

Attention!

This is a **representative** syllabus.

The syllabus for the course when you enroll may be **different**.
Use the syllabus provided **by your instructor** for the most up-to-date
information. Please refer to your instructor for more information for
the specific requirements of the course.

NeuroSC 4623: Biological Clocks & Rhythms

COURSE INFORMATION

Class meets @ 1:30-2:50 pm on Tuesdays & Thursdays (SP25)
in 380 Hamilton Hall (IHSC)

COURSE DIRECTOR:

Dr. Stuart Mangel, Office Hours (Tuesdays at 3:15-4:15 pm and Thursdays at 11:30 am-12:30 pm, or by appointment) in my office (4072 Graves Hall) or by Zoom (E-mail: Stuart.Mangel@osumc.edu; 614-292-5753).

LECTURER:

Dr. Karl Obrietan, Office Hours: by appointment; E-mail: obrietan.1@osu.edu

Website: https://osu.instructure.com/courses/184094?for_reload=1

COURSE SUMMARY: A consideration of the broad variety of biological rhythms of animals and humans, including ultradian, daily (circadian), lunar, tidal and annual cycles. After considering the field in historical perspective, we will spend several weeks on the fundamental properties of biological clocks and biological rhythms. We will then discuss the ways in which rhythms are generated on a molecular basis and how they are synchronized to the external environment. Emphasis will be on the role of molecular and cellular mechanisms of circadian clocks, and how these clocks affect the nervous and endocrine systems of mammals and birds in relation to a variety of behavioral rhythms such as locomotion, feeding, and sleeping.

Prerequisites: Neuroscience 3000 (Cellular and Molecular Neuroscience) or Psychology 3313.

COURSE LEARNING OUTCOMES:

By the end of this course, students should obtain a basic understanding of the following topics and principles: 1) methods of circadian experimentation; 2) fundamental characteristics of biological rhythms; 3) functional organization of circadian clock pathways, including circadian clock molecular machinery, entrainment mechanisms, and how clocks produce rhythmic outputs; 4) annual rhythms and photoperiodism; 5) behavioral ecology and evolution of biological timing; 6) interplay between circadian clock and light/dark adaptive mechanisms that regulate retinal function in day and night; 7) sleep and sleep disorders; 8) chronotypes, shift work and jet-lag; and 9) roles of circadian rhythmicity in disorders and diseases.

REQUIRED READING:

1. **Textbook:** Circadian Rhythms, A Very Short Introduction by Russell G. Foster and Leon Kreitzman (2017) Oxford University Press, Oxford, U.K. (referred to as "Foster, 2017" below)
eBook: <https://www.vitalsource.com/products/circadian-rhythms-a-very-short-introduction-russell-foster-leon-kreitzman-v9780191027475>
Print Copies: These can be purchased at OSU Barnes and Noble or online.
2. **Instructor-provided readings will also be used (see Syllabus below).**

LECTURES:

Students are responsible for the material presented in the lectures and reading assignments. Class attendance is therefore important. Dr. Obrietan's lectures are indicated in the Syllabus below. All other lectures will be given by Dr. Mangel. Lectures and readings will be posted on Carmen.

SYLLABUS

Lecture #; Instructor	Date	Topic	Readings
1 Start of Module 1	Tues. 1/7/2025	Course Organization, Topics, Circadian Terminology, and Overview of Chronobiology	Foster, 2017, Ch 1
2	Thurs. 1/9/2025	Experimental Methods; Principles of Circadian Experimentation	Foster, 2017, Ch 2 & 4
3	Tues. 1/14/2025	More Terminology; Fundamental Properties of Circadian Clock Pathways	Foster, 2017, Ch 1, 2 & 4
4	Thurs. 1/16/2025	Functional Organization of Circadian Clock Pathways-I	Foster, 2017, Ch 4; Welsh et al, 1995
5	Tues. 1/21/2025	Functional Organization of Circadian Clock Pathways-II	Foster, 2017, Ch 4; Berson et al, 2002
	Thurs. 1/23/2025	Exam #1 (Covers Material from 1/7/2025 – 1/21/2025)	
6 Obrietan, Start of Module 2	Tues. 1/28/2025	Molecular basis of circadian rhythms-I	Foster, 2017, Ch 4, 5; Schwartz & Gainer, 1977; Khalsa et al,1992; Silver et al, 1996
7 Obrietan	Thurs. 1/30/2025	Molecular basis of circadian rhythms-II	Foster, 2017, Ch 5
8 Obrietan	Tues. 2/4/2024	Molecular basis of circadian rhythms-III	Foster, 2017, Ch 5
9 Obrietan	Thurs. 2/6/2025	Clock cell communication	Foster, 2017, Ch 4, 5; Ralph & Menaker, 1988
10	Tues. 2/11/2025	Annual Rhythms and Photoperiodism	Foster, 2017, Ch 8
	Thurs. 2/13/2025	Exam #2 (Focuses on Material from 1/28/2025 – 2/11/2025)	
11 Start of Module 3	Tues. 2/18/2025	Infradian, Ultradian, and Brain Rhythms	
12	Thurs. 2/20/2025	Behavioral Ecology and Evolution of Biological Timing	Foster, 2017, Ch 9
13	Tues. 2/25/2025	Homeostasis and Circadian Rhythmicity	Foster, 2017, Ch 6, pp.81-86

SYLLABUS (cont.)

Lecture #; Instructor	Date	Topic	Readings
14 Obrietan	Thurs. 2/27/2025	Photic input pathways and clock entrainment I	Foster, 2017, Ch 4, 5; Obrietan et al, 1998
15 Obrietan	Tues. 3/4/2025	Photic input pathways and clock entrainment-II	Foster, 2017, Ch 4, 5; Obrietan et al, 1998; de la Iglesia et al, 2000
	Thurs. 3/6/2025	Exam #3 (Focuses on Material from 2/18/2025 – 3/4/2025)	
	T & Th 3/11/2025 & 3/13/2025	No Classes: Spring Break	
16 Start of Module 4	Tues. 3/18/2025	Integration of Circadian Mechanisms; Non-photoc Mechanisms	Foster, 2017, Ch 4, pp. 57-61, Ch.7, pp. 95-101
17	Thurs. 3/20/2025	Retina-I: Functional Organization and Effects of Light/Dark Adaptation	Chaffiol et al, 2017; Goel & Mangel, 2021
18	Tues. 3/25/2025	Retina-II: Functions of the Circadian Clock in the Retina	Ribelayga et al, 2008; Besharse & McMahon, 2016; Goel & Mangel, 2021
19	Thurs. 3/27/2025	Sleep Characteristics and Mechanisms	Foster, 2017, Ch 6
20	Tues. 4/1/2025	Sleep Disorders	Foster, 2017, Ch 3
21	Thurs. 4/3/2025	Chronotypes and Jet Lag	Foster, 2017, Ch 2, 3
22	Tues. 4/8/2025	Circadian Rhythmicity, Diseases, and Disorders	Foster, 2017, Ch 3, 7
	Thurs. 4/10/2025	Exam #4 (Focuses on Material from 3/18/2025 – 4/8/2025)	
Mangel/ Obrietan	Tues. 4/15/2025	In-Class Review of Material from 1/7/2025 – 4/8/2025	
	Thurs. 4/17/2025	Final Exam, 1:30 pm – 2:50 pm (Covers Material from 1/7/2025 – 4/8/2025)	

HOW THIS CLASS WILL WORK:

Lectures and exams will take place in person in 380 Hamilton Hall (IHSC). Reading assignments and lectures will be available to all registered students on the Carmen course website.

In addition, during about half of Dr. Mangel's lectures, students will be asked to divide into discussion groups (4 students per group). These groups will have 10 min to discuss specific material in that lecture, and afterwards, to report on their discussions to the rest of the class.

SYLLABUS ORGANIZATION:

The syllabus is set up into 4 blocks (or modules) based on scheduled examinations. At the end of each block, there will be an exam that covers material presented in the block. Exams 2-4 will also contain 5 questions on material from previous blocks. A final exam that covers material from the entire course will take place on the final day of class.

CREDIT HOURS AND WORK EXPECTATIONS:

This is a **3-credit-hour course**. According to Ohio State policy (go.osu.edu/credithours), students should expect around 3 hours per week of time spent on direct instruction (i.e., instructor content and Carmen activities, for example) in addition to 6 hours of homework (e.g., reading assignments).

EXAMS AND GRADING:

All exams will be multiple-choice or true/false. Exam questions will be based on class lectures and assigned readings. Students' final grades will reflect: Performance on 4 midterm exams and the final exam (20% of total course grade for each of the 5 exams); Each of the 5 exams will contain at least 40 questions for a total of 200 question. Exams 2-4 will each contain 5 questions that cover material from earlier portions of the course. The final exam will cover material from the entire course and occur on the last day of class. Your numerical grade is calculated by dividing the number of questions you answered correctly by 2.

There will be a total of 10 bonus questions during the course. If all 10 bonus questions are answered correctly, a student's final grade will increase by 5%. Bonus questions will be given during exams or in class. Bonus questions that pertain to the contents of Dr. Obrietan's lectures will be given in Exams 2 (two bonus questions) and 3 (one bonus question). Bonus questions that pertain to the contents of Dr. Mangel's lectures will be given in-class. There will two in-class bonus questions during Module 1, one during Module 3, and two during Module 4. The final exam will contain 2 bonus questions. Bonus questions answered correctly will contribute to your grade, but will not count if answered incorrectly.

Exams will be given in the classroom using Carmen Quiz. You will need to bring a fully-charged laptop, tablet, or iPad to class the day of the exam. The exam will be activated at the start of class (i.e., 1:30 PM) and will end at the end of class (i.e., 2:50 PM). This gives you 80 minutes to complete the exam. You are expected to take the exam in the classroom. On the day of the exam a passcode will be given to the class which must be entered to access the exam on Carmen. You will only know this code if you are present in the classroom. All exams including the final exam will take place in 380 Hamilton during regular class hours (1:30 pm – 2:50 pm).

Our established policy is that you must take the exams at the time they are scheduled unless there are critical extenuating circumstances (e.g., death in the family, documented illness). Having multiple exams on the same day is **not** considered a critical extenuating circumstance. Students will be responsible for attending class and reading and studying the assigned material.

Final grades will be calculated using a modified version of the OSU standard grading schedule. Adjustments to the grading scheme may be made depending on grade distribution.

EXAMS AND GRADING (cont.):

NeuroSC 4623 Grading Scheme

Range of Numerical Grade	Letter Grade
90 – 100	A
87 – 89.9	-A
83 – 86.9	B ⁺
80 – 82.9	B
77 – 79.9	-B
73 – 76.9	C ⁺
70 – 72.9	C
67 – 69.9	-C
60 – 66.9	D ⁺
56 – 59.9	D
< 56	E

The grading scheme that will be used (shown on the left) is a direct adjustment of the OSU Standard Grading Scheme, *i.e.*, each range of numerical grade has been moved up one level. For example, grades in the 77 – 79.9 range in the OSU Standard Grading Scheme, which result in a letter grade of C⁺, have been moved up to a grade of -B.

COURSE TECHNOLOGY

Technology Support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)

Required equipment

- Computer: current Mac (MacOs) or PC (Windows 10) with high-speed internet connection
- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone

Required software

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Full instructions for downloading and installation can be found at go.osu.edu/office365help. This will be needed if you are going to download the Powerpoint presentations.

Carmen access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (go.osu.edu/add-device).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.

- Download the Duo Mobile application (go.osu.edu/install-duo) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

LockDown Browser Information and Instructions:

This course will use LockDown Browser (instead of browsers such as Google Chrome, Firefox and Safari) during online exams. Watch this video to get a basic understanding of LockDown Browser:

<https://www.respondus.com/products/lockdown-browser/student-movie.shtml>

Download Instructions

- Go to Carmen Quiz and select an exam for the course
- If you have not already installed LockDown Browser, select the link to download the application and follow the installation instructions
- Return to the exam page in a standard browser
- LockDown Browser will launch and the exam will begin

Note: LockDown Browser can be used on a PC, Mac or iPad. The version for Ohio State, which can be downloaded for free, must be used. LockDown Browser only needs to be installed once per computer or device. It will start automatically after getting installed when a test requires it.

Guidelines and Information for LockDown Browser:

When taking an online exam follow these guidelines:

- Before starting an exam, turn off all mobile devices, (smartphones, etc), and make sure they are out of reach.
- Clear your area of all external materials - books, papers, other computers, or devices
- Remain at your desk or seat for the duration of the test.
- LockDown Browser will prevent you from accessing other websites or applications; you will be unable to exit the test until all questions are completed and submitted.

Getting Help for LockDown Browser

Several resources are available if you encounter problems with LockDown Browser:

- The Windows and Mac versions of LockDown Browser have a "Help Center" button located on the toolbar. Use the "System & Network Check" to troubleshoot issues. If an exam requires you to use a webcam, also run the "Webcam Check" from this area.
- Respondus has a Knowledge Base available from support.respondus.com. Select "LockDown Browser & Respondus Monitor" as the product to view helpful articles.
- If you're still unable to resolve a technical issue with LockDown Browser, go to support.respondus.com and select "Submit a Ticket". Provide detailed information about your problem and what steps you took to resolve it.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please contact and register with **Student Life Disability Services (SLDS)** to establish reasonable accommodations. After registration and approval of your request, SLDS will forward the accommodations

granted to me. Please make arrangements with SLDS as soon as possible so that they may be implemented in a timely fashion.

SLDS contact information: slds@osu.edu; 614-292-3307; 098 Baker Hall, 113 W. 12th Avenue.

If you have been approved for extended time with **SLDS** you will need to make arrangements with them to take the exam at their testing center. A copy of the exam will be sent to SLDS and they will administer the exams. It is expected that you will take the exam on the same day as the rest of the class.

ACADEMIC INTEGRITY (ACADEMIC MISCONDUCT)

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct* (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- *Ten Suggestions for Preserving Academic Integrity* (go.osu.edu/ten-suggestions)
- *Eight Cardinal Rules of Academic Integrity* (go.osu.edu/cardinal-rules)

INSTRUCTOR FEEDBACK AND RESPONSE TIME

Grading and feedback: For each exam, you may generally expect feedback within 4 days.

Emails: I will reply to emails within 24 hours on days when class is in session at the university. Please include the phrase "NeuroSC 4623" in the subject line of your email.

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources. If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which

responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit equity.osu.edu or email equity@osu.edu.

COMMITMENT TO A DIVERSE AND INCLUSIVE LEARNING ENVIRONMENT

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Your Mental Health:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities.

No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand resources are available at go.osu.edu/ccsondemand. You can reach an on-call counselor when CCS is closed at 614- 292-5766, and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource available at go.osu.edu/wellnessapp.

SAFETY AND HEALTH REQUIREMENTS:

All teaching staff and students are required to comply with and stay up to date on all University safety and health guidance, which includes wearing a facemask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will be warned first and disciplinary actions will be taken for repeated offenses. Please review the [University Safe and Healthy Campus Expectations](#) on the Carmen Website for the course.
