IMPORTANT: This syllabus form should be submitted to OAA (gsbs_academic_affairs@uth.tmc.edu) a week before the start of each semester.

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 2025** Course Number and Course Title: **GS04 1253: Principles in Genetics & Epigenetics** Credit Hours**: 3** Meeting Location: **UT-MDACC/Basic Science Research Building (BSRB)** Building/Room#: **BSRB S3.8112 (Computer Lab)**	Program Required Course: **Yes** Approval Code: **No** **Audit Permitted: Yes** Classes Begin: **January 14, 2025** Classes End: **May 1, 2025** Final Exam Week: **May 5 – May 9, 2025** **No final exam**

Class Meeting Schedule

Days	Times
Tuesday & Thursday (Regular Sessions)	**10:00-11:30 am**
Tuesday and & Thursday (Sessions with additional Application Workshops)	**10:00-12:00 pm**

Course Director Name and Degree: **Ashish Kapoor, PhD** Title: **Associate Professor** Department: **IMM/Center for Human Genetics** Institution: **UTH** Email Address: ashish.kapoor@uth.tmc.edu Contact Number: **713-500-2439** **Course Co-Director/s:** Name and Degree: **Abhinav Jain, PhD** Title: **Associate Professor** Department: **Epigenetics and Molecular Carcinogenesis** Institution: **MDACC** Email Address: ajain@mdanderson.org Contact Number: **713-745-2640**	**Instructor/s (See attached Class Schedule)**

NOTE: Office hours are available by request. Please email to arrange a time to meet.

Teaching Assistant(s): (if any)

TA
Name and Email Address:
Rocio Rubiano
Rocio.R.Rubiano@uth.tmc.edu

Course Description:

Principles in Genetics and Epigenetics (PIGE) is designed for students who have a major interest in the aspects of experimental and human genetics, epigenetics, and genomics as they relate to human disease, including Mendelian disorders, complex diseases, cancer, and experimental model systems. This class will provide in-depth instruction in three areas:

1) Experimental genetics
2) Human genetics and genomics
3) Epigenetics and epigenomics

This course *fulfills a requirement of the Genetics & Epigenetics Graduate Program*.

Prerequisites: *Completion of the GSBS Core Course* or *equivalent* (***please contact one of the course directors to confirm prior equivalents***).

Didactic Lectures

Didactic lectures follow a natural progression and provide in-depth instruction on topics related to (1) experimental genetics, (2) human genetics and genomics, and (3) epigenetics and epigenomics.

Application Lectures

Short application lectures (3-4; 30 min each) by trainees, including senior graduate students and post-doctoral fellows in laboratories of participating faculty will follow selected lectures to highlight specific techniques and applications to the material covered in the primary lecture.

Course Format

The class will be held two times a week, generally for one and a half hours each class:
Tuesday & Thursday, 10:00-11:30 am in BSRB S3.8112 Computer Lab. On days when an additional **Application Lecture (30 min; 10:00 am-12:00 pm)** is included, there will be a brief break (5-10 min) between the primary lecture and the application lecture by a senior trainee in the lab of the primary lecturer also **in BSRB S3.8112 Computer Lab**.

Textbook/Supplemental Reading Materials

Lectures will draw from recommended and suggested readings, including landmark historic and contemporary papers, as well as review articles. *No textbook is required.*

Learning Objective/s:

As a *foundational course*, this course is designed to *introduce students to the basic principles in genetics and epigenetics* and *prepare the student to generate novel hypothesis-driven projects* as part of their own research in the areas of genetics and epigenetics inside and outside of G&E laboratories. The course *emphasizes active learning* through a combination of didactic lectures and selected application lectures.

***Specific Learning Objectives*:**

1. Obtain foundational knowledge in experimental and human genetics, epigenetics and genomics, and understand how to address specific questions in these broad areas using suitable experimental designs and techniques, and applying relevant bioinformatic tools.

2. Understand how to utilize, design, generate and use genetically engineered model organisms to answer specific research questions.

3. Gain a multifaceted understanding of advanced human genetics and genomics, including aspects of clinical genetics.

4. Learn to apply and utilize specific bioinformatics tools to analyze publicly available data and to generate new directions of investigation.

Student responsibilities and expectations:

Students enrolled in this course will be expected to perform the following activities each week:

1. Participate in and contribute to course discussions during the didactic lectures and review sessions.
2. Process and review material from each lecture and read 1 or 2 recommended seminal reviews related to the week's topic.
3. Read 1-2 recommended primary research articles before and/or after each lecture.
4. Attend and participate at the Application lectures.
5. Prepare for and complete weekly homework assignment based on course lectures and readings.

Students are expected to complete all assigned reading material (reviews and research literature). While you may work and discuss all course materials and assignments in groups, all writing assignments must be your own. *The use of AI-based resources (e.g., ChatGPT) is discouraged. However, if you elect to use them, you must clearly indicate when and where you used them and include references.* 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 for any assignments will be grounds for dismissal from the course without credit and further GSBS disciplinary action.

Grading System: **Letter Grade (A-F)**
Student Assessment and Grading Criteria : *(May include the following:)*

Percentage	Description
Homework (85%)	There will be weekly (every Friday) open-book homework assignments based on the material covered in each lecture, to be completed within 1 week (following Friday) of assignment. *There is no final exam.*
Attendance, Punctuality and or Participation (15 %)	Attendance, punctuality, and participation. Students are expected to actively participate in the course by initiating discussions, asking questions, and providing constructive comments.

CLASS SCHEDULE – Spring 2025

2025 Date, Day	Class #	Wk	Lecture Topic	Lecturer
January 14, Tu	1	1	Introduction: What is genetics & epigenetics?	Kapoor & Jain
January 16, Th	2		Chromosomes – Cytogenetics & its implications in biomedical research	Multani
January 21, Tu	3	2	Chromosomes and aneuploidy	Cole
January 23, Th	4		Gene structure & expression	Lee
January 28, Tu	5	3	Molecular basis of disease phenotype-genotype	Hixson
January 30, Th	6		Medical genetics services & clinical risk assessment	Singletary
February 4, Tu	7	4	Next generation DNA sequencing and its applications	Kapoor & TBD
February 6, Th	8		Bulk and single cell RNA-Seq, and applications	Thennavan
February 11, Tu	9	5	Current human genetic approaches to gene discovery for multifactorial disorders	Fornage
February 13, Th	10		Applications of genetic information to health outcomes in multifactorial disorders	Fornage
February 18, Tu	11	6	Genetic basis of cancer	Ge
February 20, Th	12		Oncogenes, tumor suppressor genes and cancer pathways	Vaishnavi
February 25, Tu	13	7	Tumor Heterogeneity and scOmics Approaches	Casasent
February 27, Th	14		Functional validation of variants in disease candidate genes	Karras & Pham
March 4, Tu	15	8	Non-coding genome variation	Kapoor
March 6, Th	16		CRISPR technologies	Hart
March 10-14		9	Spring Break – No class	
March 18, Tu	17	10	Model systems: genetic manipulation of mice	Wang
March 20, Th	18		Model systems: non-rodent animal models	Eisenhoffer
March 25, Tu	19	11	Epigenetics & expression of the genome	Cheng
March 27, Th	20		Genomic imprinting and X chromosome inactivation	Chen
April 1, Tu	21	12	Genome organization and gene expression regulation	Li
April 3, Th	22		Chromatin RNAs and gene expression regulation	Li
April 8, Tu	23	13	DNA methylation	Ting
April 10, Th	24		Epigenetics techniques: bench skills	Jain
April 15, Tu	25	14	Histone code: Writers & Erasers	Lee

April 17, Th	26		Histone code: Readers	Bedford
April 22, Tu	27	15	Non-coding RNAs	Calin
April 24, Th	28		Chromatin ATP-dependent remodelers & histone variants	Bartholomew
April 29, Tu	29	16	Epigenetic regulation of cardiovascular diseases	Gurha
May 1, Th	30		Clinical applications of epigenetic discoveries	Abbas
May 5-9			Final Exams Week – No Final Exam	

AK/jal