BI582 Seminar in Biology – Spring 2018
“Sex, sexes, and sexual phenotypes”

Prof. Karen Warkentin (kwarken@bu.edu)
2 credits, one weekly discussion, Wed. 8:00-9:45 am, BRB 219
Selected primary and review papers and book chapters

The evolutionary and developmental biology of sex is full of fascinating questions on many levels. How did sex evolve? Why are there usually, but not always, two sexes – and what is “a sex”? What maintains sexual reproduction given the advantages of asexuality and the option of facultative sex? How have the diverse mechanisms of sex determination evolved and how do they work? Why and how can individuals of some species change sex, while other species do not? How do sexually differentiated phenotypes evolve and develop? What drives evolutionary patterns of sex role divergence, convergence, and reversal? Why do some animals perform same-sex or otherwise non-reproductive sexual behavior? How is environmental change affecting sexual development?

We will address a set of such questions, drawing our readings from recent syntheses of long-standing research areas focused on classic problems as well as from new research that challenges conventional perspectives. The specific set of topics for discussion, time allocation to topics, and papers to read will be determined with input from seminar participants – see (non-exhaustive) list of potential topics on P. 2. Readings will be posted on the shared course Google Drive, accessible through the BU Google site.

This is a graduate-level Biology Seminar that is open to senior undergraduates and graduate students from other programs. Students must possess sufficient biological background in evolution, development, and/or behavior to engage deeply with the readings and discussions plus a commitment to active participation.

Grading will be based on participation including contributions to weekly discussions, finding and choosing readings in collaboration with Prof. Warkentin, and leading discussions. You are expected to read carefully, think deeply, and share your thoughts each class. For the week you help lead, we’ll go through a several stage process as follows:

1) We’ll meet to focus our topic area (Wed after class or earlier if needed).
2) We’ll each do a literature search to identify candidate papers or chapters in the topic area and share them in pdf (via Google Drive “candidate readings” folders).
3) We’ll both skim candidate readings to narrow them down to a small number of finalists.
4) We’ll both read finalists and select readings for the class, meeting in-person or possibly communicating by email if the choice is easy. We’ll normally decide readings by Friday.
5) We’ll re-read the selected papers carefully and meet to discuss them prior to our class, to plan the discussion (usually on Monday or Tuesday).
6) You’ll help facilitate (lead or co-lead) our group discussion of the papers. This should not be a presentation of the material in the papers, but rather an effort to guide the group through collective consideration and discussion of the material.
BI582 – Potential Topics for Discussion

Week 1. How did sex evolve? – Evolution of meiosis, origin of sex

Why is sex so common?
Paradox and cost of sex, evolution of facultative & obligate sex, frequency of sex. Models & empirical tests.

What are sexes & why are there sexes?
– What are “sexes” & complications thereof – multiple origins of “males”, conditions for and reversibility of evolution of anisogamy/isogamy, variable systems of mitochondrial inheritance, variable numbers of self-incompatible mating types, etc.

Sex determination systems: Why so many ways of doing it?
– Sex determination mechanisms: environmental, genetic, mixed, transitions among; how they work & how they evolve; selection on sex determination mechanisms
– Offspring sex ratio plasticity & how that relates to sex determination mechanisms
– Gonochorism, hermaphrodism, sex change; mating & social systems, behavioral ecology of hermaphrodites vs. gonochorists

Sexual selection and evolution of sex differences and roles
– Problems with the classic Trivers/Bateman theory on sex role divergence, recent critiques, failed replication, alternatives, arguments against the critiques, etc.
– Types of sexual selection & their evolutionary consequences
– Context-dependence of sexual selection w/ environmental variation, plasticity
– Sex role diversity; evolutionary transitions in sex roles & in sexual dimorphism; evolution of male/female/biparental care
– Alternative strategies & sexual variation – condition-dependent (plastic) and genetic, etc.

Cooperative breeding
– Evolution of cooperative breeding, implications of cooperative breeding for selection on males & females, humans as cooperative breeders, etc.

Phenotypic plasticity: sex as a reaction norm
– Diversity of, transitions among, layering of sex determination mechanisms; congruence across elements of sexual phenotypes; epigenetics, hormones, maternal and social influences; alternative phenotypes; environmental effects on sexual development (endocrine disruption); human sexual development / variations; cross-sexual transfer of traits; etc.

Animal sexual diversity: evolution of non-reproductive sex & same-sex sexual behavior
– Prevalence, diversity, context and function of non-reproductive sexual behavior in animals, including same-sex sexual behavior and pair-bonding; evolutionary implications
– Primate mating system diversity & evolution, concealed ovulation, orgasm, socio-sexual behavior

Do (human) brains have a sex?
– critical analysis of brain sex research, brain plasticity, mosaic brain studies
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Seminar discussion schedule – final reading list

1 – 24 Jan.  Origin of sex

2 – 31 Jan.  Why is sex so common?

3 – 7 Feb.  Why are there different sexes?

4 – 14 Feb.  Evolution of sex determination systems
5 – 21 Feb.  **Mechanisms underlying sex determination**  

6 – 28 Feb.  **Sex roles: how do sexes become different (or not)?**  

Spring break – No class on March 7th.

7 – 14 Mar.  **Sexual selection & alternative causes of sexual dimorphism & ornamentation**  

8 – 21 Mar.  **Alternative reproductive tactics**  
Weir LK, Kindsvater HK, Young KA, Reynolds JD. 2016. Sneaker males affect fighter male body size and sexual size dimorphism in salmon. *Amer Nat* 188:264–271

9 – 28 Mar.  **Cooperative breeding**  
**10 – 4 Apr.  Brain sex (or not)**

**11 – 11 Apr.  Non-reproductive sexual behavior**

Substitute Monday schedule on April 18th – no class.

**12 – 25 Apr.  Same-sex sexual behavior**
MacFarlane GR, Blomberg SP, Vasey PL. 2010. Homosexual behavior in birds: frequency of expression is related to parental care disparity between the sexes. *Anim Behav* 80:375–390

**13 – 2 May  Human sexual diversity**