NOTE to STUDENTS: If you need any accommodations related to attending/enrolling in this course, please contact one of the Graduate School's 504 Coordinators, Cheryl Spitzenberger or Natalie Sirisaengtaksin. We ask that you notify GSBS in advance (preferably at least 3 days before the start of the semester) so we can make appropriate arrangements.

Term and Year **Spring 2022** Course Number and Course Title: **GS11 1123: Population Genetics** **(Cross listed with UTHealth School of Public Health PH1984)** Credit Hours: **3** Meeting Location: **UTHealth School of Public Health Building/Room #102B, RAS Building, 1200 Pressler St. , Houston** WebEx/Zoom Link:	Program Required Course: Yes **X No** Approval Code: **X Yes** No **(If yes,** the Course Director or the Course Designee will provide the approval code.) Audit Permitted: **X Yes** No Classes Begin: **January 11, 2022** Classes End: **April 26, 2022** Final Exam Week: **May 2-6, 2022**

Class Meeting Schedule

Day	Time
Tuesday	**2:00 – 4:50 pm**

Course Director
Name and Degree: **Yun-xin Fu, PhD**

Title: Professor

Department: Dept. Biostatistics and Data Science, UTHealth School of Public Health

Institution: **X *UTH*** *MDACC*

Email Address: Yunxin.Fu@uth.tmc.edu

Contact Number: 713-500-9813

Course Co-Director/s: (if any) – **N/A**

NOTE: Office hours are available by request. Please email me and cc: Sara.A.Barton@uth.tmc.edu to arrange a time to meet.

Teaching Assistant: (if any) – **N/A**

This course is offered in the Spring semester every year and will provide basic principles for understanding factors that govern the evolution of DNA and protein sequences. This course is intended for masters and doctoral level students. Course requirements will be the same for masters and doctoral level students.

This course is designed to help students to understand the fundamentals of theoretical population genetics and to be able to apply such knowledge in analyzing DNA samples from population genetics or epidemiological studies. Specifically, at the end of the course students should be able to (1) to understand allele frequency and how it is affected by various evolutionary forces, such as mutation, population division, random genetic drift, inbreeding and natural selection; (2) to understand linkage disequilibrium and dynamics, and be able to apply theory for analyzing linkage disequilibrium patterns in natural populations, such as humans; (3) to understand the fundamentals of quantita-tive genetics and be able to apply to the study of important traits in humans; and (4) to understand the fundamentals of coalescent theory and statistical properties of some fundamental summary statistics, and be able to apply statistical methods based on coalescent for analyzing DNA samples from natural populations.

This course will discuss the principles of population genetics and their applications to human populations as well as statistical methods for analyzing genetic samples of individuals from one or more populations. Topics to be covered include random mating, linkage, inbreeding, natural selection, maintenance of polymorphic and deleterious genes, molecular evolution, quantitative genetics and a modern population genetics approach known as coalescent theory, the cornerstone for analyzing DNA sequence samples from populations. Topics may vary from year to year with the background of the students. Studies at the molecular level will be emphasized.

- This course satisfies part of the Bioinformatics breadth.
- This course is an acceptable Epidemiology elective.

Textbook/Supplemental Reading Materials (if any)

Do not purchase - these texts are on reserve in the UTHealth School of Public Health Library, RAS Building, 1st floor

- Hartl D.L. and Clark, A. G. 2007. *Principles of Population Genetics*. 4th Edition. Sunderland, MA: Sinauer Assoc. Inc.

Course Objective/s:

Upon successful completion of this course, students are expected to gain adequate knowledge in several key areas of population genetics for taking more advanced courses in population genetics.

***Specific Learning Objectives*:**

The learning objectives of this course are to understand the fundamentals of theoretical population genetics and to be able to apply such knowledge for analyzing DNA samples from a population. Specifically:

(1) to understand allele frequency and how it is affected by various evolutionary forces, such as mutation, population division, random genetic drift and selection;
(2) to understand linkage disequilibrium and dynamics;
(3) to understand the fundamentals of quantitative genetics and
(4) to understand and be able to use coalescent theory and its derived methods for analyzing DNA samples.

Student responsibilities and expectations:

Students enrolled in this course are expected to attend and participate in all class lectures and complete homework assignments which will be graded and returned to the student anopen book mid-term and final examinations.

Handouts will be in either Power Point or PDF format; students are expected to have access to computers with Power Point and Adobe Acrobat reader.

Students may work and discuss all course materials and assignments in groups, all writing assignments must be your own. Plagiarism and failure to properly cite scientific literature and other sources will not be tolerated and are grounds for dismissal from the course and further GSBS disciplinary action. Cheating or engaging in unethical behavior during examinations (mid-term and final) will be grounds for dismissal from the course without credit and further GSBS disciplinary action.

Students are expected to prepare for and take an open book mid-term and final examination.

Grading System: **Letter Grade (A-F)**	
Student Assessment and Grading Criteria : (May include the following:)	
Homework/presentation (25%)	Description: **A number of graded home work assignments will be given**
Midterm Exams (35%)	Description: **Open book in-class exam**
Final Exam (35%)	Description: **Open book in-class exam**
Participation and/or Attendance (5%)	Description: **Students are expected to attend class**

CLASS SCHEDULE

Day/Date	Duration (Hr)	Lecture Topic	Lecturer
Jan 11	2:00 - 4:50 pm	Nature of genetic variation and population genetics	Yun-xin Fu, PhD
Jan 18	2:00 - 4:50 pm	Allele frequency under mutations	Yun-xin Fu, PhD
Jan 25	2:00 - 4:50 pm	Linkage disequilibrium	Yun-xin Fu, PhD
Feb 01	2:00 - 4:50 pm	Random genetic drift	Yun-xin Fu, PhD
Feb 08	2:00 - 4:50 pm	Inbreeding	Yun-xin Fu, PhD
Feb 15	2:00 - 4:50 pm	Population structure	Yun-xin Fu, PhD
Feb 22	2:00 - 4:50 pm	Natural selection	Yun-xin Fu, PhD
Mar 01	2:00 - 4:50 pm	Coalescent theory and application – 1	Yun-xin Fu, PhD
Mar 08	2:00 - 4:50 pm	Mid-term exam	Yun-xin Fu,PhD
Mar 15	2:00 - 4:50 pm	No class - Spring Break	n/a
Mar 22	2:00 - 4:50 pm	Coalescent theory and application – 2	Yun-xin Fu, PhD
Mar 29	2:00 - 4:50 pm	Coalescent theory and application – 3	Yun-xin Fu, PhD
Apr 05	2:00 -	Coalescent theory and application – 4	Yun-xin Fu, PhD

	4:50 pm		
Apr 12	2:00 - 4:50 pm	Coalescent theory and application – 5	Yun-xin Fu, PhD
Apr 19	2:00 - 4:50 pm	Coalescent theory and application – 6	Yun-xin Fu, PhD
Apr 26	2:00 - 4:50 pm	Literature study/review for the final	Yun-xin Fu, PhD
May 03	2:00- 4:50 pm	Final examination (open book)	Yun-xin Fu, PhD

NOTE: This course is Cross-listed with UTHealth School of Public Health PH1984