Bio E-123: Reproductive Biology: Physiological, Evolutionary and Behavioral Aspects

Spring 2016 Course Syllabus

Instructor: Daniel Spratt (dspratt@fas.harvard.edu)

Class Time: Wednesdays 7:40-9:40pm

Office hours: 4:00-5:00pm on Thursdays by appointment. Additional opportunities for remote office hours are being arranged.

Class location: Byerly Hall 013

Class format: The course will be offered on campus with an online option. The logistics of the course are designed to accommodate students' participation online either live or with recordings of the lectures.

Overview: This course undertakes a multidisciplinary exploration of reproductive function in humans, including physiology and evolution as well as the impact on behavior and society. Examples in other species ranging from seasonal reproductive physiology and behavior in deer to effects of testosterone on songbirds' vocalizations and behavior help provide perspectives on the complex process of human reproduction and the intricacy of its regulation by hormones. The ability of humans to understand and manipulate the influence of these hormones has had an impact on our lives, healthcare system, and society. The impact on society ranges from significant advances in women's health to passionate controversies on limiting reproduction to scandals involving androgen use in sports. Different impacts of androgens and estrogens on cognition and behavior are an evolving field in neuroscience, business, and politics.

Lectures will be interactive including small group activities for problem solving.
Lecture Schedule with Reading Assignments:

Note: Readings assigned to each lecture should be read before the lecture. The exception will be the oxytocin handout that may be read after the lecture. Much of the reading is background physiology that will be necessary to fully understand the lecture. Information that you already know in the reading can be skimmed.

Jan 27:

- Course overview.
- Evolution and reproduction.
- Why have sexual reproduction?
- Overview of endocrinology and reproduction.
  - The hypothalamic-pituitary-gonadal axes.
  - The adrenal system
  - The growth hormone axis
  - Energy metabolism, leptin and reproduction.
- Reading: Human Reproductive Biology (HRB): Chap 1 pp 3-21 (except p9); On Fertile Ground (OFG): Two Births; How We Do It (HWDI): Chap 1.

Feb 3:

- Physiology of hormones and their receptors.
- Evolution of human reproductive strategy:
- Formation of the gametes
- Sexual differentiation.
- Reading: HRB Chap 5; HWDI Chap 3.

Feb 10:

- Physiology of ovulation; mechanisms for single births; impacts of multiple births; control of fertility: contraception and fertility therapy and their social impacts.
- Nutrition and stress influences on the ovulatory cycle.
- Reading: HRB Chap 2 (pp23-40 except Ovarian Disorders pp33-34 and Uterine Disorders pp35-38); OFG Surviving the Cut; HWDI Chap 5.

February 17:

- Physiology of pregnancy:
  - fertilization
  - implantation and formation of the fetus and placenta
  - evolution of the placenta and placenta physiology
  - fetal development
  - endocrinology of parturition
- Reading: HRB Chap 2 (Chap 9 and Chap 10 pp175-193 up until Fetal Disorders then pp 198-200 up until Maternal Complications); OFG Surviving the Cut; HWDI Chap 4.
Feb 24: (Guest lecturer: Professor Peter Ellison)

- Rethinking the obstetric dilemma in human evolution.
- Reading: OFG A Time to Be Born; review HWDI Chap 5.

March 2:

- Reprise of parturition
- Pregnancy and culture in humans
- Physiology of nursing;
  - milk and its production
  - endocrinology of nursing
  - hormonal effects on maternal-infant bonding
  - effects of nursing on spacing of births: implications for infant survival and population density
- Reading:

March 9:

- Midterm 2 hours (covers lectures and readings for March 2nd)

March 16:

- Vacation

March 23:

- Physiology of male reproduction and androgens:
  - production of sperm and androgens
  - androgens’ diverse effects as related to fertility
  - the search for a fountain of youth
  - steroids in sports, exogenous and endogenous
- Comparative energy requirements of human male and female roles in reproduction.
- Reading

March 30: (Guest lecturer: Professor Meredith Reiche)

- Reproductive ecology: Influence of energy balance on reproduction.
- Reading:

April 6: (Guest lecturer: Professor Carole Hooven)

- Effects of gender on behavior and cognition
- Potential impacts in business, politics and society.
- Reading:
April 13:

- Mating strategies.
- Reading:

April 20:

- The beginning and end of reproductive life:
  - Puberty
  - Reproductive aging in women and men
  - Menopause
- Reading:

April 27: (Guest lecturer: Professor Peter Ellison)

- The endocrinology of human life history transitions
- Reading:

May 4:

- Overview of the spectrum of human sexuality: Monogamy, polygamy and polyandry; Heterosexuality and homosexuality; Gender identity
- Society’s effects on reproduction: Stress, anorexia, steroids in the environment, endocrine disrupting chemicals.
- Reading:

May 11: Final exam (2h; covers all lectures in the course but only the reading from May 4th.

Lectures will be taped and available for review.
Grading:

UG (Grad)

30% (30%) Take home quizzes, reading reflections, and online group problem solving.

30% (25%) Midterm

40% (35%) Final

*** (10%) Graduate review

Undergraduates: For students taking the course for undergraduate credit, grades will be based upon the midterm exam and the final as well as take home assignments. Lectures will be followed by take home assignments described below. Each take home assignment will be due by midnight the day before the next lecture.

Graduates: Students taking the course for graduate credit will be required to write a review of a topic in an area of their choosing in the course, exploring the literature in more detail in a direction that we began to address during class.

- Topic options will be provided by the instructor after the 5th lecture (February 25th); students can request approval of a topic outside the provided list.
- The review should deal in-depth with the endocrine physiology behind the topic selected including recent developments in the area, questions remaining, and application of the physiology to real life.
- Topic selection including request for approval of an alternate topic should be submitted by March 9th.
- The paper should include a title page, body, and references.
- The body should be 8-12 pages in length double spaced in Arial font size 11 and begin with an Introduction and end with a Conclusion. It should include 5-15 key references.
- A detailed outline or draft of the paper is due by April 20th for review by the instructor that should include at least 3 key references.
- The paper will be graded on thoroughness and clarity rather than length. Importance and relevance of the references is more important than number of references.

Non-credit students are welcome to take exams and take-home work but this is not required.

Take-home assignments: Each lecture except the last lecture (May 5th) will be followed by a take-home assignment; an open book quiz, a problem-solving assignment, or a reflection on the reading assignment. Take-home assignments will be assigned at the end of a lecture and due by midnight the day before the next lecture (i.e., 17 ½ hours before the next class). Quiz questions will be in the form of multiple choice, fill in the blank or short answer and will include material both from the lecture and from reading.

Problem-solving exercises will be assigned every other work and will be undertaken online with students working collaboratively in small groups assigned by your TA. The group grade will be based on the final discussion/answer submitted by your group. Individual grades will be the
group grade adjusted by the individual’s participation in the group. Participation will be assessed by fellow group members. Assignments will pose a real life question to be solved on the basis of the material presented in class, the reading and your reasoning. There will usually not be just one correct answer. However, the answer must make sense with respect to the material presented in class and the assigned reading. If your answer makes absolute sense based on class material but is not the answer used in real life you will still get credit. In fact some of you may come up with answers better than those used in real life. Answers will be graded on making sense with respect to class material, thoroughness, conciseness and lack of extraneous or incorrect material.

**Exams:** The exams are intended to be both a learning experience and an assessment of the knowledge you acquire in the course (and how you are able to apply it). Exams will include multiple choice, fill in the blank, matching, short answer and long answer questions. The majority of questions will be multiple choice, matching and short answer. Long answer questions will pose a specific situation and ask you to describe how an endocrine system will respond to that situation or how you could manipulate a system to achieve a specific outcome. Most questions will come from lectures with a few questions from the assigned readings. The questions from Vander will include only material that is also covered in class. Reading the material and listening to the lectures will provide complementary understanding of the material. Exams will be designed to test your knowledge rather than how fast you can answer questions.

Exams will be held in the classroom with remote arrangements also available according to Extension School policy.

**Regrades:** Only exams completed in pen will be acceptable for regrading. All regrading requests must be made within one week of the return of the graded exam.

**Class participation:** Class participation is strongly encouraged in the form of asking questions during class both for clarification or to expand the class discussion. Participation is also expected in small group problem-solving sessions during class. Each week, small groups of class members will be formed to create solutions to physiologic problems related to that week’s lectures.

**Review sessions:** Review sessions will be provided prior to each exam and at other times identified as useful by the class. Reviews prior to the midterm and final will be held on the Saturday prior to the exam and will be conducted live in person and by remote access. These sessions will be taped and available for later viewing. Additional review sessions will be offered with frequency and format decided with the class.

**Late policy:** Late take home assignments or graduate reviews will not be accepted without prior approval. If approved beforehand, there will still be a reduction of ½ grade (e.g., A- to B+) per day late. This penalty may be waived due to extenuating circumstances including health issues or family emergencies. Midterms in other classes will not be considered an extenuating circumstance.
**Required Texts:**


Additional Reading:
Relevant articles will also be assigned during the course.

Letters of Recommendation: Students who receive an A or A- in the class are welcome to request a letter or recommendation for graduate school. Strong participation in class during lectures, reviews and office hours is also very helpful.

Final Grades:
Letter grades reflect the following degree of mastery of information for the course.

A, A-
Earned by work whose excellent quality indicates a full mastery of the subject and in the case of the grade of A is extraordinary distinction.

B+, B, B-
Earned by work that indicates a good comprehension of the course material and the student’s full engagement with the course requirements and activities.

C+, C, C-
Earned by work that indicates an adequate and satisfactory comprehension of the course material and the skills needed to work with the course material and that indicates that the student has met the basic requirements for completing assigned work and participating in class activities.

D+, D, D-
Earned by work that is unsatisfactory but that indicates some minimal command of course material and some minimal participation in the class activities that is worthy of course credit toward the degree.

E
Earned by work that is unsatisfactory and not to the level of achieving course credit towards the degree.