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: Summer 2026 Course Number and Course Title: **GS04 1201: Principles of Experimental Mouse Genetics** **Credit Hours:** 1 **Prerequisites:** N/A **Meeting Location:** Basis Science Rsrch Bldg. **Building/Room#:** BSRB S3.8112 **(GSBS Computer Room)**	**Program Required Course:** No **Approval Code:** No **Audit Permitted:** Yes **Classes Begin:** May 29, 2026 **Classes End:** July 24, 2026 **Final Exam Week:** July 31, 2026

Class Meeting Schedule

Day	Time
Friday	**10am-12pm**

Course Director

Name and Degree: **Fabien Delerue, PhD**

Title: Associate Professor

Department: Genetics

Institution: MDACC

Email Address: fdelerue@mdanderson.org

Contact Number: 832-748-7186

Course Co-Director:

Name and Degree: **N/A**

Title:

Department:

Institution:

Email Address:

Contact Number:

Instructors

1. **Fabien Delerue, PhD**
   Institution: MDACC
   Email Address: fdelerue@mdanderson.org
2. **Fernando Benavides, DVM, PhD**
   Institution: Barcelona University
   Email Address: Fernando.Benavides@uab.cat
3. **Richard Behringer, PhD**
   Institution: MDACC
   Email Address: rrb@mdanderson.org
4. **Aria Vaishnavi, PhD**
   Institution: MDACC
   Email Address: AVaishnavi1@mdanderson.org
5. **Awdhesh Kalia, Ph**D
   Institution: MDACC
   Email Address: AKalia@mdanderson.org
6. **Carlos Perez, DVM, PhD**
   Institution: MDACC
   Email Address: CJPerez@mdanderson.org

NOTE: Office hours are available by request. Please email me to arrange a time to meet.	7. **Rajneesh Pathania, DVM, PhD** Institution: MDACC Email Address: RPathania@mdanderson.org

Course Description:
This course will convey fundamental knowledge in mouse genetics to inform the validity and suitability of different mouse models to address a research question. The online learning tool Canvas will be used to distribute presentations and reading assignments. Individual lectures will be limited to 50 minutes. All classes will have 10 minutes break after the first lecture. Some classes will include peer discussions, and literature review.

Textbook/Supplemental Reading Materials

- Manipulating the mouse embryo: a laboratory manual (fourth edition, 2014).

Course Objective/s:
Finding and applying a suitable in-vivo model to investigate and solve a research problem remains a common challenge for graduate students. The purpose of this course is to convey fundamental knowledge in mouse genetics to inform the validity and suitability of different mouse models to address a research question. The course goes deep into the fundamentals of mouse genetics, from cutting edge gene editing and sequencing technologies commonly used to generate genetically modified (GM) mice, to ethical and regulatory frameworks regulating the use of GM animals. The course covers all aspects of mouse genetics required to explore the appropriate use of mouse models and how to collect and interpret experimental results. Each instructor has a strong background in mouse genetics, developmental biology and modeling.

***Specific Learning Objectives*:**

1. Students will learn about the advantages and limitations of the use of the laboratory mouse as an animal model.
2. Students will learn the basic concepts of mouse embryology and genetics needed to design studies involving genetically engineered (GE) mice.
3. Students will be exposed to cutting edge technologies used to engineer precise and clinically relevant genetic changes in the mouse genome.
4. Students will learn how to responsibly design, conduct, and interpret results using GE mouse models and will be familiar with the influence of genetic background, and the environment.

Student responsibilities and expectations:
Students enrolled in this course will be expected to perform the following activities each week.

1. Read, process, and review (study) material from 1 or 2 seminal reviews related to the topic.
2. Read 2 research articles (e.g., primary research) related to the topic.
3. Participate in and contribute to discussions during the lectures.
4. Prepare for and take homework assignments, a midterm and a final examination based on lectures and some reading materials.

Students are expected to complete all assigned reading material (reviews and research literature) prior to class. While you may work and discuss all course materials and assignments in groups, all writing assignments must be your own unless otherwise instructed. Whenever relevant, specific guidelines will be provided on whether using AI-generated content is permitted. 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 (quizzes and final) 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
Attendance (15%)	Attendance will be recorded. Students are expected to attend classes and interact during the Lectures.
Analysis of a research paper (25%)	Students will be provided with a research paper related to Mouse Genetics and will be asked to critically analyze it based on the knowledge acquired during the Lectures.
Midterm Exams (30%)	6/26 – midterm exam (mix of MCQs and open answers) will cover materials from the first 8 classes
Final Exam (30%)	7/31 – final exam (mix of MCQs and open answers) will cover materials from the last 7 classes

CLASS SCHEDULE

Tentative Dates	Duration (Hour(s) taught by lecturer)	Lecture Topic	Lecturer
5/29	Lecture (50 min) Break (10 min)	Introduction to the 2026 Course History of mouse genetics. Mouse biology and animal models.	**Delerue F.**
5/29	Lecture (50 min) Discussion (10 min)	Basic concepts of rodent genetics and systematics	**Benavides F.**
6/05	Lecture (50 min) Break (10 min)	Standardized genetic nomenclature Genetic drift and substrains Influence of genetic background	**Benavides F.**
6/05	Lecture (50 min) Break (10 min)	Modifier genes and passenger mutations	**Perez C.**
6/12	Lecture (50 min) Discussion (10 min)	Types of mutations Spontaneous mutations Chemically induced mutations (random) Gene editing (targeted)	**Perez C.**

6/12	Lecture (50 min) Break (10 min)	Principles of mouse developmental biology	**Behringer R.**
6/19	Lecture (50 min) Discussion (10 min)	Gene targeting using ES-cells (KOs, KIs) Transgenesis	**Behringer R.**
6/19	Lecture (50 min) Break (10 min)	Principles of gene editing using engineered nucleases	**Delerue F.**
7/03	Lecture (50 min) Discussion (10 min)	Inducible systems (Dox,Tamoxifen), conditional systems (Cre/loxP and Flp/FRT systems)	**Delerue F.**
7/03	Lecture (50 min) Break (10 min)	Mouse models of Cancer	**Vaishnavi A.**
7/10	Lecture (50 min) Break (10 min)	Mouse models of Neuroscience	**Delerue F.**
7/10	Lecture (50 min) Discussion (10 min)	Use of Databases (e.g., Mouse Genome Informatics; Ensemble…) and practical design of a mouse model	**Delerue F.**
7/17	Lecture (50 min) Discussion (10 min)	Methods to detect genomic modifications (PCR, qPCR, KASP) and sequencing (Sanger, NGS, LRS).	**Delerue F.**
7/17	Lecture (50 min) Break (10 min)	Genomic technologies and bioinformatic strategies for cancer genomics	**Kalia A.**
7/24	Lecture (50 min) Discussion (10 min)	Environment, housing, and management Ethical requirements	**Pathania R.**

NOTE:

Exam 1: 6/26

Exam 2: 7/31