FREC 5164
Population Genomics
Spring 2019
Tues/Thurs 12:30am - 1:45pm
Cheatham Hall Room 218

I. DESCRIPTION

Contemporary sequencing, genotyping, and analytical approaches to understanding the causes and consequences of genomic variation that impinges on fitness, productivity, and health of natural and managed populations of plants and animals. Neutral population and evolutionary genetic processes, methods to identify the molecular targets of natural selection, genetic variation relevant to fitness-related traits, software tools for genomic data analysis in a population genetic context.

II. PREREQUISITES

No specific prerequisites, however, some background in evolutionary biology or population genetics will be an asset.

III. EDUCATIONAL OBJECTIVES

Having successfully completed this course, the student will be able to:

- Explain the principles of population genetics
- Describe the experimental techniques of modern genomics and their applications to ecological and evolutionary questions
- Discuss how genomics can be used to address fundamental and applied questions relevant to populations and species
- Implement population genetic analyses using appropriate software
- Demonstrate mastery of communications skills through execution of data analysis or a mock grant proposal on a chosen population genomics-related topic

IV. INSTRUCTOR

Jason Holliday, 451 Latham Hall, 231-7267, **jah1@vt.edu**, office hours: by appointment

V. TEXTS AND SPECIAL TEACHING AIDS

A variety of readings will be provided from the primary literature.

VI. GRADING

Mid-term exam	20%
Final exam	30%
Individual project	30%
Final presentation	10%
Participation	10%

VII. PARTICIPATION

Each week, the instructor will provide a lecture on a particular topic in the field, which will be followed by a class discussion of 1-2 relevant papers from the literature. While all are expected to participate in the discussion, students will take turns summarizing the assigned readings and leading the discussion. Paper summaries should include the following:

1. A brief definition of the topic or problem addressed by the paper,
2. A brief summary of methods and results,
3. Implications of the findings, and

4. Your own evaluation, as appropriate, of experimental design, data analysis, implications, etc.

VIII. INDIVIDUAL PROJECT AND FINAL PRESENTATIONS

Students will be responsible for a final project that may take one of two forms: a mock grant proposal related to a population genomics question **OR** a population genomic analysis/interpretation of a data set. In the second case, data may be from the student's own research (but the analysis should not be central to the thesis/dissertation) or from publically available sources. In addition to a written paper, students will each give a brief (10-15min) oral presentation on their chosen topic. **The paper will be due at the time of the oral presentation.** More details on the expectations for this project will be given in class.

IX. DISABILITY STATEMENT

Any student who feels that s/he may need an accommodation because of a disability please see the instructor.

X. SYLLABUS (Subject to change)

Week 1
- Introduction to population genetics and genomics

Week 2
- Polymorphism, genetic markers, high throughput sequencing and genotyping

Week 3
- Genetic drift, gene flow and population subdivision

Week 4
- Linkage disequilibrium

Week 5
- Neural theory of molecular evolution

Week 6
- Detecting selection in sequence data

Week 7
- Detecting selection in sequence data

Week 8
- Spring break

Week 9
- Mid-term exam
- Demographic forces shaping patterns of variation

Week 10
- Association mapping

Week 11
- Association mapping

Week 12
- Landscape genomics

Week 13
- Software tools

Week 14
- Software tools

Week 15
- Student presentations

Week 16
- Student presentations