This syllabus template is intended to be a customizable template. Formatting should be aligned with your school or department guidelines. Text within brackets is for informational purposes and should be edited to reflect the specifics of your course.
Contact CET for assistance with creating your syllabi, policies, learning objectives, assessments, and course activities. If you are preparing a syllabus for UCOC submission, refer to the Curriculum Office Resources page for a downloadable checklist of required items.

Revised 08/2022

Course: BISC424 *Brain Architecture*

Units: 4

Term: Spring semester, 2025; Tuesday and Thursday, 9am-10:50am

Location: Hedco Neurosciences Building, Room 100 (Auditorium, HNB100); 3641 Watt Way

Instructor: Larry Swanson

Office: Room 428 Hedco Neurosciences Building
Office Hours: Arrange at class or by email; my schedule is very flexible to meet with you (best is before or after class)
Contact Info: lswanson@usc.edu

Course Description

This course is designed for advanced undergraduates and graduate students interested in the basic structure-function organization of the brain—how it controls mind and behavior from a systems neuroscience perspective.

The outline of lectures is given below. Basically, the course is divided into a four-part sequence: an historical overview, then two approaches to overall brain architecture that are especially illuminating because they start with a simple state and follow progressive differentiation to a much more complex state (evolution and embryonic development), and finally an overview of basic functional systems or circuits (divided into four basic parts: motor, state, cognitive, and sensory). Throughout the course, examples of how to interpret relevant human brain imaging data (mostly MRI) will be provided and discussed.

Learning Objectives

The goal of this course is to understand the general principles of nervous system organization, from the structural, functional, and molecular points of view—in humans and in animals. This knowledge will be used to probe how the brain mediates cognition, emotion, and behavior, and how abnormalities in its circuitry may lead to a wide range of psychiatric, neurological, and metabolic diseases. It can also be used to stimulate new approaches to hardware and software design in computer science. An historical approach is taken so that participants gain an appreciation for how scientists actually analyze and think about brain structure and function in the laboratory.

Prerequisite(s): None.
Recommended Preparation: It is very strongly recommended that you have at least an introductory course in biology. If not, you should be using Wikipedia quite a bit.

Course Notes

The lecture PowerPoint presentations will be posted on Blackboard, usually before the lecture. Also see *Brightspace* for reading assignments, announcements, and other info. This is not a hybrid course with zoom lectures (unless there is a mandate for zoom lectures from the Administration).

Required Readings and Supplementary Materials

- Required: Swanson, Larry W. (2012) *Brain Architecture: Understanding the Basic Plan*, 2nd edition. (New York, Oxford University Press). **WARNING: THE FIRST EDITION WILL NOT WORK!**
- Usually one research article each week; assigned the previous week (posted on Blackboard).

Optional Readings and Supplementary Materials

- Recommended: Nieuwenhuys, R., Voogd, J., and Chr. van Huijzen (2008) *The human central nervous system*, 4th edition (New York: Springer). Find a cheap copy online (also available from USC library for free!) This is the most recent authoritative neuroanatomy textbook.

Description and Assessment of Assignments

14 WEEKLY QUIZZES will be given online (10 minutes each; take any time 24 hours before class on Tuesday, on Blackboard; starting January 16h) on the required reading for the current (upcoming) week; your 4 lowest scores will be dropped and total points (10 tests) will be graded on a curve. The tests will be short answer type with 10 points per test, and one or two questions may be on material covered in the two lectures on the preceding week. You are on your honor to take the test "closed book". Their purpose is to encourage you to read and understand the assigned materials before the corresponding lectures--learn general principles and the vocabulary necessary for that understanding—and to refresh your memory on the two lectures the preceding week. *There will be no makeup quizzes: those you miss will be counted among the 4/14 that are dropped.*

FINAL ESSAY (no final exam): A 5-page single-spaced essay will be due at 10am LA time on May 7th (when final exam for this course is scheduled to end). For a topic pick your favorite small, localized part of the nervous system and discuss critically what is known about three things: (a) its location in various animals, (b) the neural circuitry it is part of, and (c) what its basic function seems to be. Proper references to research articles in scientific journals (this excludes Wikipedia and the like) are required for all statements in the essay (as in any research article) and these references (choose any clear format for the references) are included in the 5 pages. Do not use illustrations or tables; just text. You can get all necessary journal references online from the USC Library. *PubMed is probably the best source of references (try looking for review articles first, but do not reference review articles, just articles in the primary neuroscience literature)*. Your grade will reflect how well you address the three topics (a-c) mentioned above, and how well you have incorporated the overall viewpoint or general philosophy of the lectures into your essay. No late essays will be accepted (except for an Incomplete grade).

AI-generated text and essays are now easy to generate but don't do it; they will be severely penalized in terms of the grade. AI generated text is easy to spot if you don't follow the exact instructions in the preceding paragraph.

Examples of small, localized parts of the nervous system might include things like retina, suprachiasmatic nucleus, lateral geniculate nucleus, substantia nigra, primary visual cortical area, and superior cervical ganglia (there are about 500 to choose from). When in doubt, ask me (email or in person).

Grading Breakdown

Table 1 Grading Breakdown

Assessment Tool (assignments)	Points	% of Grade
Weekly quizzes (10/14, 10 points each)	100	80
Final essay	025	20

Assessment Tool (assignments)	Points	% of Grade
TOTAL	125	100

Grading Scale

Final grades will be determined by dividing up the curve generated by the total scores of all the students (i.e., the course is graded on a curve). The distribution of scores varies somewhat year to year, but there are always clear breaks between grades.

Assignment Submission Policy

This is clearly described above under "Description and Assessment of Assignments". To summarize, you must submit your weekly quiz before the start of class on Tuesday (by 8:59 am), and you must submit your Final essay by 10 am LA time on May 13th, 10am (when the final exam for this course is scheduled to end); late essays will not be accepted (except for an Incomplete Grade).

Grading Timeline

I normally post the quiz results after class on Tuesday; the final essay will be graded within 3 days.

Attendance and participation

Regular attendance and participation at the lectures will greatly enhance your ability to do well on the weekly quizzes and on the final essay. In other words, you'll learn a lot more about neuroscience by attending the lectures.

Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the USC Student Handbook. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Collaboration. In this class, you are expected to submit work that demonstrates your individual mastery of the course concepts.

Group work. Unless specifically designated as a 'group project,' all assignments are expected to be completed individually.

If found responsible for an academic violation, students may be assigned university outcomes, such as suspension or expulsion from the university, and grade penalties, such as an "F" grade on the assignment, exam, and/or in the course.

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. (Living our Unifying Values: The USC Student Handbook, page 13).

Course Evaluations

Course evaluation occurs at the end of the semester is university-wide. It is an important review of students' experience in the class. The process and intent of the end-of-semester evaluation will be provided.

Course Schedule

2024 Brain Architecture (BISC424) Lecture schedule (subject to some change depending on class interest):

Week		Date	Lecture number & topic	Reading (*Brain Architecture* 2nd edn. only, & assigned article)	
1		Jan 14 (Tu)	1) Getting perspective: views from Antiquity & Renaissance	Preface, Ch. 1	
1		Jan 16 (Th)	2) How microscopes and the cell theory changed everything	Ch. 2	
2	Q1	Jan 21 (Tu)	3) How the nervous system (NS) evolved: simple animals	Ch. 3	
2		Jan 23 (Th)	4) Vertebrate evolution & early development: the basic plan	Ch. 4	
3	Q2	Jan 28 (Tu)	5) Early development of CNS parts: simple & clear	Ch. 5	Swanson & Lichtman
3		Jan 30 (Th)	6) Development of the peripheral nervous system (PNS)	Ch. 6 to p. 94: to *Generating gray…*	
4	Q3	Feb 4 (Tu)	7) Cellular development of spinal cord and brain	Ch. 6 to p. 103: to *A nervous…*	Bota et al. (Networks)
4		Feb 6 (Th)	8) Lessons from development: architectural principles	Ch. 6 finish	
5	Q4	Feb 11 (Tu)	9) Imaging the living human brain	MRI Wikipedia	Sporns et al. (Connectome)
5		Feb 13 (Th)	10) Conceptual framework for systems neuroscience	Ch. 7	
6	Q5	Feb 18 (Tu)	11) Motor system: types of responses produced by the NS	Ch. 8 to p. 148: to *Central pattern…*	Swanson (Foundational model)
6		Feb 20 (Th)	12) Somatic motor system: motor hierarchy & motivation	Ch. 8 pp. 148-56: to *Pattern…*	
7	Q6	Feb 25 (Tu)	13) Somatic motor system: circuit analysis methodology	Ch. 8 pp. 156-62: to *The autonomic…*	Swanson (Brain mapping)
7		Feb 27 (Th)	14) Autonomic motor system: control of bodily functions	Ch. 8 pp. 162-67: to *Neuroendocrine…*	
8	Q7	Mar 4 (Tu)	15) Neuroendocrine motor system: master gland (pituitary)	Ch. 8 pp. 167-71: to *Cerebellum…*	Simerly (Wired, Ann. Review)
8		Mar 6 (Th)	16) Neuroendocrine motor system: stress & reproduction	Ch. 8 pp. 167-71: to *Cerebellum…*	
9	Q8	Mar 11 (Tu)	17) Somatic motor system: motor learning & cerebellum	Ch. 8 finish	Saper (sleep)
9		Mar 13 (Th)	18) The behavioral state system: circadian rhythms	Ch. 9 to p. 189: to *Reproductive…*	
		Mar 18 (Tu)	SPRING BREAK		
		Mar 20 (Th)	SPRING BREAK		
10	Q9	Mar 25 (Tu)	19) Behavioral state system: sleep & reproductive rhythms	Ch. 9 finish	Herculano-Houzel (neuron #s)
10		Mar 27 (Th)	20) The cognitive system: thinking & voluntary behavior	Ch. 10 to p. 212: to *Cortical cellular…*	
11	Q10	Apr 1 (Tu)	21) Cognitive system: cerebral cortex, layers & cell types	Ch. 10 to p. 218: to *Cerebral nuclei…*	*Brain Architecture* Appendix B
11		Apr 3 (Th)	22) Cognitive system: cerebral cortex, circuitry; c. nuclei	Ch. 10 finish	
12	Q11	Apr 8 (Tu)	23) The sensory system: introduction	Ch. 11 to p. 242: to *Forebrain sensory…*	Swanson et al. (Forebrain)
12		Apr 10 (Th)	24) Sensory system: vision	Ch. 11 to p. 247: to *Ganglion cell…*	
13	Q12	Apr 15 (Tu)	25) Sensory system: hearing	Ch. 11 to p. 247: to *Ganglion cell…*	
13		Apr 17 (Th)	26) Sensory system: smell and taste	Ch. 11 to p. 247: to *Ganglion cell…*	
14	Q13	Apr 22 (Tu)	27) Sensory system: touch; pain-pleasure; mood-emotion	Ch. 11 finish	Can a biologist fix a radio?
14		Apr 24 (Th)	28) Modifying architecture: learning, stress, damage repair	Ch. 12	
15	Q14	April 29 (Tu)	29) Genome and connectome	Ch. 13	
15		May 1 (Th)	30) Getting a perspective: wrap up (& course evaluation)	Preface, Ch. 1	

May 13 (Tu 10am) *Final paper due: NO EXCEPTIONS ON SUBMISSION TIME (PLAN AHEAD! See syllabus)* \

Statement on Academic Conduct and Support Systems

Academic Integrity:
The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom

local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.