Course description

Sleep is a dominating presence in our biological and social lives. It is both a pleasure and a burden. It alters and challenges the way we experience the passage of time. It incorporates two of the three normal states of consciousness. It is intimately tied to remembering and forgetting. It can occur even when you think you are awake. It affects how long we live and how much we enjoy our lives. It is not optional. Yet no one fully understands the physiological mechanisms underlying sleep, or even why we sleep.

Biological rhythms coordinate virtually all the physiological and behavioral components of our existence. Whether you realize it or not, your activities every day reflect the influences of multiple ‘body clocks.’ For instance, normal sleep depends on at least three different, intertwined rhythms. Understanding biological rhythms and working with them, instead of against them, elevates your mood, keeps you alive longer, reduces traffic accidents, decreases the probability of divorce, increases the effectiveness of chemotherapy, vastly increases job productivity, moderates jet lag, enhances overall quality of life, and can even help college students pass tests.

In this course we will study the nature of biological rhythms and sleep, emphasizing the biological processes that create and control them. Along the way, we will also touch on the topic of dreaming and its functions. Sleep is ‘of the brain, by the brain, and for the brain,’ so we will spend some time studying basic neuroscience - brain structure and function. We will use readings from the scientific literature to explore research strategies of chronobiology and sleep science and to delve into the most recent thinking in the field.

The societal significance of biological rhythms and sleep cannot be overestimated. Throughout history, artists, writers, philosophers, clerics, and scholars have acknowledged these forces, sometimes with celebration, sometimes with scorn, always with respect. In the artificial light of contemporary society, it is easy to believe we’re emancipated from internal rhythms. That is a delusion with pervasive and profound negative consequences. Throughout the course, we will touch on such societal concerns and their relationships to the biological realities.

It is worth emphasizing that this is a science course. We will focus on biological processes, research strategies, and current experimental results. A significant goal of the course is to show you how chronobiologists and sleep scientists do their research and interpret their data.
Excellent notes are essential for studying and learning, to say nothing of doing well on the exams. Even the best notetakers will sometimes miss material in the lecture or find out later that they don’t understand what they have written.

This semester you will be using wikis to create complete, accurate, and comprehensible sets of class notes. Each of you will contribute to the wiki notes by adding to, clarifying, correcting, and otherwise enhancing the basic set of notes for each lecture. I will provide all the graphics from the lectures so you can incorporate them into the notes.

We will discuss the wiki system in class, and I have put a description and detailed instructions up on CANVAS. Active participation in the wikis will add points to your exam scores as described in the on-line materials.

You can find our class wikis under the Modules section of our CANVAS site.
Grades in the course will be based on two in-class examinations (40%), a cumulative final exam (20%), an 8-page paper (10%), two group paper presentations (20%), and journal entries (10%).

The mid-semester examinations will deal with: #1 - basic concepts of biological rhythms and biological clocks; #2 - details of sleep and sleep biology. The final exam will cover the last third of the course, and it will bring together major concepts from the whole course. Study materials of various types will be available a week before the exam. We normally have a review session a day or two before each exam.

The 8-page paper will be based on topics stimulated by the novel ‘House of Sleep.’ They will be analysis rather than research papers. We will discuss the papers at great length in class later in the semester, and I will post detailed instructions and example topics.

Every Tuesday, we will have a class discussion on a topic related to the lecture material. Often we will discuss one or more papers from the scientific research literature. A group of 2-3 students (the ‘presenters’) will be responsible providing an introduction to the paper(s) or topic and then leading the discussion. Over the course of the semester, every student will be a presenter twice. Each student in the group will get the same grade. However, unexcused absence from the presentation will incur a one letter grade penalty.

The papers for our Tuesday discussions will be available on CANVAS about a week beforehand. In preparation for each discussion, all members of the class will write a section in their journal posing questions about the readings or contributing supplementary information. Journal entries will be graded.

Detailed information about these weekly discussions, about their grading, about journal entries, and about reading scientific research papers is up on CANVAS.

There will be no extra-credit assignments.

The final grade will simply be the weighted average of all the individual grades. Letter grades will be assigned using an equal divisions scale, e.g. 80.00 to 83.29 = B-, 83.30 to 86.69 = B, 86.70 to 89.99 = B+

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From the Honors Program faculty guidelines:

“... set high expectations and standards for outstanding work and achievement …”

“Grades should be based on quality of the work, not effort.”

“... ‘A’ grades are for excellence and outstanding work, meaning that across the board a student’s analysis and expression of ideas is extremely strong …”
An "incomplete" will be assigned as a grade only in cases of compelling and documented need. Incompletes are normally reserved for students experiencing a catastrophic event near the end of the semester. To qualify for an incomplete, the student must have finished a substantial portion of the course and be performing at a "C" level or better. The student will be asked to sign an "incomplete contract" stipulating the requirements and date for the completion of the course and assignment of a final grade.

### No computers, phones, or tablet devices are permitted during our classes.

I understand and have considered all the arguments, valid and not, for permitting laptop and tablet computers in the classroom. However, the reality is that they present an irresistible distraction, detract from the cooperative learning environment, and unfairly affect other students. Based on ever-increasing volumes of research evidence, the distractions created by electronics in the classroom interfere with learning and active participation. In a small, discussion-based class like ours, that is especially counterproductive. For those reasons, the use of computers of any kind and of phones is banned from lectures. (The exception is when a computer is required for a DSS accommodation.)

### Regular attendance in class is necessary for success in this course.

Regular attendance in class is necessary for success in this course. If a debilitating illness or an emergency situation will make it impossible to take an exam or do a paper presentation, it is mandatory that you notify me before or on the day of the exam/presentation. You must present complete and valid documentation before any makeup exam can be taken. Failure to fulfill these requirements will result in a grade of zero.

### We have a CANVAS site for the course and will be using it extensively.

We have a CANVAS site for the course and will be using it extensively. It will be:

- a source for basic information (syllabus, readings, presentation papers, etc.)
- a communications channel for course information of immediate importance
- a convenient way for students to communicate and work together
- a source for study materials before each test
- a vehicle for reporting and keeping track of grades

To access CANVAS, go to ELMS which is both a portal and a source of help and information about the system. If you have trouble logging on or other issues, try the OIT Help Desk.

If you have a documented disability, you should contact Disability Support Services 0126 Shoemaker Hall. Each semester students with documented disabilities should apply to DSS for accommodation request forms that you can provide to your professors as proof of your eligibility for accommodations. The rules for eligibility and the types of accommodations a student may request can be reviewed on the DSS web site at The Counseling Center.
The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible, but no later than the end of the schedule adjustment period. Prior notification is especially important in connection with final exams, since failure to reschedule a final exam promptly can have very serious academic consequences.

Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning. CourseEvalUM will be open for you to complete your evaluations for fall semester courses between December 2nd and December 14th. You can go directly to the website (CourseEvalUM) to complete your evaluations. By completing all of your course evaluations each semester, you will have the privilege of accessing the summary reports for thousands of courses online at Testudo.

Essential to the fundamental purpose of the University is the commitment to the principles of truth and academic honesty. Accordingly, the Code of Academic Integrity is designed to ensure that the principle of academic honesty is upheld. While all members of the University share this responsibility, The Code of Academic Integrity is designed so that special responsibility for upholding the principle of academic honesty lies with the students. It is the responsibility of each student to understand what actions constitute a violation of the Code.

The University of Maryland honor system is fully described in the Code of Academic Integrity. Please see: Student Honor Council. In the event that an Honors College student is found responsible for a violation of the Code of Academic Integrity by the Student Honor Council, he or she will be dismissed from the Honors College for the semester in which the violation took place and for all subsequent semesters in which the student is enrolled as an undergraduate at Maryland. Additional penalties may be imposed by the Student Honor Council.

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Class meetings and course materials, including instructions, presentations, assessments, content outlines, and similar materials are the intellectual property of the course instructor and protected by legal copyright. You may take notes and make copies of course materials for your own personal use. You may not, nor may you allow others to, distribute lecture notes and course materials publicly whether or not a fee is charged without the express written consent of the instructor. Similarly, you own copyright in any work products that you create for this course. If I am interested in sharing your work with others I will ask for your written permission. Copyright violations may result in referrals to the Office of Student Conduct and/or civil penalties under State and Federal law.
Class Schedule

During the first third of the course, we will focus on biological rhythms, especially circadian rhythms, often using alertness and sleep as examples. The history of ‘chronobiology’ can help us put the major concepts into perspective. To understand the biological clock that ticks inside each of us, we will need to make a side trip into the basics of a) brain anatomy; b) how nerve cells communicate; and c) the roles of neurotransmitters and drugs. Our culture is notable in its dismissal of biological rhythms as irrelevant to our lives, and the phenomenon is worsening. Big mistake. We’ll study many instances that demonstrate why.

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<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>September 2nd</td>
<td>Introduction to the course; the nature of biological rhythms; alertness</td>
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<tr>
<td>September 4th</td>
<td>Circadian rhythms - defining the internal clock</td>
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<tr>
<td>September 9th</td>
<td>Circadian, semicircadian, and ultradian rhythms of sleep; paper demo</td>
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<tr>
<td>September 11th</td>
<td>Phase relationships – chronotypes, lifespan changes in rhythms</td>
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<tr>
<td>September 16th</td>
<td>Synchronization of circadian rhythm – entrainment; paper #1</td>
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<tr>
<td>September 18th</td>
<td>Disruption of circadian rhythms – dyschronisms, jet lag, shift work</td>
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<tr>
<td>September 23rd</td>
<td>Basics of nervous system anatomy; paper #2</td>
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<tr>
<td>September 25th</td>
<td>Discovering the biological clock I – strategies and brain pathways</td>
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<tr>
<td>September 30th</td>
<td>Discovering the biological clock II – mutations and chipmunks; paper #3</td>
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**In-class examination**

During the next third of the course, we will study the phenomenon of sleep in considerable detail by following the events of a single night's sleep. We will start with the sleepiness and drowsiness that precede sleep and finish about an hour after you wake up when the aftereffects of sleep have dissipated. We will examine the specific brain mechanisms for falling and staying asleep, at sleep architecture, and the intimate details of each sleep stage.

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<tr>
<th>Date</th>
<th>Topic</th>
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<tr>
<td>October 2nd</td>
<td>Sleepiness; paper #4</td>
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<td>October 7th</td>
<td>Falling asleep I – behavioral phenomena</td>
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<tr>
<td>October 9th</td>
<td>Falling asleep II – mechanisms; the two-factor model; paper #5</td>
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<tr>
<td>October 14th</td>
<td>Slow wave sleep I – characteristics; activity-dependent local sleep</td>
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<tr>
<td>October 16th</td>
<td>Slow wave sleep II – physiological changes; paper #6</td>
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<tr>
<td>October 21st</td>
<td>REM sleep I – characteristics</td>
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<tr>
<td>October 23rd</td>
<td>REM sleep II – physiological changes; paper #7</td>
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<td>October 28th</td>
<td>Waking up – control of sleep duration; sleep inertia</td>
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<tr>
<td>October 30th</td>
<td>Disorders of sleep - narcolepsy, sleep apnea, restless legs; paper #8</td>
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**In-class examination**
The most fundamental - and frustrating - question remains largely unanswered: Why must we sleep? What is sleep's function? This is the substance of the last portion of the course. It is now appearing likely that sleep serves multiple purposes, and we will examine the major candidates.

November 11th
Sleep deprivation I - total deprivation and its consequences; paper #9

November 13th
Sleep deprivation II – partial deprivation and its consequences

House of Sleep paper topic is due on November 11th

November 18th
Sleep and CNS plasticity - introduction to memory mechanisms; paper #10

November 20th
Sleep and CNS plasticity - sleep effects on memory, learning, and creativity

November 25th
Sleep and CNS plasticity - theoretical and practical implications; paper #11

House of Sleep paper draft is due on November 25th

November 27th
Thanksgiving break

House of Sleep paper is due by 5:00 pm on December 2nd

December 2nd
Sleep and metabolism - obesity, diabetes, death; paper #12

December 4th
Other functions of sleep and an evolutionary context

The belief that a major function of sleep is dreaming has a long tradition and continues to have proponents. But, then, what is the function of dreaming? What little objective evidence we have raises more questions than it answers.

December 9th
Dreaming I - what are dreams?; what do we dream?; paper #13

December 11th
Dreaming II - how are dreams created in the nervous system

December 19th
Final examination – 1:30–3:30 pm

We will keep some flexibility in the lecture schedule for the last two-thirds of the course. The field of sleep science is moving very quickly, and we may want to spend more time on particular topics to take into account new findings and/or the particular interests of the class. For instance, during a previous semester, researchers succeeded in reactivating memories during sleep, so we spent extra time talking about those experiments and their implications for understanding the function(s) of sleep.
Readings

Note that these are not traditional ‘reading assignments’ and there are no ‘due dates.’ The readings given below are guidelines. I have not tried to be all inclusive - there are often other relevant sections in one or more of the texts that you can profitably read. The optional books will provide greater detail, broader coverage, and some useful additional topics. For your convenience, I have included a few relevant sections for optional reading as well.

September 2nd

Foster and Kreitzman – Introduction, Chapters 1, 2, 3 and 10 (first part)
Terman and McMahon – Preface; Chapter 1

September 9th

Foster and Kreitzman – Chapters 4 and 11
Moorcroft – Chapters 1 and 2.1–2.2, 3.1–3.2
Epstein – Chapters 2 and 4
Green and Westcombe – Chapter 8
Maharg – Chapter 6

September 16th

Foster and Kreitzman – Chapters 6 (first part), 12–14
Moorcroft – Chapter 12.2
Epstein Chapters 4, 15, and 16
Terman and McMahon – Chapters 15–18

September 23rd

Foster and Kreitzman – Chapters 5 and 6 (last part); skim Chapter 7
Green and Westcombe – Chapter 3

October 7th

Moorcroft – Chapters 3.1
Epstein – Chapter 6
Maharg – Chapter 7

October 14th

Moorcroft – Chapters 3.3, 4–6
Epstein – Chapter 14

October 30th

Moorcroft – Chapters 12, 13
Epstein – Chapters 3, 5, and 6

November 4th

Moorcroft – Chapter 12
Epstein – Chapters 8–13

November 11th

Moorcroft – Chapters 3, 10, 11
Maharg – Chapters 1–3

December 9th

Moorcroft – Chapters 7–9