

UNIVERSITY OF TORONTO
SLEEP AND PRIMATE EVOLUTION: THEORY, METHODS, AND APPLICATION
Fall 2022: ANT 3031H – ADVANCED RESEARCH SEMINAR

Meeting Times and Location

Tuesday 2:00 PM - 4:00 PM Virtual Zoom

Instructor Information

Instructor:	Dr. David R. Samson
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Course website:	https://q.utoronto.ca/
Virtual Office hours:	Wednesday 3:00 – 5:00 PM
Virtual lecture/office location:	https://utoronto.zoom.us/j/5090733258
Zoom password	sleep

“If sleep does not serve an absolute vital function, then it is the biggest mistake the evolutionary process ever made.”

~Allan Rechtschaffen

COURSE DESCRIPTION:

I envision this course as an overview of our current understanding of primate sleep ecology and function with particular focus on how these elements drove the evolution of human sleep. Specifically, the aim of the class will be to provide students with a strong, theoretical background of the function of sleep in the animal kingdom with particular attention paid to primate lineages. This will serve as a springboard for the application of several innovative methods measuring the spectrum of behaviors on the inactive-active continuum.

As an overview, the course will be presented in four sections: (i) Sleep: descriptions, functions, and mechanisms from eukaryotes to humans, (ii) The evolution of primate sleep, (iii) Methods: measuring sleep and activity in primates, and (iv) Evolution’s legacy on human sleep. The first section provides students with an overview of the mechanisms and functions of sleep and circadian rhythms, as well as a historical approach that fills in the context for which most of these fundamental discoveries were made. The second section presents a phylogenetic perspective on how sleep is expressed in extant species, in both human and non-human primates. The third section, departs from presenting background information and will focus on the application of the current scientific methods used to measure sleep-wake behavior throughout mammals. Finally, the fourth section provides the most up to date evolutionary narrative of the major transitions of human sleep and the consequences of these derived characteristics to our understanding of modern sleep disorders within an *evolutionary mismatch* framework. The course will conclude with a forward thinking series of predictions on how science and technology will fundamentally alter the way humans sleep in the 21st century and beyond.

COURSE OBJECTIVES:

Upon completion of the class, the students will have:

- A general knowledge of mammalian, primate, and human sleep.
- A basic understanding of the evolutionary mechanisms driving variation in sleep expression within the primate order – and especially in humans.
- Familiarity with the cutting edge statistical and quantitative methods to measure sleep-wake regulation in primates.
- Gained knowledge and experience of how to design and execute hypothesis driven research projects that produce manuscripts with the potential to be peer-reviewed.

COURSE READINGS:

We will not explicitly use a textbook in this course; however, I do rely on two textbooks that will be available online through the UTM library. These will serve students as good background resources:

Principles and Practice of Sleep Medicine (Sixth Edition): Kryger, Roth and Dement. 2017. (Schedule abbreviation: PPSM)

Circadian Physiology (Third Edition): Refinetti. 2016. (Schedule abbreviation: CP)

Moreover, students will have to read selected scientific papers and lead discussion on the “Primary reading” articles each week during the discussion period. The scientific papers will complement the lectures. PDFs of readings will be placed on Quercus and you will be able to know which readings are required before class by looking at the *Discussion Topic* section in the schedule below. Also, the readings may be subject to change as the semester moves on and I note any new articles that could be a good fit for the topic at hand.

WEEK	LECTURE TOPIC	DISCUSSION TOPIC
1	September 14 Topic 1: Class introduction	Text reading: PPSM Ch. 1; CP Ch. 1 Primary reading: Roenneberg et al. 2007 (QALMRI exercise)
2	September 21 Topic 2: Historical overview & Normative sleep and circadian patterns	Text reading: PPSM Ch. 2; CP Ch. 5 Primary reading: Ohayon et al 2004; Samson 2020; Knutson 2014
3	September 28 Topic 3: Mechanism of sleep and circadian physiology	Text reading: PPSM Ch. 7; CP Ch. 11 Primary reading: Lulu Xie et al 2013; Lopez-Minguez et al 2016; Buxton et al 2012
4	October 5	No class
5	October 12 Topic 4: The function of sleep, or why be inactive? & Comparative mammalian sleep	Text reading: CP Ch. 8; CP Ch. 12 Primary reading: Lesku et al 2012; Tuominen et al 2019; Vaccaro et al 2020
6	October 19 Topic 5: How to measure primate sleep: methods, technology, and analysis Science: How do we do it? How do we communicate it?	Text reading: PPSM Ch. 49, 160 & 171; CP Ch. 2 Primary reading: Platt 1964; Balzamo et al 1998; Samson AJHB 2020 DUE: Hypothesis précis and discussion
7	October 26 Topic 6: Extant nonhuman primate sleep ecology	Text reading: PPSM Ch. 37 Primary reading: Pruettz 2018; Samson and Shumaker 2015; Nunn and Samson 2018 DUE: Hypothesis assignment
8	November 2 Topic 7: Human sleep ecology	Text reading: CP Ch. 10 Primary reading: Prall et al. 2018; Crittenden et al 2018; Smit et al 2019
9	November 9 Reading week (no class)	
10	November 16 Topic 8: Sleep, cognition, and human evolution Shining evolutionary light on human sleep disorders	Text reading: PPSM Ch. 5, 61; CP Ch. 15, 16 Primary reading: Perez et al. 2018; Samson 2017; Pilz et al 2018
11	November 23 Presentations	
12	November 30 Presentations	
13	December 7	Grant proposal due

EVALUATION:

Discussion participation	20%
Hypothesis precis	5%
Hypothesis assignment	15
Oral presentation	20%
Grant proposal	40%

DISCUSSION PARTICIPATION:

Each class a student will be assigned the role of leading class discussion based on the QALMRI guidelines. That being said, it is the responsibility of everyone to come to class prepared to discuss the readings.

HYPOTHESIS ASSIGNMENT:

What makes science a special and incredibly powerful tool to investigate the universe? There are several contenders, but none as strong as the *hypothesis*. We will investigate what makes a good hypothesis from a poor one. Specifically, you will be tasked with creating your own series of hypotheses and predictions that you will be able to apply to the final project – the grant proposal.

ORAL PRESENTATION:

Another core component of being a scientist is communicating your discoveries. Thus, you will be given the opportunity to give an oral presentation based on the research you are proposing in your grant proposal. You will be graded on the quality of your powerpoint presentation, the timeliness of the lecture, and the clarity of your oral presentation. Finally, body language will be assessed to help maximize how you project yourself during public performance.

GRANT PROPOSAL:

Arguably, one of the most important skills you develop as graduate students and professional scientists is the ability to craft compelling grants. Instead of making you write a traditional research paper, your major assignment will be to create a grant proposal that somehow ties a sleep related research question into your area of focus. We will be using the University of Toronto's [Connaught New Researcher Award](#) template as the format for your grant proposal. In class, we will discuss the details needed to craft an excellent proposal in an exercise that I hope you will be able to leverage throughout your career.

IMPORTANT NOTES:

1. Assignments and exams will be given on the days specified. If you miss an exam, you may be required to write a makeup examination. Appropriate medical documentation is required in all cases when an exam is missed. Emailed excuses *do not* constitute appropriate documentation.
2. Penalty for lateness. Assignments and written reports have a due date for submission to the course instructor. The deadlines for each are noted in the Course Schedule section of this syllabus, above. Late assignments will be penalized with a 10% grade deduction for each day late unless you have made prior arrangements with the instructor. Deadlines will be defined as 11:59 p.m. eastern standard time.
3. UTM has an *Accessibility Resource Centre* (<http://www.utm.utoronto.ca/accessability/accessability-resource-centre>). Students who require accommodation for documented issues are encouraged to contact the Centre to make arrangements as early in term as possible.
4. Final marks are tentative until approved by the Department Chair and Dean's Office, and recorded in the Registrar's Office.
5. You should be aware that the University of Toronto expects your work to be done independently. The University takes Academic Integrity very seriously. Any attempt to gain undue advantage over your classmates by plagiarism or other forms of cheating will be dealt with according to the *Code of Behaviour on Academic Matters*.
6. **Email policy:** Most questions can and should be asked in class or during office hours. However, if you have a quick question or comment and need to email me, please feel free to do so using "**ANT303**" as your subject line. Please, clearly indicate your student number in the email. I will try to respond as quickly as possible. I cannot respond to lengthy questions over email but will be happy to discuss them in person. If office hours conflict with your schedule please let me know and we can make other arrangements. If an emailed question is relevant to the rest of the class, I will post a response on Blackboard or discuss it in the next class. Feel free to post questions relevant to course content in the discussion forum of the course web site. **NOTE:** I recommend that you use your UTM email address or that of your home ISP (e.g., Rogers or Sympatico). Email from hotmail, yahoo, or similar accounts may be filtered as spam so use these at your own risk.
7. Please be aware that the University of Toronto has a *Code of Student Conduct* that defines non-academic offences, including for example, offences against persons, disruption, and unauthorized entry or presence, among other offences.
8. You should be aware of UTM's general regulations, including the following:

A/ Term work regulations

https://registrar.utm.utoronto.ca/student/calendar/calendar_detail2.pl?Topic=Term%20Work%20Regulations

B/ Term Tests

https://registrar.utm.utoronto.ca/student/calendar/calendar_detail2.pl?Topic=Term%20Tests

C/ Examinations

https://registrar.utm.utoronto.ca/student/calendar/calendar_detail2.pl?Topic=Examinations

D/ Academic Honesty, and

https://registrar.utm.utoronto.ca/student/calendar/calendar_detail2.pl?Topic=Academic%20Honesty

E/ Petitions, Appeals, Deferrals

https://registrar.utm.utoronto.ca/student/calendar/calendar_detail2.pl?Topic=Petitions%20Appeals%20Deferrals