Revised

1. General Information

1a. Submitted by the College of: ARTS &SCIENCES

Date Submitted: 4/7/2015

1b. Department/Division: Biology

1c. Contact Person

Name: Ruth E Beattie

Email: rebeat1@uky.edu

Phone: 257-7647

Responsible Faculty ID (if different from Contact)

Name:

Email:

Phone:

1d. Requested Effective Date: Semester following approval

1e. Should this course be a UK Core Course? No

2. Designation and Description of Proposed Course

2a. Will this course also be offered through Distance Learning?: No

2b. Prefix and Number: BIO 446

2c. Full Title: Neurophysiology Laboratory

2d. Transcript Title: Neurophysiology Laboratory

2e. Cross-listing:

2f. Meeting Patterns

LECTURE: 2.0

LABORATORY: 3.0

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 3

2i. Is this course repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. Course Description for Bulletin: This course will focus on experimentation in neurophysiology. The generation of receptor potentials in sensory neurons will be measured in addition to action potentials in axons. Pharmacological experimentation of ionotropic and metabotropic receptors subtypes and second messengers signaling will be conducted. The key role of ion channels and transporters in regulation of the membrane potential will be examined. The concept of electrochemical equilibrium will be introduced and the quantitative examination of the equilibrium membrane potential will include discussion of Goldman and Nernst equations and their applications. The mechanisms of action potential generation, as a result of synaptic and receptor stimulation within a neural cell, will be measured. lecture and laboratory Prerequisites: BIO 302 or BIO 350 or consent of Instructor

2k. Prerequisites, if any: BIO 302 or BIO 350 or consent of instructor

2l. Supplementary Teaching Component:

3. Will this course taught off campus? No

If YES, enter the off campus address:

4. Frequency of Course Offering: Spring,

Will the course be offered every year?: Yes

If No, explain:

5. Are facilities and personnel necessary for the proposed new course available?: Yes

If No, explain:

6. What enrollment (per section per semester) may reasonably be expected?: 24

7. Anticipated Student Demand

Will this course serve students primarily within the degree program?: Yes

Will it be of interest to a significant number of students outside the degree pgm?: Yes

If Yes, explain: This course will be an elective for the new neuroscience major (program paperwork has been submitted for approval)and for the Biology BS and BA.

8. Check the category most applicable to this course: Traditional – Offered in Corresponding Departments at Universities Elsewhere,

If No, explain:

9. Course Relationship to Program(s).

a. Is this course part of a proposed new program?: Yes

If YES, name the proposed new program: Neuroscience

b. Will this course be a new requirement for ANY program?: No

If YES, list affected programs:

10. Information to be Placed on Syllabus.

a. Is the course 400G or 500?: No

b. The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached: Yes

Distance Learning Form

Instructor Name:

Instructor Email:

Internet/Web-based: No

Interactive Video: No

Hybrid: No

1.How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations?

2.How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.

3.How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.

4.Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?

If yes, which percentage, and which program(s)?

5.How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?

6.How do course requirements ensure that students make appropriate use of learning resources?

7.Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

8.How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)?

9.Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? NO

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.

10.Does the syllabus contain all the required components? NO

11.I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name:

SIGNATURE|VCASS2|Vincent Cassone|BIO 446 NEW Dept Review|20141222

SIGNATURE|ACSI222|Anna C Harmon|BIO 446 NEW College Review|20150203

SIGNATURE|JMETT2|Joanie Ett-Mims|BIO 446 NEW Undergrad Council Review|20150331

SIGNATURE|JEL224|Janie S Ellis|BIO 446 NEW Senate Council Review|20150406

SIGNATURE|VCASS2|Vincent Cassone|BIO 446 NEW Approval Returned to Dept|20150406

New Course Form

https://myuk.uky.edu/sap/bc/soap/rfc?services=

Open in full window to print or save

Generate R

Attachments:

Browse... Upload File

	ID	Attachment
Delete	4671	BIOLOGY446-Neurophysiology Syllabus revised.doc

First 1 Last

(*denotes required fields)

1. General Information

a. * Submitted by the College of: ARTS & SCIENCES Submission Date: 4/7/2015

b. * Department/Division: Biology

c.

* Contact Person Name: Ruth E Beattie Email: rebeat1@uky.edu Phone: 257-7647

* Responsible Faculty ID (if different from Contact) Email: Phone:

d. * Requested Effective Date: ◉ Semester following approval OR ○ Specific Term/Year [1]

e.

Should this course be a UK Core Course? ○ Yes ◉ No

If YES, check the areas that apply:

☐ Inquiry - Arts & Creativity	☐ Composition & Communications - II
☐ Inquiry - Humanities	☐ Quantitative Foundations
☐ Inquiry - Nat/Math/Phys Sci	☐ Statistical Inferential Reasoning
☐ Inquiry - Social Sciences	☐ U.S. Citizenship, Community, Diversity
☐ Composition & Communications - I	☐ Global Dynamics

2. Designation and Description of Proposed Course.

a. * Will this course also be offered through Distance Learning? ○ Yes [4] ◉ No

b. * Prefix and Number: BIO 446

c. * Full Title: Neurophysiology Laboratory

d. Transcript Title (if full title is more than 40 characters): Neurophysiology Laboratory

e. To be Cross-Listed [2] with (Prefix and Number):

f. * Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[3] for each meeting pattern type.

2.0	Lecture	3.0	Laboratory[1]		Recitation		Discussion
	Indep. Study		Clinical		Colloquium		Practicum
	Research		Residency		Seminar		Studio
	Other	If Other, Please explain:					

g. * Identify a grading system:

◉ Letter (A, B, C, etc.)
○ Pass/Fail
○ Medicine Numeric Grade (Non-medical students will receive a letter grade)
○ Graduate School Grade Scale

h. * Number of credits: 3

i. * Is this course repeatable for additional credit? ○ Yes ◉ No

If YES: Maximum number of credit hours:

If YES: Will this course allow multiple registrations during the same semester? ○ Yes ○ No

j. * Course Description for Bulletin:

This course will focus on experimentation in neurophysiology. The generation of receptor potentials in sensory neurons will be measured in addition to action potentials in axons. Pharmacological experimentation of ionotropic and metabotropic receptors subtypes and second messengers signaling will be conducted. The key role of ion channels and transporters in regulation of the membrane potential will be examined. The concept of electrochemical equilibrium will be introduced and the quantitative examination of the equilibrium membrane potential will include discussion of Goldman and Nernst equations and their applications. The mechanisms of action potential generation, as a result of synaptic and receptor stimulation within a neural cell, will be measured.
lecture and laboratory
Prerequisites: BIO 302 or BIO 350 or consent of Instructor

k. Prerequisites, if any:

BIO 302 or BIO 350 or consent of instructor

l. Supplementary teaching component, if any: ○ Community-Based Experience ○ Service Learning ○ Both

3. * **Will this course be taught off campus?** ○ Yes ◉ No

If YES, enter the off campus address:

4. **Frequency of Course Offering.**

a. * Course will be offered (check all that apply): ☐ Fall ☑ Spring ☐ Summer ☐ Winter

b. * Will the course be offered every year? ◉ Yes ○ No

If No, explain:

5. * **Are facilities and personnel necessary for the proposed new course available?** ◉ Yes ○ No

If No, explain:

6. * **What enrollment (per section per semester) may reasonably be expected?** 24

7. **Anticipated Student Demand.**

a. * Will this course serve students primarily within the degree program? ◉ Yes ○ No

b. * Will it be of interest to a significant number of students outside the degree pgm? ◉ Yes ○ No

If YES, explain:

This course will be an elective for the new neuroscience major (program paperwork has been submitted for approval and for the Biology BS and BA.

8. * **Check the category most applicable to this course:**

☑ Traditional – Offered in Corresponding Departments at Universities Elsewhere
☐ Relatively New – Now Being Widely Established
☐ Not Yet Found in Many (or Any) Other Universities

9. **Course Relationship to Program(s).**

a. * Is this course part of a proposed new program? ◉ Yes ○ No

If YES, name the proposed new program:

Neuroscience

b. * Will this course be a new requirement [4] for ANY program? ○ Yes ◉ No

If YES [5], list affected programs::

10. **Information to be Placed on Syllabus.**

a. * Is the course 400G or 500? ○ Yes ◉ No
If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in **10.b**. You must include: (i) identi additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR

b. ☑ * The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if appl **10.a** above) are attached.

[4] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.
[5] The chair of the cross-listing department must sign off on the Signature Routing Log

[3] In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. Laboratory meeting, generally, re two hours per week for a semester for one credit hour. (from SR 5.2.1)
[4] You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.
[5] In order to change a program, a program change form must also be submitted.

Rev 8/09

BIO 446 (3 credit hours)
NEUROPHYSIOLOGY LABORATORY
Spring 2015

Instructor: ROBIN COOPER , Ph.D.
Office: BS 226
Office phone: 859-257-5950
E-mail: RLCOOP1@email.uky.edu

Required Texts
The course handouts and www based content can be accessed at:
http://web.as.uky.edu/Biology/faculty/cooper/Bio450-AS300/Bio476-Spring2015.htm

Supplementary Materials
Readings from the primary literature will be assigned on occasion. These articles will be posted on Blackboard for you to download and print.

Time: Tues - 2:00 to 3:15 PM Lecture; Thurs - 1:00 to 3:50 PM Lab

Pre-requisites are BIO 302 or BIO 350 or consent of instructor

Course Description
This course will focus on experimentation in neurophysiology, with some emphasis on muscle physiology. The generation of receptor potentials in sensory neurons will be measured as well as action potentials in axons. Pharmacological experimentation of ionotropic and metabotropic receptors subtypes and second messengers signaling will be conducted. The key role of ion channels and transporters in regulation of the membrane potential will be examined.. The concept of electrochemical equilibrium will be introduced and quantitative description of the equilibrium membrane potential will include discussion of Goldman and Nernst equations and their applications. The mechanisms of action potential generation, as a result of synaptic and receptor stimulation within a neural cell, will be measured.

The mechanisms of neuron-neuron communication through electrical and chemical synapses will be examined in live preparations. The function of gap junction ion channels will be examined and measured at electrical synapses. The complex intracellular mechanisms controlling neurotransmitter release at the chemical synapses will be examined. The proteins participating in the SNARE complex, involved in the synaptic vesicles fusion, as well as the molecular machinery involved in synaptic vesicles recycling will be emphasized along with quantal analysis of synaptic transmission. The historical introduction of the quantal hypothesis and its experimental conformation will be covered. Synaptic plasticity will be covered up to the latest discoveries in the field.

Student Learning Outcomes
By the end of this course, you should be able to:
1. Demonstrate a conceptual understanding of the information processing in the nervous system.
2. Demonstrate an understanding of the molecular mechanisms that enable signal transmission in the nervous system in terms of receptor potentials, synaptic potentials and action potentials.
3. Describe the cellular specializations and the molecular machinery involved in neuron-neuron communication.
4. Demonstrate knowledge of the mechanisms of sensory processing.
5. Demonstrate an understanding of and ability to critically analyze research papers in the field of neuroscience.
6. Develop new ideas and suggest future research directions in the field of neuroscience.

The overall objective of the course is to develop insightful understanding of neurological processes at the molecular and cellular level through experimentation.

Grades

Grades will be based on attendance, exams, homework assignments, a lab report, and conducting laboratory assignments. There will be two exams. Homework due dates and exam dates are listed in the schedule at the end of this document.

- Class attendance: 10% (scored out of 100 points and is worth 10% of your final grade) (30 class days, students will lose 10 points (1%) for each unexcused absence from class). If you have 10 unexcused absences you will lose all of your attendance points.

- Conducting all laboratory exercises 30% (scored out of 300 points – 20 points per lab notebook review, 15 labs @ 20 points per lab – worth 30% of final grade)
- Homework/problem sets: (200 points - 10 @ 20 points each (2% each) = 20% of final grade)
- 1 Lab report (worth 200 points (20% of final grade), submitted in a journal publication format)
- Exam 1: worth 100 points (10% of final grade)
- Exam 2: worth 100 points (10% of final grade)

Final grades will be assigned as follows:
A = 90-100%
B = 80-89.9%
C = 70-79.9%
D = 60-69.9%
E = 59.9% and below

NOTE: There will be NO curving of scores

Midterm grades will be posted by the end of the ninth week of the semester.

Missed exams: Make-up examinations (for missed examinations) will only be given for **DOCUMENTED** excused absences **as defined by the University (Senate Rule V.2.4.2).** Students are entitled to an excused absence for the following reasons:

a. serious illness;
b. illness or death of family member;
c. University-related trips;
d. major religious holidays;

A missed examination will result in a score of zero for that exam, unless an acceptable written excuse is presented within one week of the missed examination. Please contact the course Instructor to schedule a make-up examination.

If you are unable to take an examination as scheduled, it is your responsibility to contact me no later than 1 week after the missed exam.

Homework and problem sets that are turned in late will receive a score of zero, unless documentation for an excused absence is provided within one week of the absence. If the absence is excused then the student will have 1 week to hand in the material for a score.

Lab Notebook

Each student must keep a laboratory notebook. This should be hand-written. This notebook is the primary record of your experiments and research. It should be a hard-backed notebook not a loose-leaf binder. Notes should be made in ink not pencil. You should record all information in real time. Include experimental set-up, procedures, your data, charts and graphs, and conclusions. These notebooks will be reviewed at the end of each class period. If the notes for a particular lab are incomplete, a score of 0% will be assigned. Additional information on what to record in your lab notebook will be provided in class.

Quizzes
Four unannounced quizzes will be given during the semester and each is worth up to 10 extra credit points towards your exam score total. Each exam is worth 100 points (10% of final grade)

A missed quiz will result in a score of zero for that quiz, unless an acceptable written excuse as defined by the University (Senate Rule V.2.4.2). is presented within one week of the missed quiz.
Please contact the course Instructor to schedule a make-up quiz.

Missed Labs

Make-up labs for excused absences (as defined by the University) will be held during Dead Week. It is your responsibility to contact me no later than 1 week after the missed lab.

Course Format
In this course, you will learn the fundamentals of neural processing through a variety of activities, including lectures, problem sets, independent/group study, and in-class exercises. Please note that you are responsible for all the material in the assigned chapters, including figures, summaries, and "boxes," regardless of whether it is covered in lectures. Thus, you will be responsible for covering the material from the handouts/web materials and from reading on your own.

Blackboard/Class Communications
Course announcements, assignments, lecture outlines and additional materials will be posted online using Blackboard. Exams and homework dates will remain fixed. Updates to this syllabus (regarding topics and reading) will be posted; please check periodically. You will also receive important course announcements via your UK e-mail account. If you do not use your UK e-mail account, you need to activate it. It is strongly recommended that you check your e-mail regularly. I may send messages-sometimes with attachments-to the class using this medium. You should also feel free to e-mail me if you have any questions or problems. Feel free to call me as well, if you prefer a more personal communication. I am also available during the office hours. If you would like to meet with me at another time, please don't hesitate to e-mail or to call, and I can schedule a time to meet.

Disabilities

Any student who needs accommodation because of a disability should contact me privately to discuss the specific situation as soon as possible. The Office of Disability Resources and Services will inform the Instructor as to reasonable accommodations for students with documented disabilities.

Honesty and Civility
You must abide by UK's Code of Conduct which prohibits:
1. Academic dishonesty and impropriety, including plagiarism and academic cheating.
2. Interfering or attempting to interfere with or disrupting the conduct of classes or any other normal or regular activities of the University.
We take plagiarism and other forms of cheating very seriously. If you have any questions as to whether something is plagiarism, please ask me, or, if that's not possible, assume that it is and don't do it!

Academic Offenses:
PLAGIARISM and CHEATING are serious academic offenses.
The following is an excerpt taken from the "Students Rights and Responsibilities Handbook, University of Kentucky" regarding cheating.
"***Cheating is defined by its general usage. It includes, but is not limited to, the wrongful giving, taking, or presenting any information or material by a student with the intent of aiding himself/herself or another on any academic work which is considered in any way in the determination of the final grade."***

The following is an excerpt taken from the "Students Rights and Responsibilities Handbook, University of Kentucky" regarding plagiarism.
"***All academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression.***
When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.
Plagiarism includes reproducing someone else's work..... If the words of someone else are used, the student MUST put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic."

Charges of an academic offense will be made against any student that cheats or commits plagiarism. Penalties for such an offense will be assessed according to University Regulations regarding Academic Offenses. The most severe penalties include suspension or dismissal from the University. **I have a zero-tolerance policy regarding academic offenses**

TOPICS AND READINGS—TENTATIVE SCHEDULE
Please note that this is a tentative schedule and may be modified depending on how the course is progressing. All changes will be announced in advance, and students will be well aware of them—particularly regarding what is going to be included on exams.

Week, Topics, Student-driven In-class Activities

Week 1. - Learn about equipment (extracellular & intracellular amps, microscopes, electrode puller). Solutions and laboratory tools. Animal care. Lab notebooks & reports.

Week 2. - We will start on the bread board to learn about OHM's law and electrical conduction .....(see this lab Page- Neuron model)

Week 3. - Earthworm preparation to learn about conduction velocity and refractory periods .....(see this lab Page- Earth worm experiments)

Weeks 3 & 4. - Measure membrane potentials in crayfish abdomen muscles and plot Rp vs [Na]o graphs and Rp vs [K]o graphs. (see this lab PAGE- RP, K, Na)

Weeks 3 &4 . - Measure facilitation and depression in tonic and phasic neuromuscular junctions in crayfish abdomen muscles. We will learn how to stimulate motor nerves and record EPSPs/IPSPs. (see this lab PAGE- EPSPs)

Week 5. - Learn to record from proprioceptors (extracellular) in the crab leg and relate to joint positions. Research paper discussion. (see this lab PAGE- Joint receptors in a crab)

Week 6. - Learn how to forward fill neurons from the crab leg proprioceptors (CoCl2, 4-Di-2 ASP) as well as stain with methylene blue. (see this lab PAGE- Staining of Joint receptors in a crab)

Week 7. - Review - EXAM 1 - Learn to record from tension receptors in the crab leg related to muscle length and contraction. (see this lab PAGE- tension nerve recordings)

Week 7. - EEG Human lab (go to lab EEG lab page)

Week 8. - Introduction to the leech nervous system and practice dissection. Staining of leech ganglia.

Week 8. - Learn how to dissect the leech ventral nerve cord and obtain intracellular recordings from identified neurons. Current injections and threshold measures. Potentially two intracellular electrodes and record in situ synaptic connections. Investigate the ionic currents making up the action potentials. (see this lab PAGE- Leech ganglion lab)

Week 8 & 9. March 5 & 7, 2013 - -Mapping skin receptive fields on the leech while recording from neurons. Dye fills. (see this lab PAGE- Leech Skin lab)

2015 - Spring break

Week 10. - Learn how to remove and culture leech neurons for forming synapses in culture. (see this lab PAGE- Leech neuron culture lab)

Week 11. -Catch up on experiments and analysis day. Graph data, catch up on homework and literature gathering. Plot I V curves and use Ohms law to determine Rm with crayfish skeletal muscle.

Week 11. - Quantal analysis of synaptic transmission: Crayfish NMJ record quantal responses..(see this lab PAGE- quantal analysis)

Week 12. Sensory recordings from the cockroach cerci. (see this lab PAGE- cockroach cerci)

Week 13. Sensory recordings from the cockroach cerci. (see this lab PAGE- cockroach cerci)

Week 13. Vision: crayfish caudal photo receptor in crayfish.

.....(see this lab PAGE- Crayfish photoreceptors lab)

Week 14 (lecture). Vision: Horse shoe crab photo receptors.

.....(see this lab PAGE- Horseshoe crab photoreceptors). A paper on the responses PDF

Week 14. No class for lab. Work on your own out of lab for write ups.

Week 15. - Make up any labs needed. Make sure lab report is going along OK. Pass out take home exam.(Exam 2)

Week 16. (Finals week) Turn in final exam and reports.