Course Syllabus

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**Human Genetics 544:  Basic Concepts in Population and Statistical Genetics**

**Fall 2020 Syllabus**

**Description**:  The course will cover concepts and analytic methods for studying variation in natural populations.  The topics covered include the distribution of genetic variation, major forces of genetic stability and change, population genetics, quantitative genetics, and human population genetics.  We introduce the basic models of population, quantitative, and statistical genetics with an emphasis on understanding the hypotheses, experiments, and discussion of contemporary scientific literature in the field.  The focus is on human genetics research, however, much of the material is broadly useful and applies to natural populations of other species.

**Course objectives:**

* Develop an understanding of basic concepts in population and statistical genetics.
* Apply that knowledge to real-world situations and current research questions.

**Textbook:***Human Population Genetics.* John H. Relethford.  2012. PDF is available at: [Human Population Genetics Relethford.pdf](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1)

**On-line population simulation website:** University of Pittsburgh, [Genetic Simulator (Links to an external site.)](http://popgensimulator.pitt.edu/graphs/allele).

**• The Textbook PDF and ALL papers and materials are in Column Section "Files".**

**•  The in-person class meets in Medical Science II 3817, Monday and Wednesday, 4PM- 5PM.**

**•  The Zoom conference ID number for class is 950-4115-9261**

**Schedule:**

*Topic 1. Introduction to Population Genetics.* Aug 31-Sept 3  (Burke)
              •  [Textbook](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1) Chapter 1: **Genetic, Mathematical, and Anthropological Background**

              • **Genetic, Mathematical, and Anthropological Background:** [Lecture](https://umich.instructure.com/courses/375819/files/16154164/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/16154171/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Aug 31/[Sept 1](https://umich.instructure.com/courses/375819/files/16154171/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus)

              • [Quiz 1](https://umich.instructure.com/courses/375819/files/16223805/download?wrap=1) and [Paper 1](https://umich.instructure.com/courses/375819/files/16020719/download?wrap=1)+ [Paper 2](https://umich.instructure.com/courses/375819/files/16023219/download?wrap=1) discussion. Sept 2/[Sept 3](https://umich.instructure.com/courses/375819/files/16196098/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus)

*Topic 2. Displays of Quantitative Data*.  Sept 9 -14 (Burke)

             •  **Understanding Graphs and Displays in Pop Gen Papers:**[Lecture](https://umich.instructure.com/courses/375819/files/16286192/download?wrap=1) and content [discussion](https://umich.instructure.com/courses/375819/files/16290296/download?wrap=1" \o "Recording 9/9.mp4)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Sept 9.

             • [Quiz 2](https://umich.instructure.com/courses/375819/files/16404015/download?wrap=1). Sept 14

             • [Paper](https://umich.instructure.com/courses/375819/files/16022860/download?wrap=1) and group [discussion](https://umich.instructure.com/courses/375819/files/16381249/download?wrap=1" \o "Recording 9/14.mp4)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus)[[A](https://umich.instructure.com/courses/375819/files/16394167/download?wrap=1) [B](https://umich.instructure.com/courses/375819/files/16554912/download?wrap=1) [C](https://umich.instructure.com/courses/375819/files/16554704/download?wrap=1) [D](https://umich.instructure.com/courses/375819/files/16394166/download?wrap=1)]. Sept 14.

*Topic 3. Hardy-Weinberg Equilibrium.* Sept 16-Sept 21 (Burke)

            •  [Textbook](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1) Chapter 2: **Hardy-Weinberg Equilibrium**

            •  **Hardy-Weinberg Equilibrium**: [Lecture](https://umich.instructure.com/courses/375819/files/16416630/download?wrap=1) and content [discussion](https://umich.instructure.com/courses/375819/files/16432023/download?wrap=1" \o "Recording 9/16.mp4)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Sept 16.

            • [Quiz 3](https://umich.instructure.com/courses/375819/files/16521722/download?wrap=1). Sept 21

            • [Paper](https://umich.instructure.com/courses/375819/files/16368703/download?wrap=1) and group [discussion](https://umich.instructure.com/courses/375819/files/16557548/download?wrap=1" \o "Recording 9/21.mp4)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus)[A [B](https://umich.instructure.com/courses/375819/files/16554874/download?wrap=1) [C](https://umich.instructure.com/courses/375819/files/16554666/download?wrap=1) D]. Sept 21.

            • Links to Pop Gen simulation [websites](https://umich.instructure.com/courses/375819/files/16416868/download?wrap=1).

*Topic 4. Inbreeding*.  Sept 23-Sept 28 (Burke)

            • [Textbook](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1) Chapter 3: **Inbreeding**

            • **Inbreeding**: [Lecture](https://umich.instructure.com/courses/375819/files/16591790/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/16596400/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Sept 23

            • [Quiz 4.](https://umich.instructure.com/courses/375819/files/16699157/download?wrap=1) Sept 28.

            • [Paper](https://umich.instructure.com/courses/375819/files/16557498/download?wrap=1) and [group discussion](https://umich.instructure.com/courses/375819/files/16729833/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus)[[A](https://umich.instructure.com/courses/375819/files/16731617/download?wrap=1) [B](https://umich.instructure.com/courses/375819/files/16731616/download?wrap=1) [C](https://umich.instructure.com/courses/375819/files/16731614/download?wrap=1) [D](https://umich.instructure.com/courses/375819/files/16731613/download?wrap=1)]. Sept 28.

*Topic 5. Mutation*. Sept 30 - Oct 5 (Burke)

             •  [Textbook](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1) Chapter 4: **Mutation**

             • **Mutation**: [Lecture](https://umich.instructure.com/courses/375819/files/16762406/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/16766845/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Sept 30

             • [Quiz 5](https://umich.instructure.com/courses/375819/files/16959949/download?wrap=1). Oct 5.

             • [Paper](https://umich.instructure.com/courses/375819/files/16649512/download?wrap=1) and group discussion [[A](https://umich.instructure.com/courses/375819/files/16937595/download?wrap=1) [B](https://umich.instructure.com/courses/375819/files/16937526/download?wrap=1) [C](https://umich.instructure.com/courses/375819/files/16937593/download?wrap=1) [D](https://umich.instructure.com/courses/375819/files/16937590/download?wrap=1)]. Oct 5.

*Topic 6. Genetic Drift.* Oct 7-Oct 12 (Burke)

           •  [Textbook](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1) Chapter 5: **Genetic Drift [BUT, not including *Section V: Coalescent theory*]**

           • **Genetic Drift**: [Lecture](https://umich.instructure.com/courses/375819/files/16937500/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/16945720/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Oct 7

            • [Quiz 6](https://umich.instructure.com/courses/375819/files/17133187/download?wrap=1). Oct 12.

            • [Paper](https://umich.instructure.com/courses/375819/files/16473656/download?wrap=1) and group discussion [[A](https://umich.instructure.com/courses/375819/files/17072180/download?wrap=1) [B](https://umich.instructure.com/courses/375819/files/17072176/download?wrap=1) [C](https://umich.instructure.com/courses/375819/files/17072175/download?wrap=1) [D](https://umich.instructure.com/courses/375819/files/17072177/download?wrap=1)]. Oct 12.

*Topic 7. Natural Selection.* Oct 14-Oct 19 (Burke)

           •  [Textbook](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1) Chapters 6 & 7: **Natural Selection**

           • **Natural Selection**: [Lecture](https://umich.instructure.com/courses/375819/files/17081011/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/17110043/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Oct 14

           • [Quiz 7.](https://umich.instructure.com/courses/375819/files/17243181/download?wrap=1) Oct 19.

           • [Paper](https://umich.instructure.com/courses/375819/files/17048015/download?wrap=1) and group discussion [[A](https://umich.instructure.com/courses/375819/files/17327940/download?wrap=1) [B](https://umich.instructure.com/courses/375819/files/17316569/download?wrap=1) [C](https://umich.instructure.com/courses/375819/files/17316571/download?wrap=1) [D](https://umich.instructure.com/courses/375819/files/17316573/download?wrap=1)]. Oct 19.

*Topic 8*. Gene Flow and Population Structure. Oct 21 (Burke)

          •  [Textbook](https://umich.instructure.com/courses/375819/files/16004907/download?wrap=1) Chapter 8: **Gene Flow and Population Structure**

          • **Gene Flow and Population Structure**: [Lecture](https://umich.instructure.com/courses/375819/files/17263898/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/17268214/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Oct 21

          • [Paper.](https://umich.instructure.com/courses/375819/files/17238412/download?wrap=1)  [NOTE: **no** group presentations for this paper topic]

 *[Mid term Exam.](https://umich.instructure.com/courses/375819/files/17363088/download?wrap=1" \o "MIdTerm2020.docx)* October 26. Exam during class time 4-5PM. Please allot 1 hour for taking the exam.

*Topic 9.  Human population history.* Oct 28 - Nov 2 (Kidd)

          • **Human population history:** [Lecture](https://umich.instructure.com/courses/375819/files/17408415/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/17418927/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Oct 28

         • [Quiz 9](https://umich.instructure.com/courses/375819/files/17516911/download?wrap=1). Nov 2.

          • [Paper](https://umich.instructure.com/courses/375819/files/17407991/download?wrap=1) and [group discussion](https://umich.instructure.com/courses/375819/files/17519521/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus)[A B C D]. Nov 2

*Topic 10. Ancestry: concepts of race, ethnicity, and eugenics.* Nov 4-Nov 9 (Kidd)

          • **Concepts of race, ethnicity, and eugenics**: [Lecture](https://umich.instructure.com/courses/375819/files/17559151/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/17561689/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Nov 4.

          • [Quiz 10](https://umich.instructure.com/courses/375819/files/17717340/download?wrap=1). Nov 9.

          • [Paper](https://umich.instructure.com/courses/375819/files/17575512/download?wrap=1) (and [revision](https://umich.instructure.com/courses/375819/files/17575514/download?wrap=1)) and group discussion [A B C D]. Nov 9.

*Topic 11. Gene constraints.* Nov 11-Nov 16 (Kitzman) \*\* ALL REMOTE \*\*

          • **Gene constraints:** [Lecture](https://umich.instructure.com/courses/375819/files/17700253/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/17749972/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Nov 11.

          • [Quiz 11](https://umich.instructure.com/courses/375819/files/17802266/download?wrap=1). Nov 16.

          • [Paper](https://umich.instructure.com/courses/375819/files/17700265/download?wrap=1) ([supplement](https://umich.instructure.com/courses/375819/files/17700285/download?wrap=1)) and group discussion [A B C D]. Nov 16.

*Topic 12. Selection in human populations*. Nov 18-Nov 30 (Mueller)

          • **Selection in human populations:** [Lecture](https://umich.instructure.com/courses/375819/files/17855074/download?wrap=1) and [content discussion](https://umich.instructure.com/courses/375819/files/17855069/download?wrap=1)[Play media comment.](https://umich.instructure.com/courses/375819/assignments/syllabus). Nov 18.

          • Quiz 12. Nov 30.

          • [Paper](https://umich.instructure.com/courses/375819/files/17840005/download?wrap=1) and group discussion [A B C D]. Nov 30.

 [November 21 through 27 is Thanksgiving break. NO MONDAY or WEDNESDAY class that week.]

*Group presentation - presentation week.* Dec 1 & Dec 11

ALL Remote. Pairwise presentations. Final video recorded submission and PowerPoint slides are due on DECEMBER 11.

**Grading:**

Quizzes = 12 - remove the lowest 2 = 25% of grade
Midterm exam = 25% of grade
Group presentations = 25% of grade
Final Presentations = 25% of grade