

**Biological Changes during the Vital Cycle:  
Implications for Speech Therapy**

Code: 101703  
ECTS Credits: 6

| Degree                 | Type | Year | Semester |
|------------------------|------|------|----------|
| 2500893 Speech therapy | OB   | 2    | 1        |

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

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### Use of Languages

Principal working language: spanish (spa)  
Some groups entirely in English: No  
Some groups entirely in Catalan: No  
Some groups entirely in Spanish: No

### Other comments on languages

Classes will be taught in Catalan or Spanish, according to the teacher's preference

### Teachers

Rosa Mirapeix Lucas  
Angela Maria Bellmunt Fontanet  
Ignacio Delgado Martinez  
Michael John Edel  
Maria Oliver Bonet  
Christelle Serra Le Cheualier

### Prerequisites

There are no official prerequisites for this subject. However, it is recommended that students have passed the subjects of the first course "*Anatomy and physiology of the voice and speech organs (101701)*" and "*Anatomy and physiology of the nervous system (101700)*".

### Objectives and Contextualisation

This course is taught during the first semester of the second year, after having studied in the first year, the subjects "*Anatomy and physiology of the voice and speech organs (101701)*" and "*Anatomy and physiology of the nervous system (101700)*" that cover the different relevant systems in a situation of normality.

The subject "Biological changes during the life cycle: implications for speech therapy" aims for students to acquire basic learning of the processes and mechanisms of development, growth and human body changes along the life cycle (from the embryonic period to old age). Particular emphasis is placed on those systems

which are relevant for speech therapists, such as the nervous system and organs related to speech, voice, hearing and swallowing.

The course is divided into two modules: the first refers to the prenatal period and the second to the postnatal period.

## LEARNING OBJECTIVES

### Module 1: Prenatal period

- Describe the development of male and female gametes, and explain the process of fertilization
- Describe the genetic control of development. Enumerate the phases of human prenatal development.
- Describe the most significant changes in each of the stages of human prenatal development. Classify specimens according to fetal and embryonic stages of development.
- Identify the germ layers and relate them to their derivatives
- Describe the most significant features of development and fetal behavior
- Explain in chronological order the development of the nervous system
- Explain the changes that lead to the structuring of the neural tube and the characteristics of the brain vesicles and the spinal cord
- Describe the embryonic origin of the ear and its main malformations
- Explain the processes that lead to the formation of the face from the different primordia that constitute the face.
- Explain the mechanisms of development that lead to the formation of the anatomical elements that constitute the phonatory apparatus (mouth, lips, soft and hard palate, nostrils, pharynx, larynx, trachea, bronchii and lungs)
- Relate birth defects (affecting the main processes and structures studied during the course) with the alteration of the causal developmental mechanisms.
- Describe the development of the pharyngeal apparatus and its derivatives
- Apply knowledge to the interpretation of symptoms and signs of common congenital and developmental abnormalities

### Module 2: Postnatal period

- Describe the physiological condition according to the degree of maturity of the different systems of the human body, in particular the nervous system and the organs involved in voice and speech, at the different stages of the life cycle.
- Understand the different forms of intercellular communication that allow growth and maturation of the organism.
- Understand the role of the endocrine system, identify and describe the mechanism of action of the different hormones that are involved in postnatal growth and maturation of the body.
- Describe the events that mark the neural development after birth, such as synaptic plasticity, synaptogenesis, and myelination.
- Describe the sensori-motor changes occurring during postnatal development and ageing.
- Describe the variations in brain development and higher functions throughout postnatal development, adolescence and aging.
- Describe the factors that govern body maturation during infancy and adolescence periods
- Identify the normal evolution of the voice, and the differences by sex and age.
- Analyze and categorize the functional changes that occur during growth and aging in the organs of voice and speech.
- Assess and determine the factors involved in the postnatal growth of the larynx and the speech organs and the resulting functional changes.

### Justification:

This subject provides the student of speech therapy with the basic knowledge about the biological changes that occur throughout the life in the organs and systems of the body. Knowing the stages of normal development will serve to define the baseline framework to assess the person's situation and progress, establish a rigorous differential diagnosis, and plan the most optimal treatment.

The function of the organs related to speech, voice, hearing and swallowing is heavily influenced by the history of the person, i.e. the genetic and environmental factors that shape their anatomy, the development of the necessary connections with the nervous system, and the learning and training of the function during the life. In many occasions, abnormal development of embryo, altered growth of the child or biological changes at later ages may lead to important problems requiring logopedic interventions. Therefore, by knowing how the individual has been transformed during the different periods of life, we can correctly identify the biological situation of these structures and determine the goal and efficacy of the therapy.

For this purpose, the course is dedicated to offer the student of speech therapy the tools to understand the evolution of a subject from conception to death so the student will be able to recognize normality and identify more accurately pathological situations. The course is divided in two modules: prenatal and postnatal, which deal with the molecular, cellular and physiological mechanisms occurring before and after birth, respectively. Fundamental concepts on cell biology and genetics will be reviewed at the beginning of the course for better understanding of embryonic and fetal development mechanisms.

## Competences

- Adapt to new situations.
- Analyse and synthesise information.
- Demonstrate an understanding of disorders in communication, language, speech, hearing, voice and non-verbal oral functions.
- Develop critical thought and reasoning and be able to communicate them effectively, both in your own language and second or third languages.
- Develop independent-learning strategies
- Evaluate the scientific production that supports speech therapists professional development.
- Express oneself fluently, coherently and suitably following established norms, both orally and in writing.
- 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.
- Master the terminology that facilitates effective interaction with other professionals.
- Organise and plan with the aim of establishing a plan for development within a set period.
- Understand, integrate and relate new knowledge deriving from autonomous learning.

## Learning Outcomes

1. "Identify the main changes throughout life in language, speech, voice, hearing and deglutition; demonstrate knowledge of their biological bases."
2. Adapt to new situations.
3. Analyse and synthesise.
4. Correctly use the principal terms in anatomy, embryology, teratology, physiology, biology, genetics and gerontology.
5. Develop critical thought and reasoning and know how to communicate this effectively, both in ones own and in a foreign language.
6. Develop independent-learning strategies
7. Explain the relationship of various speech-therapy pathologies with certain disorders in the development of the nervous system and and the organs of speech, voice and hearing.
8. Express oneself fluently, coherently and suitably following established norms, both orally and in writing.
9. Identify and describe the main processes occurring during postnatal development, maturation and aging in the nervous system and in the speech, voice and deglutition organs.
10. Identify and describe the main stages and processes that occur in the embryo and fetus during normal development of the nervous system and speech, voice and deglutition organs, as well as their regulation.
11. Managing communication and information technologies.
12. Organise and plan with the aim of establishing a plan for development within a set period.

13. Synthetically explain the objectives, methodology, main results and discussion of scientific articles on the development, maturation and aging of the nervous system and of the organs related to language, speech, voice and deglutition.
14. Understand, integrate and relate new knowledge deriving from autonomous learning.

## Content

### MODULE 1- PRENATAL DEVELOPMENT

Teacher contact: Biology Part - [Maria.Oliver@uab.cat](mailto:Maria.Oliver@uab.cat) / Embryology Part - [Angela.Bellmunt@uab.cat](mailto:Angela.Bellmunt@uab.cat)

Lectures: This block has 12 sessions of 1.5h (4 of biology and 8 of embryology) covering the following topics:

Unit 1. Cellular division: Mitosis, meiosis, spermatogenesis, oogenesis and fertilization.

Unit 2. Cellular mechanisms of development: cell growth, determination and differentiation of the cell, cell proliferation, apoptosis (programmed cell death), cell migration, regulation and intensification of transcription during development and intercellular communications.

Unit 3. Genetic control of development: general characteristics and examples of implicated genes: transcription factors- Genes HOX and PAX; signal molecules- SHH.

Unit 4. First week of gestation: cleavage divisions and the migration of the embryo through the Fallopian tube, the blastocyst.

Unit 5. Second week of gestation: implantation, bilaminar embryonic disc, formation and fate of the embryonic layers. Abnormalities

Unit 6. Third week of gestation: gastrulation (embryonic disc, primitive streak, primitive node), notochord, trilaminar embryo. Derivates of the germ layers.

Unit 7. The fourth to eighth week. Embryo folding. Organogenesis.

Unit 8. Fetal development

Unit 9. Development of the nervous system: neurulation, reorganization of the neural tube, early brain structure. Central nervous system malformations

Unit 10.- Development of the pharyngeal apparatus: pharyngeal grooves, pharyngeal arches, pharyngeal pouches.

Unit 11.- Development of the face: nose and nasal cavity, oral cavity, palate and tongue. Main malformations.

Unit 12.- Development of the eyes: optic vesicles, optic cup and lens placode. Main malformations.

Unit 13. Development of the ears: inner ear, middle ear and outer ear. Malformations that affect hearing loss

Unit 14.- Development of respiratory system: upper respiratory tract and lower respiratory tract, lung development stages. Malformations of the larynx.

Seminars: In this learning activity the students will be divided into small groups to promote interaction with the teaching staff.

Sem.1- Genetics: Students will work in groups looking for information on genetic diseases involved in the malformations of the speech, voice and hearing organs. At the beginning or the end of the seminar, students will have to answer an EV2 exam. In addition, each group of students will have to present a summary of their conclusions (EV4).

Sem 2- Early embryonic development: Students will work in small groups to reinforce the theoretical content. At the beginning or the end of the seminar, the students will have to answer an exam corresponding to EV3.

Sem 3.- Organogenesis: Students will work in small groups to reinforce the theoretical content. At the beginning or the end of the seminar, the students will have to answer an exam corresponding to EV3.

Sem 4.- Anomalies in the development of the prenatal period: Students will work in small groups to reinforce the theoretical content. At the beginning or the end of the seminar, the students will have to answer an exam corresponding to EV3.

## MODULE 2 - POSTNATAL PERIOD

Teacher contact: Lectures: [Ignacio.Delgado@uab.cat](mailto:Ignacio.Delgado@uab.cat) / Seminars: [Christelle.Serra@uab.cat](mailto:Christelle.Serra@uab.cat)

Lectures: This block has 9 sessions covering the following topics:

Unit 15. General concepts on growth and postnatal development: Differences between growth and development, factors that influence growth, measurement and assessment of growth.

Unit 16. Physiology of growth: The physiological process of growth, homeostasis and feedback systems.

Unit 17. Hormonal regulation of growth: Hormonal control of somatic growth, types of hormones and classification, growth hormone (GH), thyroid hormones and their involvement in postnatal development.

Unit 18. Growth and development of the nervous system: Neuronal regeneration and compensatory mechanisms, synaptogenesis, neural plasticity and myelination during life.

Unit 19. Growth and development after birth: Physiological adaptation to the birth process, cardiorespiratory changes at birth, swallowing function during the first year of life, neurological development and the speech function after birth and later years.

Unit 20. Biological changes during adolescence: Sexual hormones, puberty and adolescence, development during adolescence, maturation of the oropharynx and larynx during adolescence, physiological changes of speech during adolescence.

Unit 21. Maturation and development of the voice and speech function during adulthood: physiological changes of voice and speech, environmental-related and other common variations of the normal voice function.

Unit 22. Biological changes during ageing: the ageing process, physiological, molecular and cellular changes of ageing.

Unit 23. Ageing of organs and systems: ageing of the cardiorespiratory system, ageing of the nervous system, ageing of the language and speech function.

Seminar: Students have a seminar consisting of a group oral presentation and interactive discussion

Sem 5.- Changes in voice, swallowing, speech, and language during the postnatal period.

## Methodology

Lectures: Systemized lectures on subject topics, emphasizing those concepts related to speech therapy practice. Students acquire the basic scientific knowledge of the subject by attending theory classes, which must be complemented by personal and independent study. Each lecture lasts 1.5 hours.

Seminars: The knowledge acquired in the lectures and self-study will be applied to solve clinical cases. The seminars involve active student work in small groups supervised by the teacher.

Virtual classroom: The virtual classroom (*Campus Virtual*) will encourage continuous learning of the students through the exchange of relevant scientific articles, videos, links, etc., and discussions.

*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*

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Activities

| Title                           | Hours | ECTS | Learning Outcomes                       |
|---------------------------------|-------|------|---|
| Type: Directed                  |       |      |   |
| Lectures                        | 31.5  | 1.26 | 14, 6, 5, 7, 1, 4                       |
| Seminars                        | 14    | 0.56 | 2, 14, 5, 13, 7, 8, 9, 10, 1, 12, 4, 11 |
| Type: Supervised                |       |      |   |
| Tutorials in person and virtual | 6     | 0.24 | 14, 6, 13, 7, 9, 10, 1, 12              |
| Type: Autonomous                |       |      |   |
| Drafting of works               | 15    | 0.6  | 5, 13, 7, 8, 9, 10, 1, 4                |
| Evaluation                      | 8.5   | 0.34 | 3, 14, 6, 7, 8, 9, 10, 1, 4             |
| Reading of texts                | 20    | 0.8  | 3, 14, 6, 5, 7, 9, 10, 1, 11            |
| Search for documentation        | 15    | 0.6  | 3, 6, 9, 10, 1, 11                      |
| Study                           | 36    | 1.44 | 3, 14, 6, 7, 9, 10, 1, 11               |

## Assessment

The assessment system is divided in 2 parts:

- I) Prenatal module (represents 65% of the final grade).
- II) Postnatal module (represents 35% of the final grade).

All students will have two opportunities to pass both parts of the subject: the assessments scheduled during the course (partial exams) and the final exam.

The exams can be written in Catalan or Spanish. If the student has difficulties in understanding the language of the written exam, she may request to have it translated to other alternative language, provided it is formally addressed in written form to the coordinator before the 4<sup>th</sup> week of the current semester.

### I) Prenatal module

The competences of this module will be assessed by:

- EV1: multiple choice questions: biology and embryology parts
- EV2: test in the classroom during seminar 2, seminar 3 and seminar 4
- EV3: group presentation of the work from seminar 1

This prenatal module will be passed if the student (1) obtains a minimum of  $\geq 4.0$  in each part of the module (EV1 to EV3), and (2) the grade of the prenatal module is  $\geq 5.0$

The grade of the prenatal module will be calculated as:

$$\text{Prenatal module grade} = \text{EV1 (55\%)} + \text{EV2 (30\%)} + \text{EV3 (15\%)}$$

## II) Postnatal module

The competences of this module will be assessed by:

- EV4: 50 multiple choice questions about the theory topics.
- EV5: Exposition and discussion of the work for the postnatal seminar.(sem.5)
- EV6: Online test covering the contents of the postnatal module.

Students will pass this postnatal module if they (1) obtain a minimum of  $\geq 4.0$  in each part of the module (EV4 to EV6) and (2) the grade of the postnatal module is  $\geq 5.0$

The grade of the postnatal module will be calculated as

$$\text{Postnatal module grade} = \text{EV4 (65\%)} + \text{EV5 (25\%)} + \text{EV6 (10\%)}$$

### Recovery exam:

Students who fail to pass any of the modules will have to attend the recovery assessment. Students who have submitted evidence of learning with a weight equal to or greater than 4 points (40%) may not be listed in the proceedings as "not assessable".

Recovery assessment of the prenatal module: Students have to attend the recovery exam of this part if the prenatal module grade is  $< 5.0$  or they have not obtained a minimum of 4.0 in each EV part of the module.

Students will take the recovery exam of the part of the module (EV1 to EV3) with a mark  $< 4.00$ , with the same characteristics of the assessment scheduled during the course.

Recovery assessment of the postnatal module: Students have to attend the recovery exam of this part if the postnatal module grade is  $< 5.0$  or they have not obtained a minimum of 4.0 in each EV part of the module.

Students will take the recovery exam of the part of the module (EV4 to EV6) with a mark  $< 4.00$ , with the same characteristics of the assessment scheduled during the course.

In order to access the final recovery, the student must have been evaluated in a minimum of 2/3 of the final grade.

A grade greater or equal than 5.0 in the recovery assessments for each module or the final will be required for the student to pass.

### Final grade:

The final grade will be the weighted average of the grade of the prenatal module (65%) and the grade of the postnatal module (35%). To apply this formula, the student should obtain a grade  $\geq 4.0$  of each re-evaluated part in the final exam.

### Continuous evaluation

| Evidence code | Description                     | Weight (%) | Format  | Authorship | Via      | Dates                   |
|---------------|---------------------------------|------------|---------|------------|----------|-------------------------|
| EV1           | Multiple choice test (prenatal) | 35.75%     | Written | Individual | Presence | first evaluation period |

|     |   |        |         |            |          |                          |
|-----|---|--------|---------|------------|----------|--------------------------|
| EV2 | classroom tests after seminars 2,3,4          | 19.50% | Written | Individual | Presence | first evaluation period  |
| EV3 | group presentation of the work from seminar 1 | 9.75%  | Written | Group      | Virtual  | first evaluation period  |
| EV4 | Multiple choice test (postnatal)              | 23%    | Written | Individual | Presence | second evaluation period |
| EV5 | Practical exposition sem 5 (postnatal)        | 9%     | Both    | Both       | Presence | second evaluation period |
| EV6 | On-line test (postnatal)                      | 3%     | Written | Individual | virtual  | second evaluation period |

Evaluation guideness: <https://www.uab.cat/web/estudiar/grados/grados/evaluaciones-1345732995017.html>

No unique final synthesis test for students who enrol for the second time or more is anticipated.

## Assessment Activities

| Title                                      | Weighting | Hours | ECTS | Learning Outcomes                             |
|--|-----------|-------|------|---|
| EV1, EV4-Written tests                     | 59        | 4     | 0.16 | 3, 14, 6, 5, 13, 7, 8, 9, 10, 1, 4            |
| EV2, EV3-Cooperative learning (group work) | 18        | 0     | 0    | 2, 3, 14, 6, 5, 13, 7, 8, 9, 10, 1, 12, 4, 11 |
| EV3, EV5-Oral presentations                | 20        | 0     | 0    | 2, 3, 14, 5, 13, 7, 8, 9, 10, 1, 12, 4, 11    |
| EV6-Online activities                      | 3         | 0     | 0    | 3, 14, 6, 5, 13, 7, 9, 10, 1, 4, 11           |

## Bibliography

### Prenatal module:

Main:

- LARSEN WD (2016) Embriología humana. 5ª edición. Elsevier Ed. Format e-book a la UAB (Biblioteca de la UAB)

- SADLER TW (2019) Embriología médica de Langman. 14ª edición. Wolters Kluwer/Lippincott Williams & Wilkins. Format e-book a la UAB (biblioteca UAB)

### Postnatal module:

Main;



- PAPALIA DE, OLDS SW.; DUSKIN R (2009). Human development. 13<sup>th</sup> edition. McGraw-Hill
- KLIEGMAN RM; STANTON B; St GEME J; SCHOR NF. (2015). Nelson textbook of pediatrics. 20<sup>th</sup> edition.

Additional:

- BUSTOS SANCHEZ I. (2014). Intervención logopédica en trastornos de la voz. Ed. Paidotribo
- COLL FLORTIT M; AGUADO G., FERNANDEZ ZUÑIGA A.; GAMBRA S, PERELLÓ E, VILA-ROVIRA JM (2013). Trastornos del habla y de la voz. Ed: UOC

## **Software**

It is not needed.