

## Population Genetics, BIOL 4395

Summer I: June 8 – July 2, 2020

Online Course

Instructor: Dr. Philip Lavretsky

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### Recommended textbooks for the course:

Halliburton, Richard. 2004. Introduction to Population Genetics. Pearson Prentice Hall.

Gillespie, John H. Population Genetics: A Concise Guide. Johns Hopkins University Press.

Falconer, Douglas S. & Mackay, Trudy F.C. Introduction to Quantitative Genetics. Pearson Education Limited.

\*\* A computer and calculator will also be needed.

### Course Description:

Broadly defined as the study of the genetic composition of populations, population genetics attempts to quantify the distribution of genetic variation and changes in the frequencies of alleles. Specifically, we will examine how the four evolutionary processes (mutation, genetic drift, natural selection, and gene flow) affect the genetic composition of natural populations. Population genetics has a large theoretical component and is rich in empirical data that we will be exploring through lectures and labs, respectively. Students will get hands-on experience analyzing Sanger and Next-Generation Sequencing data that will include humans, model organisms (e.g., *Drosophila*), and non-model organisms; although, students are encouraged to bring their own data as well.

The lab component will focus on methods of analyzing genetic data. We will analyze real data sets using a variety of computer programs. Each lab is designed to correspond with the lecture topic for that week, which will reinforce those concepts.

### Grading:

Quizzes (4 total)	40 pts (10%)
Midterm	100 pts (25%)
Final	100 pts (25%)
<u>Labs (8 total)</u>	<u>160 pts (40%)</u>
<b>Total for students:</b>	<b>400 pts</b>

**Grades** will be assigned as: 90+% = A, 80-89% = B, 70-79% = C, 60-69% = D, <60% = F.

### Quizzes (10%):

There will be 4 10-pt quizzes. Quizzes will each consist of approximately 5-10 questions evenly divided across the weeks lecture material. You are permitted to use a calculator and a list of relevant formulae will be provided. Exams will be open for a week, however, you will only have one opportunity to take each quiz and with inability to start and stop them. You will have 20 minutes to take each quiz. **Quizzes consistent of multiple choice, problem solving, and short & long-answer questions. You need to know the lecture material to complete these quizzes in allotted time.**

### Exams (50%):

There will be two 100-pt exams. Exams will be online and you will need to use the **Respondus Lockdown Browser on Black Board**. Exams will be open for a week, however, you will only have one opportunity to take each exam and with inability to start and stop them. You will have 90 minutes to take

each exam. Exams will each consist of true/false, multiple choice, and short answer. You need to know the lecture material to complete this exam in the allotted time.

Labs (40%):

You will have a total of 8 labs (2 per week) worth 20 points each (total = 160 pts). Students are expected to follow and complete computational lab protocols. There will be 2 labs per week (except for the last week) with a due date of midnight for that week's Friday. **5 points will be deducted for each day late.**

Missed Due Date(s) Policy:

If you miss quizzes or assignments due to illness or death of a family member or close friend, you must (1) notify me prior to the exam (in exceptional cases, I will wave this requirement) and (2) provide an official record of a visit to the doctor or an obituary. Otherwise, you will earn zero points for the missed quizzes/assignments.

Academic Integrity:

Cheating or plagiarism will not be tolerated. The university gives students and faculty guidelines on how to deal with violations of academic integrity, which we expect you to follow and I will follow myself (you can read them at <http://sa.utep.edu/osccr/academic-integrity/>). This policy exists to level the playing field for all students and not give the few cheaters an unfair advantage over the vast majority of students, who are hard-working and honest. Copying from a peer is easy to detect and will be considered as plagiarism.

Special needs and circumstances:

If you need any special accommodations please let me know at the beginning of the class and/or register with the [Center for Accommodations and Support Services](#). Also, if you run into personal problems beyond your control, please let me know before missing a deadline etc. I will try to be accommodating and understanding. Letting me know about problems after you missed a deadline or failed an assignment usually suggests that you are making an excuse. For the official policies on academic integrity and scholastic dishonesty, please refer to [Handbook of Operating Procedures](#).

**Campus Carry:** Persons holding a Concealed Handgun License can lawfully carry their handgun into a UTEP classroom as long as the gun remains concealed. Open carry remains prohibited on campus. In other words, none of us should see (or be able to tell that there is) a gun at UTEP. Call the University Police at 747-5611 or dial 911 if you see any individual on campus with a handgun or other type of weapon. For more information on campus carry, see [<http://sa.utep.edu/campuscarry/>]; for more information on overall campus safety, see [<http://admin.utep.edu/emergency/>].

<b>WEEK</b>	<b>Lecture Topic</b>	<b>LAB</b>	<b>EXAM</b>
<b>WEEK 1 (June 8-12)</b>	Lectures 1 ( <u>Videos 1-2</u> ): Introduction; What is Population Genetics? Lecture 2 ( <u>Videos 3-4</u> ): Genetic Variation, Hardy-Weinberg Principle & Linkage Disequilibrium Lecture 3( <u>Video 6</u> ): Pop structure & Differentiation (F stats, Phist), etc. Lecture 4 ( <u>Videos 7 &amp; 8</u> ): Mutation & Genetic Drift  <b>**Example HW-EQ Problem Solving in Video 5</b>	Lab 1: GenBank Lab  Lab 2: Quantifying genetic variation  <b>**Both due by <u>June 12</u> @ midnight</b>	<b>QUIZ 1</b> <b>** due by <u>June 12</u> @ midnight</b>
<b>WEEK 2 (June 15-19)</b>	Lecture 5 ( <u>Video 9</u> ): Migration & Gene Flow Lecture 6 ( <u>Video 10</u> ): Effective Population Size Lecture 7 ( <u>Video 11</u> ): Linkage DisEq	Lab 3: Types of Mutations  Lab 4: Recombination  <b>**Both due by <u>June 19</u> @ midnight</b>	<b>QUIZ 2</b> <b>** due by <u>June 19</u> @ midnight</b>
<b>WEEK 3 (June 22-26)</b>	Lecture 8 ( <u>Video 12</u> ): Coalescent Theory Lecture 9 ( <u>Video 13</u> ): Neutral Theory Lecture 10 ( <u>Videos 14-16</u> ): Selection	Lab 5: Constructing genealogies  Lab 6: Population subdivision  <b>**Both due by <u>June 26</u> @ midnight</b>	<b>QUIZ 3</b> <b>** due by <u>June 26</u> @ midnight</b>  <b>OPEN TO TAKE JUNE 22 &amp; 23 → EXAM 1 (Material Covering Lectures 1-7 : VIDEOS 1-11)</b>
<b>WEEK 4 (June 29 – July 3)</b>	Lecture 11 ( <u>Video 17</u> ): Forensic Science Lecture 12 ( <u>Video 18</u> ): Quantitative Genetics Lecture 13 ( <u>Video 19</u> ): Phylogenetics Lecture 14 ( <u>Video 20</u> ): Population Genomics	Lab 7: Natural selection Recombination  Lab 8: Forensics Lab  <b>**Both due by <u>July 3</u> @ midnight</b>	<b>QUIZ 4</b> <b>** due by <u>July 3</u> @ midnight</b>
<b><u>July 4-6</u></b>	<b>NO LECTURES</b>	<b>NO LAB</b>	<b>OPEN TO TAKE EXAM 2 (Material Covering Lectures 8-14: VIDEOS 12-20)</b>

Software may/will be used during labs

1. Arlequin 3.5 (<http://cmpg.unibe.ch/software/arlequin35/Arl35Downloads.html>)
2. DNAsp v5 (<http://www.ub.edu/dnasp/>)
3. MEGA5 (<http://www.megasoftware.net/>)
4. Network 4.610 (<http://www.fluxus-engineering.com/sharenet.htm>)
5. PHASE (<http://stephenslab.uchicago.edu/phase/download.html>)
6. MrBayes (<http://mrbayes.sourceforge.net/>)
7. testing for recombination program ....there are many (TBA)
8. MS (<http://home.uchicago.edu/~rhudson1/source/mksamples.html>)
9. IM & IMA2 (<https://bio.cst.temple.edu/~hey/software/software.htm>)
10. STRUCTURE 2.3.3  
([http://pritch.bsd.uchicago.edu/structure\\_software/release\\_versions/v2.3.3/html/structure.html](http://pritch.bsd.uchicago.edu/structure_software/release_versions/v2.3.3/html/structure.html))
11. R programs – e.g., PopGenome, PCA, adagenet
12. BayeScan (<http://cmpg.unibe.ch/software/BayeScan/>)
13. *dadi* (<https://bitbucket.org/gutenkunstlab/dadi>)
14. Stacks (<http://catchenlab.life.illinois.edu/stacks/>)
15. .... Other types of programs