LF252-15 Molecular Endocrinology

23/24

Department
Life Sciences
Level
Undergraduate Level 2
Module leader
Kevin Moffat
Credit value
15
Module duration
5 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module is designed as a foundation for the further study of endocrinology at the cellular & molecular level as well as providing a firm basis for understanding normal hormonal control. The module will describe basic endocrinology and its regulation in man. Where appropriate, the underlying pathologies of important endocrine diseases will be discussed. The module will provide a basic understanding of the molecular mechanisms of hormone action and will include a description of some of the main hormone receptors and their signal transduction pathways, e.g. the insulin receptor (tyrosine kinase receptor). Topics will include: function of pituitary gland and hypothalamus, function of adrenal and thyroid glands, female reproductive endocrinology including endocrine control of pregnancy; pancreas and insulin; calcium homeostasis, and endocrine function of the gastrointestinal tract.

Module web page

Module aims

The module will introduce students to major areas of molecular endocrinology and underlying pathologies of endocrine diseases. This module provides a basic understanding of the molecular mechanism of hormone action and includes a description of the main hormone receptors and their signal transduction pathways.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Lecture 1: Overview and introduction to endocrinology (Dr. K. G. Moffat) This lecture will introduce the very basic principles of endocrinology. Topics covered will include the chemical nature, synthesis, transport and mechanism of action of the major hormones. An overview of the different classes of hormone receptors and intracellular signalling mechanisms will be discussed.

Lectures 2-3: The HPA axis (Dr.M. Bolborea) This pair of lectures will describe the details of and the hormones produced by the hypothalamus, the pituitary and the adrenals. This information will be related to how the system is regulated at the whole body level and at the level of the individual glands. Finally, the physiological consequences of hormones released by the HPA will be discussed. Diseases such as Cushing's syndrome and Addison's disease will be discussed. Some aspects of genes regulated by the HPA axis may be discussed.

Lectures 4-6: Insulin, somatostatin and glucagon (Dr. K. G. Moffat) Insulin is the major hormone involved in the regulation of energy metabolism. Secreted from β-cells of the pancreatic islet, insulin is an anabolic hormone that affects an array of metabolic processes. These lectures will examine insulin secretion and action. We will examine how insulin is synthesised, processed and released. The effect of insulin on target tissues will be examined both at the level of the receptor and sub-cellular signalling events, and in terms of the metabolic repercussions of this key hormone. Counter-regulatory effects of glucagon will be discussed, along with other local hormonal communication present within the islet.

Lectures 7-8: Gut hormones (Dr. K. G. Moffat) These lectures will present the major hormones controlling secretion, motility and digestion in the GI Tract, to include: how acid secretion is controlled in the stomach and what regulates gastrointestinal motility?

Lecture 9: Adipose hormones - fat as an endocrine organ (Dr. K. G. Moffat) • What is fat? Distinguish the cells of adipose tissue and the different fat depots throughout the body. • Understand the involvement of adipose-secreted molecules and their effects on other organs and systems. • Disorders stemming from adipocyte-derived factors.

Lectures 10-12: Sex hormones (Dr. A. M. Blanks) In these lectures, the sexual differentiation and the roles of the hypothalamus (GnRH), pituitary (LH, FSH and Prolactin) and gonads (oestrogen and progesterone) in the control of reproduction will be described. The molecular mechanisms underlying the initiation of puberty and the consequences of oestrogen deficiency, which occur at the menopause will be discussed. The placental (human chorionic gonadotropin (hCG), estrogen and progesterone) and fetal (oxytocin and prostaglandins) hormones will be discussed with reference to their role in maintenance of pregnancy, labour and lactation. The effects of pregnancy on maternal nonsexual endocrine glands will also be discussed.

Lecture 13: The thyroid and thyroid hormone (Dr. P. Young) The thyroid hormones regulate the metabolic activity of almost all cells and are needed for normal growth and development. This lecture will examine the synthesis and action of the thyroid hormones. The consequences of abnormal thyroid function will also be discussed.

Lecture 14: The parathyroid and Ca2+-homeostasis (Dr. P. Young) Calcium plays a fundamental role in a number of physiological functions. Three hormones primarily regulate the control of calcium homeostasis: parathyroid hormone, calcitonin and vitamin D. This lecture will concentrate on the parathyroid gland and the interactions between parathyroid hormone and vitamin D. It will use specific diseases to illustrate their interactions.

Lecture 15: Endocrine signalling (Dr. K. G. Moffat) REVISION The major hormones will be discussed by reference to the downstream signal transduction pathways and second messengers that they activate. Thus the activation of nuclear hormone receptors, cAMP cascade, phospholipase C, RTKs and mitogen activated protein kinase cascades will be examined in respect of specific hormone receptors.

Learning outcomes

By the end of the module, students should be able to:

- Level 5 understanding of the human endocrine system
- Level 5 understanding of endocrine signalling and feedback loops
- Level 5 understanding of pharmacological control of endocrine signalling
- Level 5 understanding of pathophysiology of the endocrine system
- Level 5 understanding of the HPA axis, HPT axis and glucose homeostasis

Indicative reading list

Rang, H. P., Ritter, J. M.,
Flower, R. J. and Henderson, G.
Rang and Dale's Pharmacology
8th Edition 2016
Churchill Livingstone
ISBN: 978-0-7020-5362-7
Students are directed to the current literature for an up-to-date appreciation of developments in this area

Subject specific skills

Understand the general principles of cell signalling

Understand the basic organisation of the endocrine system
Understand the HPA-axis and the function of the pituitary in integrating hypothalamic-to-hormonal signals
Understand insulin secretion and signalling to regulate energy homeostasis and metabolism
Understand the role of various other endocrine signals, including PTH, thyroxine and sex hormones

Transferable skills

Adult learning
Self Directed Learning

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (10%)
Other activity	10 hours (7%)
Private study	125 hours (83%)
Total	150 hours

Private study description

Self directed learning and revision for the final exam

Other activity description

In-module assessment

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D1

	Weighting	Study time
In-Module Assessment	30%	30 hours

Authentic assessment, based on a common problem or dataset researchers would deal with on a regular basis in the academic environment. This is in-line with both AQSC and RSB requirements on assessments

Online Examination	70%	45 hours

1.5 hr exam- 45 min short answer question paper / 45 min essay based paper

~Platforms - Moodle

	Weighting	Study time

- Online examination: No Answerbook required

Assessment group R1

	Weighting	Study time
Online Examination - Resit 45 min SAQ paper / 45 min essay paper ~Platforms - Moodle	100%	

- Online examination: No Answerbook required

Feedback on assessment

Pastoral meetings with personal tutors.

Past exam papers for LF252

Availability

Courses

This module is Core for:

- Year 2 of UBSA-C700 Undergraduate Biochemistry
- ULFA-C1A2 Undergraduate Biochemistry (MBio)
  - Year 2 of C1A2 Biochemistry
  - Year 2 of C700 Biochemistry
- Year 2 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)
- Year 2 of ULFA-C1A6 Undergraduate Biochemistry with Industrial Placement (MBio)
- Year 2 of ULFA-B140 Undergraduate Neuroscience (BSc)
- Year 2 of ULFA-B142 Undergraduate Neuroscience (MBio)
- Year 2 of ULFA-B143 Undergraduate Neuroscience (with Industrial Placement) (MBio)
- Year 2 of ULFA-B141 Undergraduate Neuroscience (with Placement Year) (BSc)

This module is Optional for:

- UBSA-C1B9 Undergraduate Biomedical Science
  - Year 2 of C1B9 Biomedical Science

    - Year 2 of C1B9 Biomedical Science
    - Year 2 of C1B9 Biomedical Science
- ULFA-C1A3 Undergraduate Biomedical Science (MBio)
    - Year 2 of C1A3 Biomedical Science
    - Year 2 of C1B9 Biomedical Science
- Year 2 of ULFA-C1A7 Undergraduate Biomedical Science with Industrial Placement (MBio)
- ULFA-CB18 Undergraduate Biomedical Science with Placement Year
    - Year 2 of CB18 Biomedical Science with Placement Year
    - Year 2 of CB18 Biomedical Science with Placement Year
    - Year 2 of CB18 Biomedical Science with Placement Year
- Year 2 of UMDA-CF10 Undergraduate Integrated Natural Sciences (MSci)