This course is about the endocrine system, a subdiscipline of physiology. Because endocrinology is borne out of an inter-relationship among several biological disciplines, such as biochemistry, cell biology, and physiology, students wishing to succeed in this course, should have fulfilled the pre-requisites of BIOL 380 (Cell Biology) or the entire CHEM 431 (Biochemistry) series (Qtr system course I.D.s).

**COURSE OBJECTIVES:** The objectives of this course are to gain detailed knowledge of (a) the structure and function of the endocrine system; (b) homeostasis and feedback mechanisms; and (c) factors regulating hormone production, secretion, and action. In addition, students will successfully research and write a review paper germane to endocrinology.


**GRADING:** There will be 2 midterm exams each consisting of a mixture of multiple choice and short-answer questions, worth 100 points each. There will also be 6 quizzes/assignments (15 points each), a term paper (worth 100 points), attendance (2 points /day = 54 points, not counting 1st day of class and exam days), and a final exam (150 points). Total points, therefore, will be ~ 594. Grades will be assigned based on the following scale:

Grades in this course are not curved. Course grades will be assigned on a percentage basis, where 91-100% = A, 81-90% = B, 71-80% = C, 61-70% = D, and 60% and below = F. The top 2% and bottom 2% will be “+” and “-” grades, respectively. Thus, 81-82% = B- and 89-90% = B+.

Exams and Quizzes. I use the quizzes/assignments to encourage you to attend class; towards that end, there will be no make-up quizzes. The quizzes will be on Thursdays and on the lecture material of the previous day or week. If an assignment, I will either provide hard copy in class or post it on Moodle, in which case, you must print it out, answer the questions and then hand in hard copy (due date will be specified on the assignment). If you miss an exam, I will consider a make-up, provided you can furnish me with a valid reason and documentation (proof) for missing it. Generally, only your own medical problem or jury duty will qualify as a valid reason.
Term Paper. The term paper should be 10-12 typed, double-spaced pages, reviewing the most current literature on an endocrine-related topic. You may use books, but not as primary sources, and only to clarify concepts in your mind. Papers are due Week 14, no later than Tuesday, 11/22/16. Late papers will be penalized 10 points per weekday it is late. However, papers received during Week 13, no later than Tuesday, 11/15/16, will receive 10 extra credit points. I do not accept electronic versions of your paper – Only hard copy. Possible topics might be, but are not limited to:

- The roles of leptin and ghrelin in satiety
- The molecular basis of insulin-stimulated glucose uptake
- The effects of (intense) regular exercise on the maintenance of diabetes
- The role of estrogen in calcium homeostasis
- The molecular reasons of estrogen (hormone) replacement therapy
- Anabolic effects of growth hormone
- Regulation of growth hormone
- Steroid hormone pharmacology (e.g., for inflammation)
- Melatonin and circadian rhythms
- Iodine regulation in the thyroid
- Insulin-like growth factor (be more specific)
- The roles of glucagon and insulin in blood glucose balance
- The effects of anabolic steroids on testosterone production
- Any hormone-based disease (e.g., diabetes mellitus, PCOS)
- Any hormone-based condition (e.g., what happens during aging, hirsutism)

If you have another topic in mind, but aren’t sure of its appropriateness, please clear it with me first.

General Term Paper Guide and Topics that should be Covered.

Your term paper should address the following topics pertaining to your chosen endocrine gland, hormone, and/or endocrine-based clinical condition. To give adequate coverage to a topic, usually no fewer than 10-12 references should be used, with the majority of the references (~ 8-10) being from peer-reviewed journal articles. Wikipedia text is not acceptable, whereas figures found on Wikipedia may be.

Please organize your paper in the following order, using the following as Headings, then subheadings (in bold):

1. Short introductory paragraph about what the paper is about.

2. Anatomy and physiology of the gland (preferably with figures) that produces/secretes your hormone. Include a figure of the molecular structure of your hormone; if a peptide, then the primary amino acid sequence and secondary structure will suffice.

3. Pharmacodynamics and pharmacokinetics of your hormone: I.e.:
A. Is the hormone bound to plasma proteins?
B. How is it degraded? How is it metabolized? What are the metabolic end-products?
C. What is the half-life, volume of distribution, and clearance of the hormone?
D. How is the hormone regulated (e.g., negative feedback)? Is the hormone regulated by other hormones? Is the hormone regulated by a particular physiological condition (e.g., hungry state for glucagon; mid-life for estrogen; time of day for cortisol or melatonin)?
E. Receptors for the hormone: Cytosolic? Membrane-bound? Dimer? Monomer? How are these regulated?

Again, figures would greatly aid in the presentation (e.g., metabolic pathways of the hormone).

4. What condition (e.g., progesterone in menstrual cycle) or disease (e.g., insulin in diabetes and obesity) involves the hormone? Of course, if you chose the last bullet point above, then this criterion would be redundant.

5. A short paragraph of closing remarks.

References List and corresponding in-text citations. Be sure you make the appropriate citations (e.g., experimental findings from the literature) in the text of your paper. Each reference MUST be cited SOMEWHERE in the text/figures/tables of the term paper. And vice versa: each reference cited in the paper itself MUST appear in your References List.

Be sure you include page numbers in your paper.

**BIOL 4390 Lecture Schedule**

Lectures can be found on Moodle.

As Instructor, I reserve the right to slightly alter the following schedule:

<table>
<thead>
<tr>
<th>Wk</th>
<th>Date</th>
<th>Topic (Lecture #)</th>
<th>Reading Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T, 8/23</td>
<td>Introduction to the course – Endocrine System (1)</td>
<td>Ch. 1</td>
</tr>
<tr>
<td>1</td>
<td>R, 8/25</td>
<td>Introduction to the course – Endocrine System (1) (Cont’d).</td>
<td>Ch. 1</td>
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<tr>
<td>2</td>
<td>T, 8/30</td>
<td>Hormone Chemistry; Types of Hormones and Chemical Messengers (2)</td>
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<tr>
<td>2</td>
<td>R, 9/1</td>
<td>Molecular Basis of Protein Hormone Production (3);</td>
<td>Ch. 2; pp. 81-97, 349-380</td>
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<td></td>
<td></td>
<td>Synthesis of Steroid Hormones (4)</td>
<td>pp. 81-97, 349-380</td>
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<tr>
<td>3</td>
<td>T, 9/6</td>
<td>Synthesis of Steroid Hormones (4) (Cont’d)</td>
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<tr>
<td>3</td>
<td>R, 9/8</td>
<td>Regulation of Plasma Hormone Levels (5); Quiz 1</td>
<td></td>
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<tr>
<td>4</td>
<td>T, 9/13</td>
<td>Regulation of Plasma Hormone Levels (5) (Cont’d)</td>
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<tr>
<td>4</td>
<td>R, 9/15</td>
<td>Hormone Receptors on the Plasma Membrane (6); Quiz 2</td>
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<tr>
<td>5</td>
<td>T, 9/20</td>
<td>Hormone Receptors on the Plasma Membrane (6) (Cont’d)</td>
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<td>5</td>
<td>R, 9/22</td>
<td>Midterm Exam 1 (Covers Lectures 1-6)</td>
<td></td>
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<tr>
<td>6</td>
<td>T, 9/27</td>
<td>Intracellular Hormone Receptors (7)</td>
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<tr>
<td>6</td>
<td>R, 9/29</td>
<td>Intracellular Hormone Receptors (7) (Cont’d); Quiz 3</td>
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<tr>
<td>7</td>
<td>T, 10/4</td>
<td>The Hypothalamus and Pituitary (8) Ch. 5, 6</td>
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<tr>
<td>7</td>
<td>R, 10/6</td>
<td>The Hypothalamus and Pituitary (8) (Cont’d) Ch. 5, 6</td>
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<tr>
<td>8</td>
<td>T, 10/11</td>
<td>Gastrointestinal Hormones (9) Lecture slides</td>
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<tr>
<td>8</td>
<td>R, 10/13</td>
<td>Gastrointestinal Hormones (9) (Cont’d); Quiz 4 Lecture slides</td>
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<tr>
<td>9</td>
<td>T, 10/18</td>
<td>Hormonal Control of Ca Homeostasis (10) Ch. 14</td>
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<tr>
<td>9</td>
<td>R, 10/20</td>
<td>Hormonal Control of Ca Homeostasis (10) (Cont’d) Ch. 14</td>
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<td>10</td>
<td>T, 10/25</td>
<td>The Thyroid Hormones (11) Ch. 12</td>
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<td>10</td>
<td>R, 10/27</td>
<td>Midterm Exam 2 (Covers Lectures 7-11)</td>
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<tr>
<td>11</td>
<td>T, 11/1</td>
<td>Growth Hormones (12)</td>
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<td>11</td>
<td>R, 11/3</td>
<td>Growth Hormones (12) (Cont’d); Pineal (13); Quiz 5</td>
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<tr>
<td>12</td>
<td>T, 11/8</td>
<td>Adrenal Gland (14) Ch. 13</td>
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<tr>
<td>12</td>
<td>R, 11/10</td>
<td>Adrenal Gland (14) (Cont’d) Ch. 13</td>
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<tr>
<td>13</td>
<td>T, 11/15</td>
<td>Pancreatic Hormones: Metabolism of Nutrients (15). Term Paper Due for 10 EC points. Ch. 15</td>
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<tr>
<td>13</td>
<td>R, 11/17</td>
<td>Pancreatic Hormones: Metabolism of Nutrients (15) (Cont’d); Quiz 6</td>
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<tr>
<td>14</td>
<td>T, 11/22</td>
<td>Reproductive Endocrinology in the Male (16) Term Paper Due. Ch. 9</td>
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<tr>
<td>14</td>
<td>R, 11/24</td>
<td>Thanksgiving – No classes held.</td>
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<tr>
<td>15</td>
<td>T, 11/29</td>
<td>Reproductive Endocrinology in the Female (17) Ch. 8</td>
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<tr>
<td>15</td>
<td>R, 12/1</td>
<td>Reproductive Endocrinology in the Female (17) Ch. 8</td>
<td></td>
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</tbody>
</table>
| R, 12/8 | Final Exam (100 pts from Lectures 12-17; 50 pts from Exam 1 and Exam 2 material); 11:20 - 13:20.
ADA: Reasonable accommodation will be provided to any student who is registered with the Office of Students with Disabilities and requests needed accommodation.

**Student Learning Outcomes and Learning Objectives.** Students will be able to demonstrate knowledge on the following:

1) Introduction
   a. Homeostasis (both negative and positive)
   b. Functions of the endocrine system
   c. Components of the endocrine system
   d. Chemical structure of hormones
   e. Regulation of hormone secretion
   f. Transport and distribution of hormones
   g. Mechanisms of hormone action
   h. Regulation of hormone receptors

2) Hormone Chemistry
   a. Classification of hormones
   b. Classification of system/function
   c. Classification by source
   d. Classification by structure
   e. Peptide hormones
   f. Steroid hormones
   g. Amino acid derivatives

3) Molecular Basis of Peptide Hormone Production
   a. Regulation of peptide hormone levels
   b. Transcription and translation
   c. Secretion

4) Synthesis of Steroid Hormones
   a. Overview of steroid hormones
   b. Peptide vs steroid hormones
   c. Cholesterol
   d. Steroids from the adrenals
   e. Steroids from the testes
   f. Steroids from the ovaries

5) Regulating Plasma Hormone Levels
   a. Factors Involved: Secretion versus Removal
   b. Regulation of secretion
   c. Metabolic clearance and half-life
   d. Carrier proteins
   e. Glycosylation role in hormone-receptor binding

6) Hormone Receptors on the plasma membrane
   a. Membrane-bound receptors
   b. G-protein coupled receptors
   c. Signal transduction via camp
   d. Role of Ca
   e. Role of protein kinase C
7) Intracellular Hormone Receptors
   a. Steroid receptors
   b. Responsive elements
   c. Transcription
   d. Steroid receptor pathways
   e. Regulation of steroid hormones
8) Pineal Gland and melatonin
   a. Role of the suprachiasmatic nucleus in the hypothalamus
   b. Role of the pineal gland in the secretion of melatonin
   c. How melatonin is regulated
9) Hypothalamus and Pituitary
   a. Regulation of anterior and posterior pituitary hormones
   b. Hormones and releasing factors
   c. Water balance via hormone regulation
10) Gastrointestinal Hormones
    a. Digestion and absorption
    b. Pancreatic hormones
    c. GI hormones and paracrine function
    d. Integration of neural and endocrine signals
    e. Signaling mechanisms
11) Thyroid Hormones – Production and Regulation
    a. Production of thyroid hormones
    b. Transport and activities of T3 and T4
    c. Regulation and secretion
    d. Actions of thyroid hormones
12) Regulation of Calcium Homeostasis
    a. How Ca is regulated by parathyroid hormone, calcitonin, and vitamin D
    b. Bone strength and Ca metabolism
13) Growth Hormone
    a. Regulation, synthesis, release, actions, and metabolism of growth hormone
    b. GH receptor
14) Pancreatic Hormones and Carbohydrate Metabolism
    a. Pancreas as an exocrine organ
    b. Insulin and glucagon regulation of CHO metabolism
    c. Major metabolic pathways for CHO, lipids, and proteins
15) Adrenal Steroid Hormones
    a. Adrenal steroidogenesis
    b. Cortisol
    c. Aldosterone
    d. Androgens
16) Reproductive Endocrinology in the Male
    a. Neuroendocrine control of the testes
    b. Mechanism of LH and FSH
    c. Transport, metabolism, and actions of testosterone
d. Meiosis and spermatogenesis
e. Seminal fluid formation
f. Male sexual function

17) Reproductive endocrinology in the female
   a. Neuroendocrine regulation of ovarian hormones
   b. Follicle development, ovulation, and luteinization
   c. Oogenesis and oocyte maturation
   d. Menstrual cycle
   e. Pregnancy, parturition, and lactation

**ACADEMIC HONESTY:** Students are expected to read and abide by the University’s Academic Honesty Policy, which can be found at [http://www.calstatela.edu/academic/senate/handbook/ch5a.htm](http://www.calstatela.edu/academic/senate/handbook/ch5a.htm). Students who violate this policy will be subject to disciplinary action and may receive a failing grade in the course for a single violation.