APPLICATION FOR NEW COURSE

1. Submitted by College of _______ Arts and Sciences _________ Date 11/18/04

Department/Division offering course Biology

2. Proposed designation and Bulletin description of this course

a. Prefix and Number __507____ b. Title* Biology of Sleep and Circadian Rhythms

*NOTE: If the title is longer than 24 characters (including spaces), write a sensible title (not exceeding 24 characters) for use on transcripts __Sleep&Circadian Rhythms

c. Lecture/Discussion hours per week 3 d. Laboratory hours per week

e. Studio hours per week

f. Credits 3

g. Course description

This course provides an introduction to the fields of sleep and circadian rhythms including the underlying neuroanatomy, neurophysiology, and the molecular and genetic underpinnings of sleep and circadian behaviors. The medical and societal relevance of these areas will also be emphasized. Considerable time will be spent reading and analyzing the primary literature in these fields, including student presentations of selected articles.

h. Prerequisites (if any)

Bio 304 genetics; Bio 315 cell biology; Bio 350 animal physiology (or equivalent)

or consent of instructor

i. May be repeated to a maximum of ___________________________ (if applicable)

4. To be cross-listed as

Symbol and Number ___________________________ Signature, Chairman, cross-listing department

5. Effective Date Fall 2005, but taught twice thus far as an A&S500 (semester and year)

6. Course to be offered  □ Fall  □ Spring  □ Summer

7. Will the course be offered each year? (Explain if not annually)  □ Yes  □ No

8. Why is this course needed?

Sleep is one of the most basic animal behaviors, but historically has received little scientific attention. This course will help remedy this lack of knowledge regarding sleep and circadian rhythms, and provide an opportunity for advanced undergraduates and graduate students to explore an important area of neuroscience in depth. Aside from important fundamental knowledge, sleep and circadian disturbances afflict almost 75 million people in the USA alone, and this course provides considerable background in various sleep disorders that have substantial medical and societal relevance.

9. a. By whom will the course be taught? Bruce O'Hara  □ Yes  □ No

b. Are facilities for teaching the course now available?  □ Yes  □ No

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10. What enrollment may be reasonably anticipated?  15 - 25

11. Will this course serve students in the Department primarily?  
   ☑ Yes  ☐ No
   Will it be of service to a significant number of students outside the Department?  
   ☑ Yes  ☐ No

In the A&S 500 course thus far I have had a number of non-BIO students. I believe this course would be valuable for a variety of students in several different departments that have a neuroscience focus.

Will the course serve as a University Studies Program course?  
☐ Yes  ☑ No

If yes, under what Area?

12. Check the category most applicable to this course
   ☐ traditional; offered in corresponding departments elsewhere;
   ☑ relatively new, now being widely established
   ☐ not yet to be found in many (or any) other universities

13. Is this course applicable to the requirements for at least one degree or certificate at the University of Kentucky?  
   ☑ Yes  ☐ No

14. Is this course part of a proposed new program: 
   If yes, which?  
   ☐ Yes  ☑ No

15. Will adding this course change the degree requirements in one or more programs?*  
   If yes, explain the change(s) below  
   ☐ Yes  ☑ No

16. Attach a list of the major teaching objectives of the proposed course and outline and/or reference list to be used.

17. If the course is a 100-200 level course, please submit evidence (e.g., correspondence) that the Community College System has been consulted.

18. Within the Department, who should be contacted for further information about the proposed course?
   Name  Bruce O'Hara  Phone Extension  x7-2805

*NOTE: Approval of this course will constitute approval of the program change unless other program modifications are proposed.
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Signatures of Approval:

[Signature]
Department Chair

[Signature]
Dean of the College

12/8/04
Date

1/14/05
Date

12/13/04
Date of Notice to the Faculty

*Undergraduate Council

*University Studies

*Graduate Council

*Academic Council for the Medical Center

*Senate Council (Chair)

Date of Notice to University Senate

*If applicable, as provided by the Rules of the University Senate

ACTION OTHER THAN APPROVAL

Rev 8/02
Syllabus for A&S 500 course (Fall 2004):

Biology of Sleep and Circadian Rhythms

Lecture: Tuesday and Thursday evenings 7:00 – 8:15pm, Rm. 305/308 Morgan Bldg.

Instructor: Bruce O’Hara
334A Morgan Bldg.
257-2805
bohara@uky.edu

Office hours: TuTh 2-4pm, Rm. 334A Morgan Bldg.

Learning objectives:
1. To introduce the fields of sleep and circadian rhythms.
2. To provide increased depth in the neurosciences.
3. To learn to read and evaluate primary literature.
4. To learn to distinguish between well established scientific findings vs. more speculative, emerging or working hypotheses.

Learning outcomes:
1. Students will understand the terminology and technology that forms an important basis in the study of sleep and circadian rhythms including details of Electroencephalograms (EEG), Electromyograms (EMG), Electrooculograms (EOG), Spectral Analysis, Delta power, Slow wave sleep, REM sleep, the Circadian System, Phase shifts, Phase response curves, and actigrams.
2. Students will be able to identify all major brain regions, and all sub-regions associated with sleep and circadian rhythms. They will know the major neurotransmitter systems and some of the drugs that interact with these systems. They will learn state of the art methods in molecular biology and genetics and how these methods are used to understand the brain, sleep and circadian rhythms.
3. Students will be able to read and understand original scientific articles in the areas of sleep and circadian rhythms.
4. Students will learn to identify and evaluate the strengths and weaknesses of different hypotheses in the fields of sleep and circadian rhythms, and begin to understand what scientific ideas are well established vs. those that are still emerging or relatively untested.

This course will cover several different aspects of sleep and circadian rhythms from the molecular to the behavioral level, and will examine both normal and abnormal variations that occur. Circadian rhythms are among the most well defined behaviors we know. In mammals, we know the precise neuroanatomical location and the molecular underpinnings of the master circadian pacemaker. Circadian behaviors have also been well defined mathematically. Sleep, on the other hand, is perhaps the least understood behavior. Although we spend one third of our life sleeping, we still do not know the basic function or functions of sleep, and this remains one of the major questions in biology and the neurosciences.
Course Description for University Bulletin: This course provides an introduction to the fields of sleep and circadian rhythms including the underlying neuroanatomy, neurophysiology, and the molecular and genetic underpinnings of sleep and circadian behaviors. The medical and societal relevance of these areas will also be emphasized. Considerable time will be spent reading and analyzing the primary literature in these fields, including student presentations of selected articles. Prereq: BIO 304, 315, 350 (or equivalent) or consent of instructor.

Expectations: I expect all students to do the weekly readings. Occasional short quizzes will be given as an additional incentive to come to each class prepared (however, there will be no surprise quizzes). Much of the reading material comes from the primary literature, and it will often be difficult to understand all the experiments. I do not expect complete understanding of every paper, but I do expect you to understand the key points that we will discuss in class, and I will strongly encourage you to ask questions when you do not understand something. You will also be given one paper (or two closely related papers) to present to the entire class. These presentations will be given in weeks six to fourteen. For this paper, you must understand all experiments and the relevant background material (some of which may reside in the cited references of this paper). I will meet with each student at least twice for this presentation to make sure you have sufficient understanding of the relevant material, and have prepared appropriate powerpoint slides. You will pick this paper by the fourth week of the semester so that there will be sufficient time to prepare.

Grading for undergraduate students will be based on one early Midterm in week Five (largely focused on Circadian Rhythms), one oral powerpoint presentation (given in weeks six to fourteen), and a final exam focused on Sleep (materials primarily from weeks six to fifteen). Midterm will count 20%, Presentation 25%, Final 40%, Class participation 10%, Small quizzes and assignments given approximately every other week 5%. Grading of the presentations will be based on your preparation, understanding of the material, and oral presentation. Oral presentations will be approximately 30 minutes each. Grading for graduate students will include all the above plus one oral examination on a topic chosen by the student.
The following traditional grade system will be used:

A = 90 – 100%; B = 80 – 89%; C = 70 – 79%; D = 60 – 69%; E = < 60

Final grades may be scaled up depending on the overall distribution of scores, but in no case will grades be lower than this scale.

Attendance: I expect all students to attend each class unless you have an excused absence. Material, quizzes, exams, etc. missed for an excused absence can be made up by performing equivalent work before or after the absence. Unexcused absences will result in a lower class participation grade.

Week One/Two: Introduction to Sleep and Circadian Rhythms

Sleep and dreaming, by J.A. Hobson, from *Fundamental Neuroscience*

Phylogeny of sleep regulation, by I. Tobler, from *Principles and Practice of Sleep Medicine*

Circadian timing, by R.I. Moore, from *Fundamental Neuroscience*
**Week Two/Three:** a). Concepts, Terminology, & Quantitative Descriptions of Circadian Behavior
   b). Neuroanatomy & Neurophysiology underlying the Circadian System

   The supra-<i>c</i>hiasmatic nuclei contain..., by W.J. Schwartz et al. *Neurobiol, 1987*

   Circadian rhythms from flies to human, by Panda et al. *Nature, 2002*

   Website on neurophysiology of biological rhythms & sleep, Colorado University

**Week Four:** Molecular underpinnings of the Circadian Pacemaker

   Coordination of circadian timing..., by S.M. Reppert & D.R. Weaver *Nature, 2002*

**Early MIDTERM Exam: September 28, 2004**

**Week Five/Six:** Neuroanatomy and Neurophysiology underlying Sleep Regulation


   Sleep and serotonin: An unfinished story, by M. Jouvet *Neuropsychopharmacol., 1999*

   Dopaminergic role in stimulant-induced wakefulness, by Wisor et al. *J. Neurosci, 2001*

   Website on neurophysiology of sleep, by M.F. Hilton, Harvard Medical School

**Week Seven/Eight:** Sleep Homeostasis and Circadian Rhythms – The Two Process Model

   Sleep homeostasis and models of sleep regulation, by A. Borbely & P. Acherman, From *Principles and Practice of Sleep Medicine* 3rd ed

   The human circadian timing system..., by C.A. Czeisler & S-B.S. Khalsa, From *Principles and Practice of Sleep Medicine* 3rd ed

   REM-sleep timing..., by J.H. Benington & H.C. Heller *AJP, 1994*

   The homeostatic regulation of sleep..., by P. Franken et al. *J. Neurosci, 2001*

   Long-term vs. Short-term..., by P. Franken *J. Sleep Res., 2002*

**Week Nine/Ten:** Genetic and Molecular aspects of sleep

   Genetics of sleep and sleep disorders, by P. Franken & M. Tafti *Frontiers Biosci., 2003*
Genetics of sleep disorders, by B.F. O'Hara & E. Mignot CRC book, 2000

A role for cryptochromes in sleep regulation, by J. Wisor et al. BMC Neurosci, 2002

Differential increase in the expression of heat-shock..., by A. Terao et al. Neurosci, 2003

Regulation of Clock and NPAS2 DNA binding by the redox..., Rutter et al. Science, 2001

**Week Eleven: Sleep Disorders**

Classification of sleep disorders, by M.J. Thorpy, Principles & Practices of Sleep Medicine

Epidemiology of sleep disorders, by M. Partinen & C. Hublin, Principles & Practices of Sleep Medicine

Randomized trial of Modafinil..., by US Modafinil in Narcolepsy Multicenter Neurology, 2000

Stanford Sleepiness Scale, Epworth Scale

The sleep disorder canine narcolepsy is caused by a mutation..., Lin et al. Cell, 1999

Narcolepsy in orexin knockout mice: genetics of sleep regulation, Chemelli et al. Cell, 1999


**Week Twelve: Sleep and Dreaming**

The relation of eye movement..., by W. Dement & N. Kleitman J. Exp. Psych. 1957

The mental experience of sleep, by W. Dement, from The Experimental Study of Human Sleep: Methodological Problems, 1975


Lucid Dreaming..., by S. LaBerge, Behavioral Brain Sciences, 2000

**Week Thirteen: Sleep and Development**

Development of REM and SWS..., by M.G. Frank & H.C. Heller AJP, 1997

Sleep ontogenesis revisited..., by J. Louis et al. Sleep, 1997

Rapid eye-movement sleep deprivation..., by Shaffery et al. Neurosci., 2002

Sleep enhances plasticity..., by M.G. Frank et al. Neuron, 2001
**Week Fourteen:** Sleep Functions I – Metabolic Energy Restoration?

- *Sleep deprivation decreases glycogen...*, by P. Gip et al. *AJP*, 2002
- *Brain glycogen decreases with increased...*, by J. Kong et al. *J. Neurosci*, 2002

**Week Fifteen:** Sleep Functions II – Learning and Memory?

- *Sleep and memory: A molecular perspective*, by L. Graves et al., *TINS*, 2001
- *Effects of early and late nocturnal sleep...*, by W. Plihal & J. Born *Psychophys.*, 1999
INVESTIGATING BODY  Math. & Nat.  COURSE, MAJOR, DEGREE or PROGRAM  BI0 507
(Area)  (department or college)
DATE FOR COUNCIL REVIEW  CATEGORY: NEW, CHANGE, DROP

INSTRUCTIONS: This completed form will accompany the course application to the Graduate/Undergraduate Council(s) in order to avoid needless repetition of investigation. The following questions are included as an outline only. Be as specific and as brief as possible. If the investigation was routine, please indicate this. The term "course" is used to indicate one course, a series of courses or a program, whichever is in order. Return the form to Leonidas Bachas, Associate Dean, 275 Patterson Office Tower for forwarding to the Council(s). ATTACH SUPPLEMENT IF NEEDED.

1. List any modifications made in the course proposal as submitted originally and why.

   NONE

2. If no modifications were made, review considerations that arose during the investigation and the resolutions.

3. List contacts with program units on the proposal and the considerations discussed therein.

4. Additional information as needed.

   NONE

5. A&S Area Investigator Recommendation:

   [ ] APPROVE, [ ] APPROVE WITH RESERVATION, [ ] DISAPPROVE

6. A&S Council Recommendation:

   [ ] APPROVE, [ ] APPROVE WITH RESERVATION, [ ] DISAPPROVE

7. A&S Council Investigator, Dave Moecher

   Date: JAN 14 05

File: InvestigatorRpt

JAN 25 2005