

Degree programme	Type	Course
Biochemistry	OP	4

Contact lecturer

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

To have passed the subject of Animal Physiology, as well as of Cell Biology and Biochemistry

Objectives

The subject "Endocrinology" is an option of the last course in Biology and Biochemistry, so that the student already has a high level of basic knowledge of biology, which will allow to deepen in this matter.

The subject does not structure to the classic mode of "Hormone A, functions B and C", but will analyze several relevant biological aspects in which endocrine / neuroendocrine factors participate. The idea is to give an integrated vision of critical factors in the survival of the individual and of the species: rhythms, stress, growth and longevity, weight control, sexual and maternal behavior. As far as possible we will proceed to the analysis of animal models that help us to understand the human species.

In the classes, articles and scientific reviews of reference journals will be used as much as possible (Nature, Science, Cell, etc.) rather than textbooks. Documentation will be prepared that will be provided beforehand to the student with the fundamental information, indicating the original reference of the publication in case the student needs clarification and wishes to consult it (it will not be indispensable but it will also benefit the student from the point of view of the domain of the English). The idea is that the student has to complement that basic information with the work in class, acquiring an important method of work.

Learning outcomes

- CM13 (Propose innovative solutions to restore normal physiological processes in pathological

situations.) Propose innovative solutions to restore normal physiological processes in pathological situations.

- CM14 (Interpret experimental results regarding physiological processes at the molecular level in animals and plants, with particular emphasis on the nervous and endocrine systems.) Interpret experimental results regarding physiological processes at the molecular level in animals and plants, with particular emphasis on the nervous and endocrine systems.
- KM19 (Describe the different cell types present in animals and plants at a structural, physiological and biochemical level.) Describe the different cell types present in animals and plants at a structural, physiological and biochemical level.
- KM20 (Identify the biochemical and genetic changes associated with various pathologies, as well as any molecular or physiological alterations that they cause.) Identify the biochemical and genetic changes associated with various pathologies, as well as any molecular or physiological alterations that they cause.
- SM15 (Analyse the role of hormones, neurotransmitters, and growth factors in the regulation of gene expression and metabolism.) Analyse the role of hormones, neurotransmitters, and growth factors in the regulation of gene expression and metabolism.
- SM16 (Interpret experimental results from studies of molecular-level physiological processes.) Interpret experimental results from studies of molecular-level physiological processes.

Contents

After the basic concepts of the previous basic subject (Animal Physiology), Endocrinology will proceed to deepen the various endocrine axes, particularly at the neuroendocrine level, its relationship with behavior, and trying to maintain a vision integrated into the major themes:

1. Introduction. General organization of the nervous and endocrine system; local factors.

Hypothalamic-pituitary relationship. Hypothalamic survival circuits: hunger, thirst, sex ... Action programmes (motivations, emotions) & feelings: ancestral mechanisms; vasopressin and oxytocin as examples.

2- Circadian rhythm, ancestral mechanism. Suprachiasmatic nucleus. Clock genes. Use of light as a synchronizing mechanism & other possible synchronizers. Living against our circadian rhythm has a cost. Seasonal rhythms & melatonin. Other rhythms

3- Stress and some of its consequences. Anticipatory and reactive pathways control the hypothalamus-pituitary-adrenal axis. MR and GR receptors. Cushing disease & glucocorticoids. Stress & fear & anxiety & depression: interactions with the Immune System, and an example of the importance of epigenetics. Epigenetic intergenerational and transgenerational inheritance.

4- Obesity, the new epidemic?. Body weight control: much more than an aesthetic issue. Diets, drugs and surgical procedures (and their failures & potential hazards). Main factors and pathways involved. Homeostatic & hedonic systems. Body mass index, fat deposits & genome-wide association studies (GWAs) & its limitations. "Battle of the sexes" & genomic imprinting. Obesity & inflammation. Obesity & microbiome.

5- Growth: Heritability and susceptibility. GWAs. Growth & development. Endocrine control of growth. Psychosocial dwarfism & stress. Hypothalamus-pituitary-somatic axis: GH, IGF-I&II.

6- Growth vs. longevity: it was not so simple. Size of the species & longevity: strict or flexible law?. Caloric

and/or food intake restriction: apparent relationship with morbidity & longevity. Senescence, telomeres, oxidative stress, mitochondrial DNA, p53 & longevity. mTOR, rapamycin & other \"anti-aging pills\". What (probably) announces the experiments of parabiosis between old and young animals. Epigenetic clock & longevity.

7- Genetic, gonadal and phenotypic sex. Dmrt1, SRY and other critical factors in sexual determination and differentiation. Gonadal sex is not irreversible. Compensation of the gene dose of the sex chromosomes. XIC: X inactivation center. Somatic sexual identity in mammals?. Internal and external genitalia: main hormones involved. Intersexual states: congenital adrenal hyperplasia & Prader classification.

8- Hypothalamus-pituitary-gonadal axis: integral control of vertebrate reproduction. Importance of the control of GnRH neurons: pulse generator versus preovulatory peak. Sex steroids, kisspeptin & other factors involved. Puberty: everything changes. Menarche & context & kisspeptin & limitations of the GWAs. Puberty & risk behaviors.

9- Sexual differentiation of behavior: Battle of the sexes?. Sexual dimorphism: what does it reveal? Sexual selection: the omission of Darwin. The Coolidge effect. Sex drive and performance. Sexual steroids & oxytocin. Proceptivity & receptivity. Relevance of the hypothalamus.

10- Violence: a major problem. Is there a link between sex and violence?. Lethal aggression intra-species: we are not the only ones. Relevance of the hypothalamus. Infanticide & males and paternity dilution. Infanticide & females. Monogamy vs polygamy in mammals. Social vs sexual monogamy. Oxytocin & vasopressin & dopamine: pair bonding and other social behaviors.

11- Attractivity (body & facial): what is it and what does it reveal? Main characteristics and factors involved. Some considerations about pheromones & MHC in mammals.

12- Sexual orientation & gender. CNS Organization and activation by sexual steroids in animal models. Default sex & masculinization & defeminization: beware of analgesics. Evidence in humans and possible biological bases.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Time dedicated to studying	65	2.6	CM13, CM14, KM19, KM20, SM15, SM16
Practices	12	0.48	CM14, KM20, SM15, SM16
Preparation of seminars	6	0.24	CM13, CM14, KM19, KM20, SM15, SM16
Seminars	4	0.16	CM13, CM14, KM19, KM20, SM15, SM16
Elaboration of works related to the classroom	14	0.56	CM13, CM14, KM19, KM20, SM15, SM16

Theoretical classes	35	1.4	CM13, CM14, KM19, KM20, SM15, SM16
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The formative activities are composed of:

- (a) theoretical classes, with the usual format of master class supported by images usually obtained from scientific articles. Much of this material will be available to the student on the virtual campus
- (b) practices, in which the levels of cortisol in skin and saliva are analyzed
- (c) seminars, where, as far as possible, functional tests will be carried out with the students

These activities must necessarily be complemented by other supervised and autonomous ones.

Use of AI.

For this subject, the use of Artificial Intelligence (AI) technologies is allowed exclusively in support tasks, such as bibliographic or information searches, text correction or translations. The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. The lack of transparency of the use of AI in this assessable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

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.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Practices	10%	4	0.16	CM13, CM14, KM20, SM15, SM16
Theoretical exam	80%	6	0.24	CM13, CM14, KM19, KM20, SM15, SM16
Seminars	10%	4	0.16	CM13, CM14, KM19, KM20, SM15, SM16

The continuous evaluation process includes four evaluation activities, of three different types, distributed throughout the course, none of which represents more than 50% of the final grade.

Partial theory 1: 40% (depending on the course schedule could be higher or lower but never more than 50%)

Partial theory 2: 40% (depending on the course schedule could be higher or lower but never more than 50%)

Practices: 10%

Seminars: 10%

The theory exam will be test type, with 4 possible answers being just one correct, and using the soft penalty in the correction.

The practices will be valued by a test type exam. The seminars will be assessed through oral presentation and discussion of results (80%) and test type test (20%; using English in the presentation will be taken into account).

Participation in the four evaluation activities is mandatory. Attendance at practical sessions is mandatory. A system for recovering the evaluation of the subject is contemplated, except for practices and seminars, since due to their eminently practical nature, does not allow it. To qualify for the recovery exam, the minimum mark in the average of the subject (Endocrinology) will be 3.5. To participate in the recovery exam, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject.

The theoretical knowledge will be evaluated by two partial exams. The student must obtain at least 4,5 if he/she wants to compensate partial exams. If the recovery test is to be carried out, it may be for the first, second or both partials, depending on the notes obtained above. If both partials exceed 4,5 but do not reach the average 5, the student will be able to choose the partial exam to recover, if so he/she wishes. Overall 5 must be obtained to pass the subject. The possibility of 'improving the grade' is not contemplated.

The commission of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless such use is expressly authorized in the teaching guide), which may lead to a significant variation in the grade, means that this act will be graded with a 0. In the event that the teaching guide provides that in order to pass the subject it is an essential requirement to have obtained a minimum grade in this assessment act or that several irregularities occur in the assessment acts of the same subject, the final grade for this subject is 0. Apart from this, a disciplinary process may be initiated against the student who incurs any of these irregularities.

Single assessment.

The single assessment consists of a single synthesis test in which the contents of the entire theoretical program of the subject will be evaluated. The test will consist of multiple-choice questions, like those of continuing education. The grade obtained in this synthesis test will account for 80% of the final grade of the subject.

The evaluation of the practical activities (10%), and the classroom practices (10%) will follow the same process as the continuous assessment.

The delivery of evidence of the practical activities and classroom practices will follow the same procedure as in the continuous assessment.

The single assessment test will be held on the same date set in the calendar for the last continuous assessment test and the same recovery system will be applied as for continuous assessment. The review of the final grade follows the same procedure as for continuous assessment. The same non-assessable criterion will be applied as for continuous assessment.

Non-assessable.

Students will obtain the \"Non-assessable\" qualification when the assessment activities carried out have a weighting of less than 67% in the final grade. Attendance at practical sessions is mandatory; students will obtain the \"Non-assessable\" qualification when the absence exceeds 20% of the programmed sessions.

Bibliography

Reviews and articles selected with electronic access. Main Journals:

Physiological Reviews: <https://journals.physiology.org/journal/physrev>

Endocrine Reviews: <https://academic.oup.com/edrv>

Annual Review of Physiology: <https://www.annualreviews.org/journal/physiol>

Nature: <https://www.nature.com/>

Nature Reviews Endocrinology: <https://www.nature.com/nrendo/>

Nature Reviews Genetics: <https://www.nature.com/nrg/>

Nature Reviews Immunology: <https://www.nature.com/nri/>

Nature Reviews Molecular Cell Biology: <https://www.nature.com/nrm/>

Nature Reviews Neuroscience: <https://www.nature.com/nrn/>

Nature Medicine: <https://www.nature.com/nm/>

Science: <https://www.sciencemag.org/>

Cell: <https://www.cell.com/>

Current Biology: <https://www.cell.com/current-biology/home>

Cell Metabolism: <https://www.cell.com/cell-metabolism/home>

Proceedings of the National Academy of Sciences of USA: <https://www.pnas.org/>

The Lancet: <https://www.thelancet.com/>

Neuron: <https://www.cell.com/neuron/home>

The New England Journal of Medicine: <https://www.nejm.org/>

Software

Not used

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE