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, 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** Course Number and Course Title: **GS14 1024: Systems Neuroscience** Credit Hours: **4** **Prerequisite: Consent of Instructor** Meeting Location: **McGovern Medical School** Building/Room#: **MSB 7.046**	**Program Required Course: Yes** **Approval Code: No** **Audit Permitted: Yes** Classes Begin: **January 13, 2026** Classes End: **May 1, 2026** Final Exam Week: **May 4-8, 2026**

Class Meeting Schedule

Day	Time
Tues, Thurs	**11:00-1:00 p.m**

Course Director

Name and Degree: **Harel Shouval, PhD**
Title: Professor
Department: Neurobiology and Anatomy
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Course Co-Director

Name and Degree: **Fabricio Do Monte, DVM, PhD**
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Instructors

1. **Michael Beierlein, PhD**
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4. **Kelly Bijanky, PhD**
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NOTE: Office hours are available by request. Please email me to arrange a time to meet.	5. **Harel Shouval, PhD** Institution: UTHH Harel.Shouval@uth.tmc.edu 6. **Fabricio Do Monte, DVM, PhD** Institution: UTHH Email Address: Fabricio.H.DoMonte@uth.tmc.edu

Course Description:

This course covers the key concepts in systems neuroscience that allow students to understand how individual neurons and circuits process information and how they modulate behavior. The central idea behind the class is to illuminate the connection between physiology and function. In order to do this we will concentrate on several diverse brain systems, and in each of these systems first pose the question, what is the function of the system. We will then explore how their structure and physiology account for their function.

The aim of this course is to understand central fundamental principles, not to understand every known detail of brain. Therefore, this will not be a survey course. We chose several different systems that are qualitatively different to obtain a broad understanding of the principles of systems neuroscience.

This course will provide students with fundamental knowledge of the function, development, and plasticity of neuronal circuits. We will do this by exploring different types of brain systems to understand how preceptions of the external world are formed, how movements are executed, how decisions are formed, and how space Is represented and how memories are formed. The course will examine how stress and fear are processed and regulated, how the brain regulates metabolisem and how pain is signalled peripherally and processed centrally.

We will use these different systems to understand unifying principles including how the brain processes information, how different cell types contribute to the function of circuits how the brian is modified by development and by experience.

An integral part of the course is a neuroanatomy lab that will relate the functional view presented in the course with the actual anatomical structures in which these functions are implemented. There will also be several student presentation in which each student in the class has the opppurtunity to present a scientific paper related to the course material.

Textbook/Supplemental Reading Materials

- To be distributed during the classes

Course Objective/s:

Upon successful completion of this course, students will: Understand general principles of systems neuroscience. They will learn in several example systems how brain circuits lead to the observed physiology, preception and behavior. They will also understand various recording techniques as well as methods used

to analyze experimental results. They will learn to comprehend the scientific process and how to read and present scientific papers. They will also learn about functional neuroanatomy and how structure relates to function.

***Specific Learning Objectives*:**

1. Learn how physiological circuits implement function.

2. Learn to critically evaluate key concepts in systems neuroscience.

3. Learn how to analyze and understand physiological data.

4. Learn basic facts about brain development and plasticity.

5. Learn about the functional neuroanatomy of brain circuits.

Student Responsibilities and Expectations:

1. Students will attend all lectures unless they are sick or have other justifiable reasons.

2. When students are provided with reading materials for a class or a topic they should read these before the class.

3. Participate in and contribute to course discussions during lecture, review sessions.

4. Students are expected to ask questions when they do not understand the material presented.

5. If the students do not understand the materials presented they will be able to contat the instructures and set up an appointment with the instructor to improve their knowledge.

6. Read and present a research paper to the class.

7. Prepare for and take 3 course exams, and submit answers on time.

8. Grading: Each exam will contribute to 30% of the final score and student presentations will count for the remaning 10%.

9. 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**
Presentation (15 %)	Each student will read and present to the class a primary research paper.
Midterm Exams (50 %)	Two equally weighted take home midterm exams.
Final Exam (25 %)	The final exam has the same format as the midterms and it covers the last two modules.
Participation and/or Attendance (10 %)	Grade reflect both attendance and participation.

CLASS SCHEDULE - See attached

Systems Neuroscience (GS14 1024) Schedule: Spring 2026

Introduction

1. 1/13 11:00-12:00 Introduction to Systems Neuroscience (Shouval)
2. 1/13 12:00-1:00 Introduction to Systems Neuroscience (Shouval)
3. 1/15 11:00-12:00 Introduction to Neuroanatomy (Nagayama)
4. 1/15 12:00-1:00 Introduction to Neuroanatomy (Nagayama)

Part 1

Module 1 – Vision (Shouval)

5. 1/20 11:00-12:00 Functional neuroanatomy of the visual system
6. 1/20 12:00-1:00 Receptive fields in V1 and their organization
7. 1/22 11:00-12:00 Spike statistics and correlations
8. 1/22 12:00-1:00 Signal detection theory
9. 1/27 11:00-12:00 Receptive field plasticity
10. 1/27 12:00-1:00 Parallel visual streams and higher order visual areas
11. 1/29 11:00-12:00 Relating physiology to behavior 1
12. 1/29 12:00-1:00 Relating physiology to behavior 2
13. 2/3 11:00-12:00 Student presentation
14. 2/3 12:00-1:00 Student presentation

Module 2 – Motor Control (Beierlein)

15. 2/5 11:00-12:00 Introduction
16. 2/5 12:00-1:00 Spinal cord circuits and motor control 1
17. 2/10 11:00-12:00 Spinal cord circuits and motor control 2
18. 2/10 12:00-1:00 Basal ganglia and movement initiation
19. 2/12 11:00-12:00 Cerebellum and motor learning 1
20. 2/12 12:00-1:00 Cerebellum and motor learning 2
21. 2/17 11:00-12:00 Student paper presentation
22. 2/17 12:00-1:00 Student paper presentation

Neuroanatomy lab 1 (Bijanki)

23. 2/19 11:00-12:00 Neuroanatomy lab I
24. 2/19 12:00-1:00 Neuroanatomy lab I

Midterm Take home Exam 1 2/20-2/23

Part 2

Module 3 – Representation of Space and Memory (Shouval)

25.	2/24	11:00-12:00	Hippocampal representation of space 1
26.	2/24	12:00-1:00	Hippocampal representation of space 1
27.	2/26	11:00-12:00	Place cells 1
28.	2/26	12:00-1:00	Place cells 2
29.	3/3	11:00-12:00	The entorhinal cortex and grid cells
30.	3/3	12:00-1:00	Memory formation, storage, and retrieval
31.	3/5	11:00-12:00	Student paper presentation
32.	3/5	12:00-1:00	Student paper presentation

Spring Break 3/9-3/13

Module 4 – Stress, fear and reward (Do Monte)

33.	3/17	11:00-12:00	Neural circuits of stress 1
34.	3/17	12:00-1:00	Neural circuits of stress 2
35.	3/19	11:00-12:00	Neural circuits of fear 1
36.	3/19	12:00-1:00	Neural circuits of fear 2
37.	3/24	11:00-12:00.	Neural circuits of reward 1
38.	3/24	12:00-1:00.	Neural circuits of reward 2
39.	3/26	11:00-12:00	Student paper presentation
40.	3/26	12:00-1:00	Student paper presentation

Neuroanatomy lab 2 (Bijanki)

41.	3/31	11:00-12:00	Neuroanatomy lab 2
42.	3/31	11:4512:45	Neuroanatomy lab 2

Midterm exam 2 Dates: 3/31-4/4

Part 3

Module 5 - Homeostatic regulation (Tong)

43.	4/2	11:00-12:00	Feeding and energy expenditure 1
44.	4/2	12:00-1:00	Feeding and energy expenditure 2
45.	4/7	11:00-12:00	Water balance and temperature 1
46.	4/7	12:00-1:00	Water balance and temperature 2
47.	4/9	11:00-12:00	Sleep control 1
48.	4/9	12:00-1:00	Sleep control 2
49.	4/14	11:00-12:00	Student presentation

50. 4/14 12:00-1:00 Student presentation

Module 6 – Pain. (Walters)

51. 4/16 11:00-12:00 Introduction to pain
52. 4/16 12:00-1:00 Peripheral systems driving pain
53. 4/21 11:00-12:00 Spinal systems and nociceptive information
54. 4/21 12:00-1:00 Brain systems, nociceptive information and affective pain
55. 4/23 11:00-12:00 Chronic pain mechanisms
56. 4/23 12:00-1:00 Evolutionary and systems perspectives on conscious pain
57. 4/28 11:00-12:00 Student presentation
58. 4/28 12:00-1:00 Student presentation

Neuroanatomy lab 3 (Bijanki)

59. 4/30 11:00-12:00 Neuroanatomy lab 3
60. 4/30 12:00-1:00 Neuroanatomy lab 3

Final Exam 5/4-5/8