Circadian Rhythms

3 credits
Tuesdays and Thursdays 9:30 – 10:50 at FA242

Instructor: Kwangwon Lee
202 Science Building, Phone: 225-6066
Email: kwang1@camden.rutgers.edu
Office hours: Tuesday 1:30 – 4:30 pm

Overview
This course will explore the cellular and molecular mechanisms by which organisms "keep time". Although the existence of biological clocks has been known for close to 3 centuries, it is only in the last 30 years that we have started to understand how these endogenous clocks run. Furthermore, work conducted in the last 10 years has revealed a high degree of conservation in the mechanisms that make clocks run. The course will cover fundamental properties of biological rhythms and cellular and molecular structure of circadian oscillators in many organisms including cyanobacteria, fungi, insects, plants, reptiles, birds, and mammals.

Expected learning outcomes

1. Students will become familiar with core concepts in circadian rhythm studies.
2. Students will be able to read, discuss and evaluate current research articles in the field of chronobiology.
3. Students will choose a particular area of clock study of their interest and write a research proposal on the topic.

How can we achieve the expected learning outcomes?

1. Lecture.
First few weeks, I will give lectures on key concepts in clock studies.

2. Reading primary research articles, review articles, and chapters of books. Students are expected to read assigned reading materials before each class. Every week, there will be a quiz (based on the reading material) for students to answer through the course website.

3. Presentation/Discussion.
My major goal for this course is for students to develop critical thinking and their own perspectives on the subject. For this goal, discussion during classes is an important component for the course.

You (individually or in groups, depending on enrolment) will be responsible for one PowerPoint presentation, centered on a specific paper but broad enough to

cover a particular aspect of this topic. The starting point for this presentation will be a paper (+review article, if applicable); I can help you in finding the article if you need help. Everyone will be required to read this paper before class and answer some simple questions about it. Articles from the following journals are acceptable for class discussion; Science, Nature, PNAS, Chronobiology International, and Journal of Biological Rhythms. If a student wants to use an article from other journals, the student needs an approval from the instructor.

Logistics:
Students should do three tasks **at least one week** before their presentation/discussion **(otherwise, deduction of 10 points from the Presentation grade, see the rubrics)**;

1. Discuss with the instructor the presentation/discussion.
2. Upload **one primary research article** (not a review article) into the "Resource" (SAKAI). Display name should follow the format; Last name of the first author of the article_year of publication. For example, Lee_2009.
3. Send **two simple quiz questions** (and your answers) to the instructor by e-mail, kwang1@camden.rutgers.edu. If the questions are not good quality questions, the instructors will send them back to you for revision. It is strongly advised to send the questions as soon as possible.

The research articles and quizzes for class presentation/discussion will be available to all students via the course web in **one week before each presentation/discussion.**

3. Term paper.
Students will write a term paper on a topic of their interests. The paper is intended to get you to think like a "clock person". For this you will identify (with my help if necessary) a research question and come up with experiments that would address/resolve the question. Thus, the paper is intended to be an experimental proposal, **not** a review paper. In order to make sure that you are on the right track, a **first submission** of your paper will be due **November 10**, and the **final** version will be due **November 30**. Your paper should be 3 page-long (recommended) excluding references. Please list only references you actually read. This is not a review paper. This is rather a research proposal. Students will practice "critical thinking" on the subject by designing experiments, by predicting possible pitfalls of the approach, and by evaluating the term papers written by classmates. The paper should include introduction, experimental approach, expected outcome of the project, and references (not included in the three page limit). I can help you in choosing topics and developing the project. Collaboration by two or more students is encouraged.

The first submission of your paper will be due **November 10**, and the **final** version will be posted on the course web before **November 30.**

Once a paper submitted the paper would be evaluated by me and four other anonymous students (below). These evaluation/feedbacks are for students to learn from each other and improve their term papers. The evaluation (by five evaluators) accounts for 20% of the total term-paper grade. Once the final papers submitted, students will read all the term papers and vote for the best term papers. The top four term papers will be presented and discussed in the class.

4. Peer evaluation.
Students will evaluate four term papers written by classmates. Term-paper evaluation rubrics will be provided.

5. Individual meetings.
Students are recommended to meet with me at least two times; 1) to discuss his/her presentation, 2) to discuss his/her term paper during office hours.

Grading

25% Quiz

Before-class quiz (regular): Students are expected to answer quiz questions before each class (SAKAI system, https://sakai.rutgers.edu/portal). Quiz questions for each week will be automatically removed from the web page before the class (9:30 am on Tuesdays and Thursdays).
In-class quiz (occasional): There could be a short quiz during the first 5 min (9:35-9:40).

25% Presentation

Although your presentation will be centered on a specific paper, it must be broad enough to cover your particular topic. Your main objectives are to a) give a lucid presentation on this topic and b) to stimulate a lively discussion (any strategy is acceptable).

25% Class Participation

Since the class relies on discussion, students' attendance will be recorded. I expect you to attend all the lectures. If you cannot attend a class, you may contact the instructor in advance for arranging a make-up project.

25% Term-paper

Please read the attached "term-paper evaluation rubrics"

Class Participation has three different categories:

- Class attendance
- Class Debate
- Class discussion

These three categories contribute equally to the Class Participation grade.

Class attendance will be assessed by subtracting the penalty points;
No class missed 100 points
Missed one class 90 points
Missed two classes 80
Missed three classes 70 and so on.

When a student has a legitimate reason for missing a class, the student should contact the instructor beforehand and arrange a make-up assignment.

Class Debate will be assessed by self/peer evaluation.
Each person will evaluate one's own and opponent group in six different categories (see Class Debate Assessment Rubric).

Each person will also evaluate herself/himself and team mates in two categories (see Class Debate Assessment Rubric).

The best score one can get in Class Debate evaluation is 100 points;

- Self Group Evaluation 30 points (average points evaluated by your group members)
- Peer Group Evaluation 30 points (average points evaluated by the opponent group)
- Self Individual Evaluation 20 points
- Peer Individual Evaluation 20 points (average points evaluated by your group members)

Class Discussion grade will be discussed during the first class.

SAKAI
All the course material including lecture note will be available through the SAKAI web site, https://sakai.rutgers.edu/portal

Code of academic integrity
Each student in this course is expected to abide by the University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work.

Plagiarism is a serious academic offense
All writing assignment should be an original work by a student. Students are highly recommended to educate themselves on the subject;
http://library.camden.rutgers.edu/EducationalModule/Plagiarism/whatisplagiarism.html
http://sociology.camden.rutgers.edu/curriculum/plagiarism.htm

Religious Holidays
I support my students who wish to practice their religious beliefs. Students are being advised to discuss religious absences with me well in advance of the

religious holiday so that arrangements for making up work can be resolved before the absence.

Students with Disabilities (all schools excluding law)
Associate Dean Thomas DiValerio
(856) 225-2663 tdivaler@camden.rutgers.edu

Campus Center, Room #326 (stairs by the third street entrance, elevator located behind the corner convenience store and down the hall from the main campus lounge and multipurpose room).

More information; http://studentaffairs.camden.rutgers.edu/disabled.html

Tentative **Syllabus (Lecture/Discussion)**

Reference textbook

Chronobiology: biological timekeeping / Edited by Jay C. Dunlap, Jennifer J. Loros, Patricia J. DeCoursey.

We will discuss primary research papers in our classes.

September 1,
Course organization.

September 6,
General overview on circadian clocks.

September 8,
Fundamental properties of circadian rhythms: 24 hr free running period and temperature compensation

September ?, (optional) Academic Skills class:

Literature search, Power Point presentation, term-paper writing.

September 13,
Fundamental properties of circadian rhythms: Entrainment / Phase

September 15,
Molecular structure of circadian clocks: Overview

September 20,
Limit cycle theory / modeling

September 22, **Fundamental properties of circadian rhythms**

September 27, **Fundamental properties of circadian rhythms**

September 29, **Human clock**

October 4, **Mammal clock**

October 6, **Fungal clock**

October 11, **Insect clock**

October 13, **Plant clock**

October 18, **Prokaryotic clock**

October 20, **Circannual rhythm and Photoperiodism**

October 25, **Open subject**

October 27, **Open subject**

November 1, **Open subject**

November 3, **Open subject**

November 8, **Open subject**

November 10
First term-paper Due

November 10, **Open subject**

November 15, **preparing class debate**

November 17, **preparing class debate**

November 22, **Class Debate**

November 24, **No class, Thanksgiving Break**

November 29, **Open subject**

November 30
Final term-paper Due

December 1, **Open subject**

December 6, **Presentation of term-papers.**

December 8, **Summary.**