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: **GS14 1223: Neurocircuits and Behavior** **Credit Hours:** 3 Meeting Location: **McGovern Medical School** Building/Room#: **MSE R649 (7th floor, blue section)** **WebEx/Zoom Link:** In person	**Program Required Course:** No **Approval Code:** No **(If yes,** the Course Director or the Course Designee will provide the approval code.) **Audit Permitted:** Yes **Classes Begin:** February 8th, 2022 **Classes End:** May 26th, 2022 **Final Exam Week:** N/A

Class Meeting Schedule

Day	Time
Tuesdays	9:00 a.m to 10:30 a.m.
Thursdays	9:00 a.m to 10:30 a.m.

Course Director:
Name and Degree: **Fabricio H. Do Monte**
Title: Assistant Professor

Department: Neurobiology and Anatomy
Institution: ***UTH*** *MDACC*

Email Address:
Fabricio.h.domonte@uth.tmc.edu

Contact Number: 713-500-5613

Course Director:

Name and Degree: **Qingchun Tong**
Title: Professor

Department: Institute of Molecular Medicine
Institution: ***UTH*** *MDACC*

Instructor/s: N/A – **(see attached syllabus)**

Email Address: qingchun.tong@uth.tmc.edu

Contact Number: 713-500-3453

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

Teaching Assistant: N/A

Course description:
This is an advanced course aimed at students interested in systems neuroscience. The course will be divided into three modules: 1) new technologies in neuroscience; 2) functional neural circuits; and 3) manuscript peer review process. During the **new technologies** module, the students will be exposed to a basic introductory lecture about new techniques that are being actively used in current neuroscience research. In the following class, all students will read a scientific article about one of the techniques, and one of the students will lead the scientific discussion. During the **functional neural circuits** module, students will be exposed to an introductory lecture about functional neuroanatomy with a special emphasis on behavioral control. In the following class, the students will discuss a representative recent article that applies the previously learned techniques to identify neural circuits and/or cellular mechanisms underlying different types of behavior. These articles will serve as example cases to introduce new development in neuroscience. Given the vast literature on neural circuits and function, students will pre-select three articles directly related with the previous class, and the entire group will decide which article is most relevant for the group discussion. All the article presentations will be in the form of journal club discussion. The final module will be focused on the **manuscript peer review** process. During this module, students will select relevant unpublished manuscripts that are publicly accessible (e.g., BioRxiv), and will independently read, analyze, and evaluate the manuscripts by identifying strengths and weaknesses related to study design, technical approaches, data analysis and interpretation.

Textbook/Supplemental Reading Materials: To be provided during the classes

Course Objective/s:

Upon successful completion of this course, students will:

- Understand the new research frontier in the rapidly developing field of behavioral and brain functions;
- Obtain a working knowledge about novel neuroscience techniques that have revolutionized our field in the last years;

● Improve their ability in interpreting and designing neuroscience research experiments using new scientific technology;

● Acquire skills in effectively assessing, reviewing, and evaluating research manuscripts that use the last generation of innovative tools in neuroscience.

Student responsibilities and expectations:

This course is an advanced elective course and requires students to have some basics on neuroanatomy, neurophysiology and brain functions. The course aims to engage all students to be actively involved in the classes. The structure of the course will repeat itself every week. On Tuesday, the students will be given a basic introductory lecture. On Thursday, there will be an intensive scientific discussion of a significant article in the field. Each week, a student will be designated to be the discussion leader and will have to prepare a presentation of the selected article to discuss with the class. All the students should read the article and take notes of the important points. Faculty will moderate the discussion. Whenever possible, papers with contradictory results will be included to stimulate discussion. During the last weeks of the course, students will be exposed to the peer-review process of scientific articles. They will be requested to read the assigned manuscript and prepare a short write-up including a brief background of the field, a general description of the work, the major and minor issues of the manuscript and recommendations on how to address them. All students are expected to participate atively during the classes. Learning resources will include: lecture slides, reviews, and research papers. We will use CANVAS to organize course materials.

Grading System: Pass/Fail

Student Assessment and Grading Criteria : *(May include the following:)*

Percentage	Description
Participation and attendance (40 %)	
Research article presentations (30 %)	See Modules 1 and 2 below
Research article peer-Review (30 %)	**See Module 3 below**

SCHEDULE FOR THE CLASSES

Module 1. New Technologies in Neuroscience

General course introduction and group/material distribution (Dr. Fabricio Do Monte & Dr. Qingchun Tong) **(February 8th)**

1. Genetic manipulations I (Dr. Qingchun Tong)
Lecture: Introduction to the generation of knockout and transgenic rodents. **(February 10th)**
Article discussion **(February 15th)**

2. Genetic manipulations II (Dr. Sheng Zhang)
Lecture: Ground rules of CRISPR/RNA interference. **(February 17th)**
Article discussion **(February 22nd)**

3. Brain activity manipulations I (Dr. Fabricio Do Monte)
Lecture: Advances on pharmacology, neurotransmitters, neuropeptides and their receptors. **(February 24th)**
Article discussion **(March 1st)**

4. Brain activity manipulations II (Dr. Fabricio Do Monte)
Lecture: Introduction to optogenetics, chemogenetics, deep brain stimulation (DBS) and transcranial magnetic stimulation (TMS). **(March 3rd)**
Article discussion **(March 8th)**

5. Brain activity monitoring in humans (Dr. Alan Prossin)
Lecture: Principles of human brain research with a focus on PET and related research frontiers. **(March 10th)**
Article discussion **(March 15th)**

6. Brain activity monitoring in laboratory animals (Dr. Fabricio Do Monte)
Lecture: Fundamentals of single-unit recordings, fiber photometry, 2-photon Ca2+ imaging, and microendoscopy. **(March 17th)**
Article discussion **(March 22nd)**

7. Neuroanatomical tools (Dr. QingchunTong)
Lecture: Introduction to neural tracing and immunohistochemical methods. **(March 24th)**
Article Discussion **(March 29th)**

Module 2. Functional Neural Circuits

8. Hypothalamus function in feeding (Dr. Qingchun Tong)
Lecture: Introduction to hypothalamic functions with special focus on feeding behavior. **(March 31st)**
Article Discussion **(April 5th)**

9. Amygdala and emotion (Dr. Fabricio Do Monte)
Lecture: Introduction to amydalar functions with special focus on fear/anxiety. **(April 7th)**
Article Discussion **(April 12th)**

10. Mesocorticolimbic circuits modulating reward behavior (Dr. Scott Lane)
Lecture: The mesocorticolimbic dopaminergic system in the control of reward seeking. **(April 14nd)**
Article Discussion **(April 19th)**

11. Cortical circuits in cognition and decision-making (Dr. Fabricio Do Monte)
Lecture: Cortico-hippocampal pathways modulating learning and memory: from place cells and engram to choice behavior. **(April 21st)**
Article Discussion **(April 26th)**

12. The Brain Stem function (Dr. Michael Zhu)
Lecture: The role of midbrain, pons and medulla in basic functions and brain-body communication. **(April 28th)**
Article Discussion **(May 3th)**

13. Gut-Brain interactions (Dr. Bhanu Ganesh)
Lecture: The crosstalk between central and peripheral nervous system: the microbiota as a major player. **(May 5th)**
Article Discussion **(May 10th)**

Module 3. Manuscript Peer Review process

1. Review of publicly accessible manuscripts (Dr. Fabricio Do Monte & Dr. Qingchun Tong) **(May 17th, May 19th, May 24th, May 26th)**

**Note: Article Discussion and Manuscript Review*: The students will take turns to present the pre-selected articles as well as the peer reviews during each lecture. A total of 13 articles and 4 manuscripts will be reviewed. According to the number of participants, the students may be divided into groups to present.