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HUNTER COLLEGE  
The City University of New York  
Molecular Endocrinology Biol 376-02  
Spring 2016

Meeting Days: Tuesday, Friday  
Meeting Times: 11:10 to 12:25pm  
Meeting Place: Room 603 Hunter West

Instructor: Dr. Jesus Angulo  
Email: [angulo@genectr.hunter.cuny.edu](mailto:angulo@genectr.hunter.cuny.edu)  
Office: 802 Hunter North Hours: Monday 9-11am

Note: If you need to contact Professor Angulo or schedule an appointment, send an email with "Biol 376 Course" in the subject line. Email is the best method of contact.

*Textbook of Endocrine Physiology* 6th Ed. by J. Griffin and S. Ojeda  
\$55.00 Hunter College Bookstore ISBN 978-0-19-974412-1

*Grading System:*

**3 exams each worth 1/3 of the final grade** (all essays).

You will receive 9 lecture packets during the semester. The average of the three exams will determine the final grade.

This is how grades will be awarded:

A+	97.5-100	B-	80-82.4
A	92.5-97.4	C+	77.5-79.9
A-	90-92.4	C	70-77.4
B+	87.5-89.9	D	60-69.9
B	82.5-87.4	F	0-59.9

**Attendance:** Attendance is required. The material covered in lecture is the material on which you should focus in preparing for exams.

**Description of exams:** You will be tested on essays. Fill-ins and multiple choice questions. All exams are closed book. No electronic devices in class. Students who arrive more than 15 minutes late will not be allowed to take the exam. If you have to leave the room for whatever reason, you must give the exam to the instructor and do not return. Exams require memorization and thinking.

**Writing requirements:** The language of the course is English. Well-constructed sentences are required to answer the essay questions. A complete answer will require a beginning, middle and end. Disjointed and scattered scientific information, even if correct, will not constitute a complete answer. Only relevant information pertinent to the question will be accepted.

**Policy on exam re-grades:** If you feel an error has been made in grading one of your exams, discuss it with the instructor.

**Extra credit and make-up exams:** There will be no extra credit assignments. Opportunities to make up exams may be granted if and only if students can provide a university-sanctioned excuse supporting documentation. If you miss an exam, you will automatically earn a grade of zero for this exam and it will be used in calculating your final grade.

**Policy on incomplete grades:** incomplete grades will be allowed only under exceptional circumstances; arrangements for completion of the required work must be made prior to the start of the next semester.

**Cell phones:** please turn off all cell phones prior to entering the classroom. No devices of any kind on your desk except exam and pencil/pen.

**Plagiarism and other forms of academic dishonesty:**

“Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The college is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedure.”

## **COURSE DESCRIPTION**

### **1. Introduction to the Nervous System**

Brain coordinates; The action potential; Vesicular release of transmitter; Pre- and post-synaptic membranes; Classical neurotransmitters; Peptide neurotransmitters; Synthesis and degradation; Ion channels; G protein-coupled neurotransmitter receptors; Second messengers; Differential gene expression; Hypothalamic-pituitary axis.

### **2. Introduction to the Endocrine System (1-30, 49-87, 101-119).**

Endocrine glands and hormones; Chemical nature of hormones; Function of hormones; Reproduction; Growth and development; Maintenance of internal environment; Regulation of energy balance; Synthesis and release of hormones; Patterns of hormone secretion; Transport and metabolism of hormones; Feedback mechanisms; Mechanisms of endocrine disease; Transcription; DNA (Cis) elements; Protein factors; RNA processing; Translation; Posttranslational processing; Hybridization; Fluorescent *in situ* hybridization; Cloning; Polymerase chain reaction; DNA sequence analysis; Relationship of binding to biological response; Receptor structure and function; Guanine nucleotide-binding (G protein)-coupled receptors; Nicotinic acetylcholine receptors; Receptors with intrinsic protein tyrosine kinase activity; Guanylyl cyclase receptors; Receptors for growth hormone, prolactin, and other members of the cytokine receptor superfamily; Signal transduction mechanisms; G protein-coupled signal transduction; Cyclic adenosine monophosphate regulation of cellular function; Signal transduction mechanisms independent of cyclic adenosine monophosphate; Steroid hormone receptors: molecular forms and receptor

transformation; Regulation of gene expression by members of the nuclear receptor superfamily; Hormone-response elements and regulation of gene transcription; Steroid receptor effects mediated by protein-protein interactions; Steroid hormone actions via classical steroid receptors within the plasma membrane; Endocrine dysfunction caused by homologous and heterologous receptor regulation; Endocrine dysfunction caused by autoimmune disease involving antireceptor antibodies; Disorders due to receptor and postreceptor defects; Androgen resistance; Vitamin D resistance; Principle of radioimmunoassay; Characteristics and advantages of immunometric assays; Chromatography and spectrometry; Sampling the plasma; Effect of plasma-binding proteins; Interpretation of normal ranges; Urinary hormone secretion; Stimulation tests; Suppression tests; Problems in interpreting dynamic tests; Measurement of hormone receptors.

### **3. Hypothalamic-Pituitary-Adrenal Axis (120-146).**

The pituitary gland; The hypothalamus; Hypothalamic releasing and inhibiting hormones; Anterior pituitary hormones; Mechanism of action of releasing hormones; Mechanism of action of inhibiting hypothalamic hormones; Synaptic transmitters involved in controlling the release of releasing hormones; Short loop feedback of pituitary hormones; Ultrashort loop feedback of releasing and inhibiting hormones; Pituitary growth hormone, its action and its control; Clinical assessment of anterior pituitary function; Hypothalamic disease; Hypopituitarism; Acromegaly and gigantism; Hyperprolactinemia. Epigenetic mechanisms in stress and behavior.

### **4. Hypothalamic-Pituitary-Somatic Tissues (274-293).**

Growth hormone secretion and action; Insulin-like growth factors; Additional growth regulators; Growth patterns and curves; The insulin-like growth factor axis; The fibroblast growth factor family of peptides and receptors; The epidermal growth factor system; Other growth factor-promoting peptides; Growth inhibitory peptides; Short stature, diagnosis and causes; growth hormone and insulin-like factor deficiencies; Tall stature; Insulin-like growth factor axis in diabetes; Insulin-like growth factor axis in proliferative disorders.

### **5. Electrolyte Homeostasis (147-166).**

Structure of the posterior pituitary gland; Posterior pituitary hormones: vasopressin and oxytocin; Procontractile cardiovascular peptides; Vasodilatory cardiovascular peptides; The natriuretic peptides; The adrenomedullins; Integrated control of water and sodium homeostasis; Aldosterone; Cortisol; Renin-angiotensin system; Adrenal hypertension.

### **6. The Adrenal Gland (319-348).**

Anatomy of the adrenal glands; Anatomical and functional zonation; The adrenal cortex; Steroidogenesis; Regulation of glucocorticoid secretion; Molecular mechanisms of corticosteroid action; Syndromes of congenital enzymatic deficiency; Glucocorticoid-remediable aldosteronism; Glucocorticoid insufficiency; Cortisol excess (Cushing's syndrome); Regulation of mineralocorticoid secretion; Primary and secondary aldosterone excess; Genetic disorders of mineralocorticoid action; Adrenal androgens;

The adrenal medulla; Synthesis and release of epinephrine; Fate of secreted catecholamines; Action of epinephrine, arousal, metabolic and cardiovascular actions; Features of catecholamine excess; Assessment of adrenal function.

### **7. The Thyroid Gland (294-318).**

Synthesis and secretion of thyroid hormones; Iodide kinetics; Iodide transport and organization; Storage and release of thyroid hormones; Transport of thyroid hormones and tissue delivery; Kinetics of thyroid hormone production and turnover; Deiodinase enzymes involved in thyroid hormone activation and inactivation; Effects of illness and drugs on thyroid hormone metabolism; Hypothalamic-pituitary-thyroid axis; Thyroid autoregulation; Mechanism of thyroid hormone action; Physiological effects; Effects of thyroid hormone deficiency and excess; Measurement of serum thyroid-stimulating hormone; Measurement of circulating thyroid hormones; Effect of nonthyroidal illness on thyroid function tests; Hypothyroidism; Hyperthyroidism.

### **8. Physiology of Neuropeptides (handout).**

Biosynthesis and degradation; Neuropeptides are neurotransmitters and neuromodulators; Neuropeptides and G protein-coupled receptors; Internalization of neuropeptide receptors; Frequency of stimulation and release mechanisms; Vesicular storage and release of neuropeptides; Neuropeptides are colocalized with classical transmitters; Interactions between neuropeptides and classical transmitters.

### **9. Endocrinology of the Reproductive System (186-225, 226-248).**

Structural organization of the ovary; Ovarian hormones; Biosynthesis, transport, and metabolism of steroid hormones; Peptide hormones of ovarian origin; Pituitary control of ovarian hormone formation; Intraovarian and extraovarian actions of steroid hormones; The menstrual cycle; The gonadotropin-releasing system and its neural control; Follicular development, ovulation and atresia; The corpus luteum; Ovarian feedback control of gonadotropin secretion; Negative and positive feedback; Dynamics of the hypothalamic-pituitary-ovarian relationship; Fetal, neonatal and infantile phases; Puberty; Somatic changes; Metabolic signals; Mechanisms involved in the regulation of the onset of puberty; The adrenal gland and puberty; Reproductive cyclicity; Menopause; The mammary gland; Lactation; Clinical assessment of reproductive function; Deranged reproductive function; Isosexual precocity; Delayed puberty; Abnormal uterine bleeding; Amenorrhea; Galactorrhea; Hirsutism; Fertility control; Structural organization of the testis and the male reproductive tract; Testosterone formation; Testosterone transport and tissue delivery; Metabolism of androgens; Androgen action; Stages of spermatogenesis; Regulation of spermatogenesis; Seminal fluid formation; The hypothalamic-pituitary-testicular axis; Development and maintenance of reproductive function; Clinical assessment of reproductive function; Deranged reproductive function; Fertility control.

## **LEARNING OBJECTIVES**

*The student will gain a deep knowledge of the physiology of the endocrine system and of homeostatic mechanisms.*

*The mechanism of action of the various hormones will be studied in rich detail from receptor to signaling pathways and physiological responses.*

*The role of the brain as the master regulator of the endocrine system and how it integrates hormones with physiology.*

*The student will be able to read papers in the endocrine literature and appreciate the scientific contributions of the paper. Throughout the course attention is paid to experimental details and how they translate into knowledge of hormone action.*

*The student will be able to appreciate the importance of the endocrine system in maintaining normal physiological responses and how aberrations and environmental factors can contribute to the development of disease states.*

*The student will be able to understand the delicate balance between nature and nurture in relation to endocrine/neural mechanisms.*

### **COURSE OUTLINE**

The following is a tentative schedule of classes. Changes will be announced during class time. It is your responsibility to be aware of changes to the schedule.

#### Month      Day

Jan	25	Introduction
Jan	29	Overview Neuroscience
Feb	1	
Feb	5	
Feb	8	
Feb	15	
Feb	19	
Feb	22	Review
Feb	26	Exam 1 (ppt Slide Packets 1, 2 & 3)
Mar	1	
Mar	5	
Mar	8	
Mar	12	
Mar	15	
Mar	19	
Mar	22	
Mar	26	
Mar	29	Review
Apr	2	Exam 2 (ppt Slide Packets 4, 5 & 6)
Apr	5	
Apr	9	
Apr	12	
Apr	16	

Apr	30	
May	3	
May	7	Review
May	10	Exam 3 (ppt Slide Packets 7, 8 & 9)

HAVE A GREAT SUMMER!!!

Formula for success:

"If A is a success in life, then  $A = x + y + z$ : work is x; y is play ; and z is keeping your mouth shut." *Albert Einstein*

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shared via CourseHero.com