**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 the Graduate School's 504 Coordinator, Natalie Sirisaengtaksin, PhD. 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 2026**<br><br>Course Number and Course Title:<br>**GS04 1253: Principles in Genetics & Epigenetics**<br><br>**Credit Hours: 3**<br><br>Prerequisites: **GSBS Core Course or equivalence**<br><br>Meeting Location: **UT-MDACC/Basic Science Research Building (BSRB)**<br><br>Building/Room#: **BSRB S3.8367 (Gallick Classroom)** | **Program Required Course: Yes**<br><br>**Approval Code: No**<br><br>**Audit Permitted: Yes**<br><br>**Classes Begin: January 13, 2026**<br><br>**Classes End: April 30, 2026**<br><br>Final Exam Week: **May 4 – May 8, 2026; No final exam** |

**Class Meeting Schedule**

| Day | Time |
|---|---|
| **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**
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Contact Number: **713-500-2439**

**Course Co-Director/s:** (if any)
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 the end of the document)

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

**Teaching Assistant**:

Name and Email Address: **TBD**

**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 S3.8367 (Gallick Classroom)**. 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 S3.8367 (Gallick Classroom)**.

**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.*

**Course 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.<br>Students are expected to actively participate in the course by initiating discussions, asking questions, and providing constructive comments. |

| 2026<br>Date, Day | Class<br># | Wk | Lecture Topic | Lecturer |
|---|---|---|---|---|
| January 13, Tu | 1 | 1 | Introduction: What is genetics & epigenetics? | Kapoor & Jain |
| January 15, Th | 2 | | Gene structure & expression | Lee |
| January 20, Tu | 3 | 2 | Chromosomes and aneuploidy | Cole |
| January 22, Th | 4 | | Next generation DNA sequencing and its applications | Kapoor |
| January 27, Tu | 5 | 3 | Molecular basis of disease phenotype-genotype | Hixson |
| January 29, Th | 6 | | Medical genetics services & clinical risk assessment | Singletary |
| February 3, Tu | 7 | 4 | Current human genetic approaches to gene discovery for multifactorial disorders | Fornage |
| February 5, Th | 8 | | Applications of genetic information to health outcomes in multifactorial disorders | Fornage |
| February 10, Tu | 9 | 5 | Genetic basis of cancer | Ge |
| February 12, Th | 10 | | Oncogenes, tumor suppressor genes and cancer pathways | Vaishnavi |
| February 17, Tu | 11 | 6 | Bulk and single cell RNA-Seq, and applications | Casasent |
| February 19, Th | 12 | | Tumor Heterogeneity and scOmics Approaches | Casasent |
| February 24, Tu | 13 | 7 | Functional validation of variants in disease candidate genes | Karras & Pham |
| February 26, Th | 14 | | Non-coding genome variation | Kapoor |
| March 3, Tu | 15 | 8 | CRISPR technologies | Hart |
| March 5, Th | 16 | | TBD | TBD |
| March 9-13 | | 9 | Spring Break – No class | |
| March 17, Tu | 17 | 10 | Model systems: genetic manipulation of mice | Behringer & Quinne |
| March 19, Th | 18 | | Model systems: non-rodent animal models | Eisenhoffer |
| March 24, Tu | 19 | 11 | Epigenetics & expression of the genome | TBD |
| March 26, Th | 20 | | Epigenetics techniques: bench skills | Jain |
| March 31, Tu | 21 | 12 | DNA methylation | Ting |
| April 2, Th | 22 | | Histone code: Readers | Bedford |
| April 7, Tu | 23 | 13 | Histone code: Writers & Erasers | Lee |
| April 9, Th | 24 | | Genomic imprinting and X chromosome inactivation | Chen |
| April 14, Tu | 25 | 14 | Chromatin ATP-dependent remodelers & histone variants | Bartholomew |
| April 16, Th | 26 | | Non-coding RNAs | Calin |
| April 21, Tu | 27 | 15 | Genome organization and gene expression regulation | Li |
| April 23, Th | 28 | | Chromatin RNAs and gene expression regulation | Li |
| April 28, Tu | 29 | 16 | Epigenetic regulation of cardiovascular diseases | Gurha |
| April 30, Th | 30 | | Clinical applications of epigenetic discoveries | Abbas |
| May 4-8 | | | Final Exams Week – No Final Exam | |

## Course Directors


**Kapoor, Ashish – Class #1, 4, 14**

Director

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**Jain, Abhinav – Class #1, 20**

Co-Director

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## Teaching Assistant (TA)

**TBD – All classes**

## Lecturers (alphabetical order)

**Abbas, Hussein – Class #30**

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**Calin, George – Class #26**

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**Cole, Francesca – Class #3**

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**Hart, Traver – Class #15**

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**Hixson, James – Class #5**

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**Lee, Min-Gyu – Class #23**

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**Lee, Shih-Han "Peggy" – Class #2**

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