RK. Neurología para el logopeda. 5ª edición, Elsevier-Masson, Barcelona, 2010.
8. W. WEBB. K. ADLER NEUROLOGÍA PARA EL LOGOPEDA. Elsevier. 5th edition. 2010
9. JORDI PEÑA-CASANOVA MANUAL DE LOGOPEDIA (4ª ED.). Elsevier 2013