TO: Randy Smith, Vice Provost for Academic Programs
FROM: Jennifer Schlueter, Faculty Fellow for Curriculum, Graduate School
DATE: 24 October 2017
RE: Proposal for a new tagged Masters in Applied Neuroscience

The Department of Neuroscience is proposing a new tagged Masters in Applied Neuroscience.

The proposal was received by the Graduate School in December 2015. It was reviewed by the combined GS/CAA Curriculum subcommittee, chaired by the Faculty Fellow, on 4 December 2015, and revisions were requested that same day. Revisions were received on 18 August 2016, and the proposal received its second review by the combined GS/CAA Curriculum subcommittee in November 2016. Revisions were requested on 20 December 2016. These revisions were received on 30 January 2017. The revised proposal received its third review by the combined GS/CAA Curriculum subcommittee on 6 February 2017, and revisions were requested on 7 February 2017. Revisions were received in summer 2017, and the proposal received its fourth review by the combined GS/CAA Curriculum subcommittee on 5 October 2017. It was forwarded it on to the Graduate Council for their review on 6 October 2017. The proposal was reviewed and approved at the Graduate Council on 23 October 2017. The positive results of this review were shared with the proposers on 24 October 2017.

1. DESIGNATION OF NEW DEGREE PROGRAM: Master's in Applied Neuroscience

INTRODUCTION

The goal of the proposed Master's in Applied Neuroscience is to develop a biomedical work force with expertise in the rapidly expanding field of Neuroscience. The intent is to prepare the highest caliber of students equipped to effectively serve in a senior research position or in an academic setting as an instructor to promote advances in biomedical research and education in general, and specifically in the growing field of Neuroscience. The intent is to provide students with a Master's level curriculum that will provide both the didactic course work as well as research and teaching training that will prepare students for careers requiring advanced biomedical training beyond the baccalaureate degree. A recent survey https://neurosciencemajor.osu.edu/careers-neuroscience) by the Undergraduate Neuroscience Major at The Ohio State University (OSU) determined that graduates with a Bachelor of Science degree in Neuroscience found employment in several areas including, Pharmaceutical Sales, Laboratory Technician, Science Writer, Science Advocacy, Lab Animal Care Technician, Sales Engineer, Special Education Assistant, Health Educator/Community Health Workers, Public Policy and several other areas. In general these positions have salaries ranging from $25,000 to $44,000 per year.

The intent of developing the Applied Neuroscience Master's Degree is to prepare students for advanced placement in a large number of biomedical fields that require a Master's degree as the basis for employment or advancement. Based on various jobs websites (https://www.indeed.com/q-Ms-Neuroscience-jobs.html; http://work.chron.com/can-masters-degree-neuroscience-4161.html) graduates would be immediately prepared for careers including, but not limited to, Research Assistant or Research Associate in a scientific or clinical research laboratory, Senior Scientist in Pharmacology, Research Scientist in Human-Machine Interactions, Neuroscience Genomics Research Associate, Medical Science Liaison, Marketing Assistants, Computer Lab and/or Sales Assistants for biotechnical or pharmaceutical companies, Neuroimaging technicians, Science Teacher, Research and Teaching Administrator, Adviser in public and government Institutions, Academic journalist, Medical writer, Clinical data manager and Patent Agent. Salaries increased significantly in these fields ranging from $73,000 to $104,000. In addition, students who obtain a master's level education in Neuroscience will be well-prepared to enter programs that may require additional training including medicine, dentistry, nurse practitioner, physician's assistant, genetic counselor, biostatistician, speech-language pathologist, and public health. In summary, obtaining an Applied Neuroscience Master's degree from The Ohio State University will expand employment opportunities well beyond what is available to individuals with a Bachelor's Degree.

All students enrolled in the Master's in Applied Neuroscience will take rigorous academic courses that will comprise a select subset of the courses developed for students studying to receive their Ph.D. in the Neuroscience Graduate Program. This course work, described below, will serve as the foundation for the program and provide the essential didactic knowledge they will need to be viable for advanced positions. In addition to the didactic coursework, students will then have a more specialized program developed around their specific career goals. Some students will specifically want a research/laboratory based career whereas others may be interested in higher education. Students on a research oriented track will be given extensive training in laboratory techniques under the guidance of experienced basic science and clinical science researchers. Those with an interest in pursuing a career in higher education will be mentored by faculty with extensive teaching credentials. Additional course work, as appropriate to the tracks, will be included as described below.

Faculty

The faculty involved in this program all have P status in the Graduate School. They are experienced mentors, having trained numerous Ph.D students as part of the Neuroscience Graduate Program (NGP). They participate in the didactic courses and are well-prepared to take students in the proposed Master's program into their laboratories for training. In addition, many of the faculty in the Department of Neuroscience participate in teaching courses in the Neuroscience Undergraduate Major. This includes faculty who teach two of the three required core courses in the curriculum with enrollments of 140 - 190 students/semester as well as several elective courses. These faculty will serve as mentors to students

interested in pursuing a pathway that will allow them to teach neuroscience courses at institutions of higher education.

The proposal is to make this a 4 semester program. A minimum of 30 semester credit hours will be required. To be in good standing in the Graduate School, a student must maintain a graduate cumulative point-hour ratio (CPHR) of 3.0 or better in all graduate credit courses and must maintain reasonable progress toward Graduate School or graduate program requirements.

CRITERIA FOR ADMISSION

Admission to the program would be limited to students with a baccalaureate from accredited institutions. Additional criteria would include demonstration of high promise based on their current professional activities. The minimum GPA for admission would be 3.0, although on average we would expect higher GPAs in the area of 3.4 – 4.0. GRE scores would be expected to be >70% in verbal and quantitative examinations. The proposed class size is initially 30 – 50 students. This likely would grow as the program becomes established.

DESCRIPTION OF THE PROPOSED CURRICULUM

The Master's in Applied Neuroscience at OSU will have a core didactic curriculum that is Neuroscience based. The objective is to provide advanced level knowledge and skills that will be valuable for practicing professionals. Regardless of whether students choose a career pathway in research or academia, they will need basic knowledge of the organization and function of the nervous system and how it relates to disease processes. This core curriculum (NeuroSc 7001, 7002, 7050, 7100, 7200.01, and 7890) is made up of well-established courses taken by students enrolled in several graduate programs including the Neuroscience Graduate Program, Biomedical Science Graduate Program, Molecular, Cellular & Developmental Biology Graduate Program, etc. Courses also are taken by undergraduate students in the Neuroscience Honor's Program, and students in other biologically based Master's Programs (e.g., Exercise Physiology, Anatomy). Finally, they are applicable for students seeking a graduate minor in Neuroscience. Most of the courses needed for this degree are already approved. Some will need to be developed specific to the Applied Master's degree. They syllabi for established and preliminary syllabi for courses to be developed are included in the Appendix.

ESTABLISHED COURSES

NeuroSc 7001: Foundations of Neuroscience I. This course provides students with an understanding of basic cellular, molecular, neurophysiological, and neuropharmacological principles. It also relates these principles to the basic organization of the normal and diseased nervous system. This is a letter graded course.

NeuroSc 7002: Foundations of Neuroscience II. This course covers basic neuroanatomy as well as the organization of select systems in the nervous system including motor, sensory, autonomic, and higher cognitive centers. It is designed to provide students with an understanding of how neural systems are organized and function and to relate this information to basic principles of behavior. This is a letter graded course.

NeuroSc 7050: Neurobiology of Disease. The intent of this course is to familiarize students with clinical and basic science research being carried out related to various diseases of the nervous system. The course also helps students develop critical thinking skills by having them discuss a relevant paper on each topic and to have them write an NIH style grant in which they develop a research project related to a specific neurological disease. This is a letter graded course.

NeuroSc 7100: Current Topics in Neuroscience. This course reviews recent literature under the direction of an expert in the field. They will be asked to critically evaluate the assigned papers with respect to the hypothesis of the study, techniques, writing style, and whether the data supports the conclusions. Critical thinking and ability to interpret relevant Neuroscience literature is essential for all types of positions. The papers selected for the course are correlated with material presented in NeuroSc 7001. This is an S/U graded course.

NeuroSc 7200.01: Neuroscience Laboratory. This is a laboratory component of NeuroSc 7002. The goals of this course are to familiarize students with the anatomy of the human brain, to relate anatomical material to radiographic images, and to use case studies to provide further understanding of human neuroanatomy and brain function. This is a letter graded course.

NeuroSc 7890: Seminar in Neuroscience. In this course, selected topics in neuroscience are presented by faculty, invited speakers from outside the university, and by students enrolled in the course. In addition, students discuss papers related to the research of outside speakers prior to their presentations. This is a letter graded course.

Statistics. If students have not had a statistics course as an undergraduate they will be required to take one of several courses offered by other departments at OSU. If they demonstrate proficiency in this area, the course will be waived. Demonstration of proficiency will be determined on a written examination that tests basic statistical concepts.

Electives: Students in both the research and education track may elect to take additional electives related to their specific career goals. Examples include but are not limited to:
Biology 6001: College Biology Teaching
EDUCST 7406: Course Design for Higher Education
ESEPSY 7404: College Teaching
BMI 5710 - Introduction to Biomedical Informatics
BIOETHC 6000—Bioethics Theory and Foundations

NEW COURSES TO BE SUBMITTED FOR APPROVAL

NeuroSc 7000.1: **Research Techniques.** This will provide the necessary skills for students who have a goal to work in a basic science or clinical research laboratory either in academia or industry. They will be assigned to laboratories where they will become competent in various lab skills including but not limited to animal handling, PCR, immunohistochemistry, genetic screening, CRISPR, maintenance of lab notebooks, basic data analysis, microscopy, etc. This will be a letter graded course.

NeuroSc 7000.2: Education Techniques. Students intent on a career in an education setting (e.g., high school science, neuroscience courses at community or small liberal arts colleges) would be paired with a faculty member engaged in didactic teaching at the undergraduate and/or graduate level. These students will be assigned to a mentor with a primary focus in education where they will become competent in developing courses, giving lectures, grading exams, counseling students, etc. These will be a letter graded course.

NeuroSc 7530: Bioethics.
The intent of this course is to discuss issues related to: Research and Research Misconduct, Ethical issues involving human and/or animal subjects, HIPPA/FERPA regulations, Applied Medical Ethics, IRB/IACUC regulations, Authorship and publication issues, Data management and record keeping, Peer review; Confidentiality, Issues of collaboration, Conflict of interest, Ethical Conduct Toward Students/Peers, Ethics of Teaching. Readings will be assigned prior to each session and students will be given a short quiz at the beginning of each session on the topic to ensure they have reviewed the material. This also should enhance participation during each session. We will work with faculty in the Center for Bioethics in the College of Medicine to develop this course. This will be a letter graded course.

NeuroSc 7600: Capstone Project
The Capstone projects is designed to demonstrate that the students are able to think critically, solve challenging problems, and develop skills such as oral communication, public speaking, research skills, media literacy, teamwork, planning, self-sufficiency, or goal setting—i.e., skills that will help prepare them for careers in the biomedical science field. The projects will require students to apply skills or investigate issues and to demonstrate research or education proficiency.

The objective of the capstone course is to allow the students to synthesize and integrate the knowledge from their didactic course work with laboratory and teaching skills. The goal of the capstone course is designed to evaluate the student's ability to problem solve, carry out a critical analysis of scientific procedures and/or educational material, and their ability to communicate this information to their peers and instructors in the degree program. The course will determine if students are prepared to critically assess the literature, demonstrate competence in various lab skills or educational strategies analyses. The Capstone document will also constitute a portion of the University's required master's examination (described below). The ultimate educational goals of the Capstone Project is to demonstrate learning and proficiency, enhance student confidence and self-perception, and solidify educational and career aspirations.

The proposed sequence of core courses is as follows.

Summer Semester: **(7 Credit Hours)**
NeuroSc 7530 - Bioethics – 3 credit hours
NeuroSc 7000.X – Research/Education Techniques –4 credit Hours

Autumn Semester (15 Credit Hours):
NeuroSc 7001 Foundations of Neuroscience I – 6 credit hours
NeuroSc 7100 – Current Topics in Neuroscience – 1 Credit hour
NeuroSc 7000.X – Research/Education Techniques --6 credit hours
NeuroSc 7890 – Seminar Topics in Neuroscience – 2 Credit Hours

Spring Semester (15 Credit Hours)
NeuroSc 7002 Foundations of Neuroscience II – 6 credit hours
NeuroSc 7200.01 Neuroanatomy Laboratory (half semester) - 1 Credit Hour
NeuroSc 7050 – Neurobiology of Disease – 3 Credit Hours
NeuroSc 7000.X – Research/Education Techniques – 4 credit Hours
NeuroSc 7890 – Seminar Topics in Neuroscience – 1 Credit Hours

Summer Semester (3 credit hours):
NeuroSc 7600: Capstone Project (3 credit hours)

The minimum number of credit hours a student will earn is 40 (7 + 15 + 15 +3 = 40) although some will earn more if they choose to take electives as noted above.

EVALUATION: In addition to their letter grades in the core courses, students will receive a written evaluation at the end of each semester from their mentor (NeuroSc 7000.X). The comments will be reviewed by the Master's Committee and discussed with the students.

FINAL EVALUATION OF STUDENTS - MASTER'S EXAMINATION

Committee: The Master's Examination Committee will be composed of at least two Graduate Faculty members including the student's mentor. The student's advisor may invite other graduate faculty members to participate as members of the committee. The advisor of each master's student will hold membership at the category M or P level in the Neuroscience Graduate Program. All members of the Master's Examination Committee will be present during the oral portion of the examination and will participate fully in questioning the student as well as in the discussion and decision on the result.

Examination: The final examination will consist of both written and oral components to evaluate students. For the written portion, students will be asked to use the document from their Capstone Project as the written document for the Master's Examination. They will submit a draft to the Master's Examination Committee which must be approved by all members. In general, the written portion of the

examination will consist of a detailed report of research they carried out in their mentor's lab. This would include hypothesis development, background of the project, methods used to test the hypothesis, results, inclusion of appropriate citations and discussion of the findings. For students in the education track, they would be expected to develop a new course on paper, including rationale for the course, syllabus, study plans, methods of evaluation of students and sample lectures.
Evaluation: After submission, the full paper will be reviewed by members of the Master's Examination Committee. When it is approved, students will have 2 weeks to prepare for an oral defense of their paper. At the oral defense, the focus will be on the paper itself, but topics from any of the courses they have taken may be included. The advisor will serve as the chair of the oral defense. Upon completion of the oral examination the Examination Committee will determine if the student has adequately addressed all questions and vote to pass or not pass the student.

ADMINISTRATIVE ARRANGEMENTS FOR THE PROPOSED PROGRAM

The Department of Neuroscience within the College of Medicine will be the administrative unit that has primary responsibility for administering the program. The Director, co-director, and a committee of graduate faculty will have primary responsibility for developing a handbook that specifically defines the requirements and responsibilities of faculty and students in accordance with the Graduate School Handbook. They also would be responsible for monitoring student progress. In addition to those duties specified in the Graduate School Handbook, the Neuroscience Master's Committee will develop and evaluate the curriculum, establish program policies, standards, and procedures, screen applicants for admission to the program and make final determinations on admission, approve programs of study (as to general program requirements) for students in the program, conduct reviews of students at the end of each semester, receive and act on petitions from graduate students, hear and respond to graduate student grievances, and conduct any other program business that may arise.

EVIDENCE OF THE NEED FOR THE PROGRAM

Whereas several Ohio Universities offer Ph.D. degrees in Neuroscience that are primarily focused on a career in research, there are few Master's degree programs. Two of note are

Kent State University offers a Master's of Science in Neuroscience. Although it is defined as a Master's degree, preference is given to students applying for the Ph.D. Program. The description suggests that the Master's degree is given as a terminal degree for students that complete the core course work and who also have some research experience but for whatever reason choose to end their graduate training at that point.

Wright State University offers a Master's of Science in Physiology and Neuroscience. The purpose of the master's degree is to provide the student with a strong research-oriented background in one of several areas of physiology, biophysics, or neuroscience.

The Master's in Applied Neuroscience at OSU would have a core curriculum that is Neuroscience based. However, it also will have components that would specifically focus on individual student needs. Depending on individual student interests, we will propose different rotations that they could enter to further help them in achieving their future career goals in research or teaching as described above.

In summary, this would be a unique program. It will allow students to explore different possibilities in a variety of biomedical careers with a neuroscience emphasis. Successful students would receive a Master's degree at the end of the program which is a tangible acknowledgement that they have a certain level of expertise in a very important and rising biomedical field of study increasing their marketability, and their likelihood of obtaining a lab, academic, or industry related position. Students successfully completing the program would receive a letter of recommendation and a personal assessment.

SPECIAL EFFORTS TO ENROLL AND RETAIN UNDERREPRESENTED GROUPS

The proposed major would critically evaluate applications from under represented students and make every effort to ensure they are included in the class. For recruitment, we plan to specifically target several colleges within Ohio (e.g., Central State University, Wilberforce) that are Historically Black Colleges.

Information on the program in the form of posters, brochures and website information would be sent to these schools. All attempts will be made to personally contact faculty advisors in majors such as Biology, Psychology and Neuroscience in order to establish a working relationship between our program and their school. We plan to personally visit these schools for events including career days or research days to discuss the degree, how it could help them find better employment, and encourage qualified students to apply. We also will advertise in minority-oriented media. Included in the media will be images that reflect diversity in the program (e.g., women, African-Americans, Asian Americans). We will also provide information on the importance of diversity at The Ohio State University and resources available to them outside the Department of Neuroscience (e.g., Office of Diversity and Inclusion, Hale Black Cultural Center, Leadership Initiatives for Women of Color, Latino and Latin American Space for Enrichment and Research, Student Life Multicultural Center). Another goal would be to work with students to help them find financial support that may be offered by groups or agencies that focus on supporting underrepresented individuals. Finally, we will encourage them to attend the Graduate and Professional Student Recruitment Initiative which is attended by minority students who demonstrate an interest in graduate programs at The Ohio State University.

Retention of all students in the program is important. An important factor in retaining students is mentoring. Students will be assigned to labs with experience in mentoring undergraduate/early graduate students. We now have extensive experience in this area due to our involvement in the Undergraduate Neuroscience Major. Faculty in the Department have mentored 65 undergraduate students. In part, the success of this mentoring relationship is evidenced by the fact that undergraduate students from labs of our faculty have presented data at the Denman Research Forum. In the last 3 years, 8 students have received 1st, 2nd, 3rd, or 4th place awards. They also have presented at the Neuroscience Research Day and the College of Medicine Research Day. Students also are co-authors on faculty papers. This demonstrates that our faculty are excellent in mentoring students at all levels and in training them in lab skills. For underrepresented students, we will carefully monitor their progress and offer assistance as needed in the way of tutors, one-on-one counseling, and meeting with peers from this program or others with a similar focus. The focus of the program is to help students expand their professional development and to provide the necessary skills needed to make them more competitive and resilient.

AVAILABILITY AND ADEQUACY OF THE FACULTY AND FACILITIES AVAILABLE FOR THE NEW DEGREE PROGRAM.

No new facilities are required. Involved faculty will be those with graduate status in the Neuroscience Graduate Program. Individual faculty will be identified based on the needs of the program each year.

NEED FOR ADDITIONAL FACILITIES AND STAFF AND THE PLANS TO MEET THIS NEED.

The program would need an Administrative Associate to support the operational aspects of the program. This individual would be a staff member in the Department of Neuroscience. In addition, we will need to support 4-5 Teaching Assistants. As the program grows, we may need to hire part-time lecturers.

PROJECTED ADDITIONAL COSTS ASSOCIATED WITH THE PROGRAM AND EVIDENCE OF INSTITUTIONAL COMMITMENT AND CAPACITY TO MEET THESE COSTS.

No additional costs are anticipated at this time. This degree program has the support and commitment of the Dean for Medical Education in the College of Medicine. His letter is attached to the submission.

CONCURRENCE.

Concurrence was obtained from the director of the Neuroscience Graduate Program. This program only offers a Ph.D. degree and is research based. It is not in conflict with this proposed Master's Degree Program. Dr. Oberdick's letter is attached.

APPENDIX 1

GENERAL PROGRAM GOALS

Upon completion of the Masters of Applied Neuroscience, students should attain:

1. advanced knowledge in subject matter relevant to the field of Neuroscience including cell and molecular neuroscience, neuroanatomy, neurophysiology, behavioral neuroscience, and translational neuroscience.

2. a working understanding of the scientific method as well as laboratory and/or teaching skills relevant to the field of Neuroscience.

3. knowledge and comprehension of statistics and experimental design.

4. knowledge and comprehension of the neuroscience research and education literature

5. a sense of responsibility as well as an understanding of the ethical dimensions of the discipline of Neuroscience. Students should develop ethical behaviors, cultural sensitivity, teamwork, and display professional conduct appropriate for an individual in a research or academic area.

6. verbal and written communication skills for teaching and interactions with peers within the scientific community

LEARNING OBJECTIVES

The general program goals will be measured by the following learning objectives.

1. Students will demonstrate competency in attaining advanced knowledge in neuroscience by:
   a. Posting final grades $\geq$ B in the base curriculum.
   b. Demonstrating their ability to apply this knowledge to other program goals such as interpreting literature, conveying this information to others in a classroom setting, applying it to their research experiences, and incorporating the information into formal and informal discussions with their peers or other faculty in the program.

2A. Students will demonstrate competency in understanding the scientific method as it relates to their lab efforts by their ability to:
   a. Follow a protocol that includes all steps in the procedure and demonstrate competency in preparing all reagents, equipment, and supplies needed to complete each step in the protocol.
   b. Complete procedures in a timely manner.
   c. Trouble shoot if there are unexpected problems that arise resulting in failure of an experiment.
   d. Analyze data generated from procedures carried out in the laboratory.
   e. Keep proper notes in a notebook (online or paper).
   f. Discuss results with their mentor and/or other members of the lab.
   g. Design the next set of experimental procedures to be carried out.

2B. Students will demonstrate competency in understanding educational theory by their ability to:
   a. Prepare lectures for a course which will be reviewed by the mentor.
   b. Present lectures to the mentor and following guidance for modifications.
   c. Present lectures to a class at an appropriate level for the student audience.(i.e., undergraduate students, graduate students).
   d. Review the evaluation of the presentation with the mentor and make appropriate changes.
   e. Evaluate students in the class through tests to determine if information presented is consistent with student scores.
   f. Schedule appointments with students to review material presented and answer their questions.

3. Students will demonstrate competency in statistics by:
    a. Selecting appropriate tests during data analysis as confirmed by their mentor
    b. Assessing the quality of an exam question based on Difficulty and Discrimination Scores and revising questions as needed.

4. Students will demonstrate competency in understanding scientific or educational literature by:
    a. Explaining the purpose and goals of a given study.
    b. Critically assessing results of a given study.
    c. Determining the reproducibility of the data.
    d. Judging the relevance of the study relative to their ongoing studies.
    e. Discussing the literature with peers and/or faculty during seminars, lab meetings, or one on one sessions.

5. Students will demonstrate competency in professional and ethical behavior, cultural sensitivity, and teamwork by:
    a. Demonstrating co-operation with others in the laboratory or classroom
    b. Recognizing and responding to constructive criticism from their peers, mentors, and faculty.
    c. Demonstrating a willingness to assist others in the laboratory or classroom.

6. Students will demonstrate competency in verbal and written communication skills for teaching and interactions with peers within the scientific community by:
    a. Preparing presentations which will be reviewed by their mentors and members of the Master's Committee.
    b. Presenting data at local (e.g., Neuroscience Research Day) and where possible national meetings (e.g., Annual meeting of the Society for Neuroscience).
    c. Employ feedback from those reviewing or attending the presentation.
    d. Successfully conveying to their Master's Examination Committee their neuroscience knowledge base in both written and oral presentations.
    e. Participate in discussions during seminars, laboratory or educational meetings.
    f. After completing an experiment, they will discuss the data with their mentors or other knowledgeable members of the lab to determine if they understand the results of their studies.

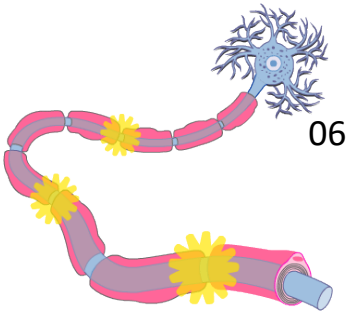
Long term Assessment of the Program

We will track student success in gaining employment. This will be essential for evaluating the effectiveness of the program. Periodically, alumni survey will be sent to graduates of the program requesting information on their current positions.

Appendix 2 – Syllabi

ESTABLISHED COURSES

Foundations of Neuroscience I



NGSP 7001

06 credit hour Fall Semester, 2016

1175 Graves Hall

8:30AM -9:50 AM

Course Directors: Dr. Candice Askwith and Dr. Christine Beattie

Module Leaders

Basic Neurophysiology Module A **Dr. Candice Askwith**	**Cellular and Molecular** Module B **Dr. John Oberdick**	**Neurotransmission and Glia** Module C **Dr. Min Zhou**	**Neurodevelopment** Module D **Dr. Christine Beattie**
4066B Graves Hall	226A Rightmire Hall	4066C Graves Hall	190 Rightmire Hall
(614) 688-7943	(614) 292-8714	(614) 366-9406	(614) 292-5113
askwith.1@osu.edu	oberdick.1@osu.edu	min.zhou@osumc.edu	beattie.24@osu.edu

Course Objectives: To develop a working knowledge of the cellular, molecular, and neuro-physiological principles fundamental to neuroscience research and relate these principles to the normal and diseased nervous system. The course will consist of four modules. Module A will provide knowledge of neurophysiology: the ionic basis of electrical excitability of neurons, action potentials, synaptic transmission, and basic biophysics of neurons. Module B will cover the cellular and molecular aspects of the nervous system. Module C will cover more advanced topics such as neurotransmitter systems and the fundamental mechanisms of neuronal and glial communication. Module D will convey a foundational understanding of how the nervous system develops.

Text and Website: A textbook is not required; Relevant chapters found in any basic Cell Biology, Neuroscience, or Development textbook would be an excellent supplement. For neurophysiology, and basic neuroscience text book such as those authored by Kandel, Bear, Haines, Mathews, Nicholls, Purves, or Zigmond would contain chapters with relevant information. For cell and molecular biology, text books authored by Squire, (Fundamental Neuroscience) or Cell/Molecular Biology texts by Alberts or Roberts. For neurodevelopment, “Development of the nervous system” (Sanes, Rah, and Harris-available at the Health Sciences Library). **Our web site is: http://carmen.osu.edu/**.

Student Evaluation: Three Exams (33.33% each) taken in the classroom.

#	Date	Topic	Instructor	Module/ Leader
1	Wed 8/24/2016	*Course Overview/*Membrane Potential and Ion Channels	**C. Askwith/ C. Beattie** askwith.1@osu.edu	
2	Fri 8/26/2016	Ionic currents and Ohms Law	**C. Askwith**	
3	Mon 8/29/2016	Ionic Basis of the Action Potential	**G. Bishop** bishop.9@osu.edu	
4	Wed 8/31/2016	Basic Electrophysiology Techniques	**G. Bishop/C. Askwith**	
5	Fri 9/02/2016	Propagation/Modulation of Action Potentials	**G. Bishop**	
	Mon 9/05/2016	**NO CLASS**	Labor Day	
6	Wed 9/07/2016	Synaptic Potentials	**C. Askwith**	
7	Fri 9/09/2016	Synaptic Integration	**C. Askwith**	
8	Mon 9/12/2016	Synaptic Plasticity: LTP/LTD	**C. Askwith**	
9	Wed 9/14/2016	Advanced Methods in Neurophysiology	**C. Askwith**	
	Fri 9/16/2016	**EXAM 1**		
10	Mon 9/19/2019	The Nucleus and Chromatin Structure	**J. Oberdick** oberdick.1@osu.edu	
11	Wed 9/21/2016	Transcription Factors and Transcriptional Networks in Neuroscience	**J. Oberdick**	
12	Fri 9/23/2016	Protein Synthesis and Translational Control	**C. G. Lin** lin.492@osu.edu	
13	Mon 9/26/2016	Protein Sorting and Trafficking	**C. G. Lin**	
14	Wed 9/28/2016	Axonal transport and the cytoskeleton of nerve cells I	**A. Brown** brown.2302@osu.edu	

#	Date	Topic	Instructor	Module/ Leader
15	Fri 9/30/2016	Axonal transport and the cytoskeleton of nerve cells II	**A. Brown**	
16	Mon 10/03/2016	Signaling Pathways I	**Chen Gu** gu.49@osu.edu	
17	Wed 10/05/2016	Signaling Pathways II	**K. Obrietan** obrietan.1@osu.edu	
18	Fri 10/07/2016	The Mitochondria	**J. Oberdick**	
19	Mon 10/10/2016	High-Throughput DNA Sequencing and In Silico Applications	**J. Oberdick**	
	Wed 10/12/2016	**EXAM 2**		
	Fri 10/14/2016	**NO CLASS**	Autumn Break	
20	Mon 10/17/2016	Cell Biology of the Synapse	**J. Jontes** Jontes.1@osu.edu	
27	Wed 10/19/2016	Electrical Synapses	**G. Bishop**	
21	Fri 10/21/2016	Excitatory and Inhibitory Amino acids	**C. G. Lin**	
22	Mon 10/24/2016	Catecholamines: Dopamine, Epinephrine	**H. Gu** gu.37@osu.edu	
23	Wed 10/26/2016	Acetylcholine, Serotonin, Histamine	**R. T. Boyd** boyd.16@osu.edu	
24	Fri 10/28/2016	Neuropeptides, ATP, and Other Neurotransmitters	**C. Askwith**	
25	Mon 10/31/2016	Glia and Myelination	**D. McTigue** dana.mctigue@osumc.edu	
26	Wed 11/02/2016	Astrocyte Physiology	**M. Zhou** min.zhou@osumc.edu	
28	Fri 11/04/2016	Cell Survival and Death	**S. Yoon** yoon.84@osu.edu	
29	Mon 11/07/2016	The extracellular matrix and axonal injury	**Y. Shen** yingjie.shen@osumc.edu	

#	Date	Topic	Instructor	Module/ Leader
	Wed 11/09/2016	**EXAM 3**		
	Fri 11/11/2016	**No Class**	Veterans Day	
30	Mon 11/14/2016	Overview of Nervous System Development and Neural induction	**C. Beattie** beattie.24@osu.edu	
31	Wed 11/16/2016	Polarity and Regionalization	**J. Oberdick**	
32	Fri 11/18/2016	Neuro and Gliogenesis	**A. Fischer** fischer.412@osu.edu	
33	Mon 11/21/2016	Determination and Differentiation	**C. Beattie**	
	Wed 11/23/2016	**NO CLASS**	Thanksgiving	
34	Fri 11/25/2016	**NO CLASS**	Thanksgiving	
35	Mon 11/28/2016	Mechanisms of Axon Guidance	**C. Beattie**	
36	Wed 11/30/2016	Target Selection and Topographic Maps	**C. Beattie**	
37	Fri 12/02/2016	Synapse Formation and Elimination	**C. Beattie**	
38	Mon 12/05/2016	Stem Cells	**A. Fischer**	
39	12/07/2016	Methods in Neuroscience	**C. Beattie/ Oberdick**	
Finals Week December 09th-15th (Fri-Thurs)			**EXAM 4 To Be Determined**	

Neuro 7100 Paper Discussion Class format

Where: Graves 1165
When: 9:00-10:15 AM Tuesday mornings
Course Directors: Dr. Min Zhou and Dr. Andy Fischer

1. The lectures for 7100 will discuss a relevant, current paper the week following their presentation in NeuroSc 7001 by individuals giving the lectures.

2. Lecturers are responsible for selecting a paper and sending a PDF of the paper to Dr. Zhou at least 1 week before the discussion.

3. Lecturers will provide a PPT presentation of the figures.

4. Lecturers should include PPT schematic diagrams that explain any crucial or novel techniques used in the paper.

5. Students will volunteer or be called upon to interpret and discuss the figures.

6. Students are responsible for understanding the motivation behind the paper and be able to set up the paper and discuss all figures.

7. Lecturers will interject as needed to add relevant information, provide clarity for an unfamiliar method, clear-up any misconceptions, direct students attention to a missed point, etc.

8. It is expected that a student-led discussion will ensue around the questions provided by the lecturer.

9. Lecturers and course directors will ensure that all students are participating and will call on students if necessary.

Schedule:
Sept 1 - Overview
Sept 8 - Askwith
Sept 15 – Bishop
Sept 22 - Oberdick
Sept 29 – Brown
Oct 06 – Obrietan
Oct 13 - Jontes
Oct 20-break SfN
Oct 27 - Lin
Nov 3 - McTigue
Nov 10 - Zhou
Nov 17 - Beattie
Nov 24 -Fischer

NeuroSc/Dent 7002: FOUNDATIONS OF NEUROSCIENCE II
(6 CR HOURS)
SPRING SEMESTER 2017

FACULTY

Dr. Georgia Bishop	**3187 Graves Hall**	**2-8363**	**bishop.9@osu.edu**
Dr. Susan Travers	**4153 Postle Hall**	**2-7619**	**travers.3@osu.edu**
Dr. Derick Lindquist	**049 Psychology Building**	**2-2236**	**lindquist.40@osu.edu**

CLASSROOM: 1024 GRAVES HALL -SOUTHWEST (9TH AVENUE) SIDE OF GRAVES HALL ON THE FIRST FLOOR.

LECTURE FORMAT: Lectures will be given M, W, and Th from 8:30-10:00 AM. These are intended to provide an **overview** of the structure and function of the nervous system as well as **general concepts of the organization of a region/system.** They are not intended to be all inclusive. Students will be expected to read the textbook for supplemental information.

SUGGESTED TEXTBOOKS:
Nolte **The Human Brain, 6th Edition: An Introduction to Its Functional Anatomy**
Kandel, et al. **Principles of Neural Science, 4th Edition**. McGraw-Hill Publishers
Squires et al., **Fundamental Neuroscience, Third Edition** Academic Press.

EXAM FORMAT: Individual instructors will prepare questions from their lectures. The number of questions will be proportional to the amount of time the instructor lectured. The written portion will consist of short answer, multiple choice, and fill in the blank questions. The exams are not cumulative. Each will cover material presented since the last exam.

Final Grade: Your final grade will be based on the total number of points you accumulate relative to the number of points available from all exams.

ACADEMIC INTEGRITY (ACADEMIC MISCONDUCT)
Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct." The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct. If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include suspension or dismissal from the University and a failing grade in this course. If you have any questions about the above policy, please contact me. Other sources of information on academic misconduct (integrity) include: COAM's web page (<http://oaa.osu.edu/coam/home.html>) "Eight Cardinal Rules of Academic Integrity" (<http://www.northwestern.edu/uacc/8cards.html>).

DATE	TOPIC	LECTURER
1/9	Introduction to Course, Terminology & Overview of Nervous System	Bishop
1/11	Arterial and Venous supply to CNS; Ventricles and flow of CSF	Bishop
1/13	Peripheral Nervous System; Functional Components of Nerves Autonomic Nervous System	Bishop
1/16	**No Class MLK holiday**	
1/18	Cranial nerves – components and peripheral distribution	Bishop
1/19	Anatomical and Functional Organization of the Spinal Cord	Lerch
1/23	Brainstem I	Travers
1/25	Brainstem II	Travers
1/26	Organization of Diencephalon (Thalamus) and Telencephalon	Bishop
1/30	**EXAM 1 Covers material from 1/9 through 1/26**	
2/1	Principles of Sensory Processing and Coding	Travers
2/2	Somatosensory System: transduction touch	Travers
2/6	Pain	Travers
2/8	Taste	Travers
2/9	Peripheral Muscle Receptors and spinal cord reflexes Descending pathways that control motor neurons	Bishop
2/13	Vestibular System	Bishop
2/15	Cerebellar Control of Movement	Bishop
2/16	Basal Ganglia Control of Movement	Bishop
2/20	**EXAM 2 Covers material from 2/1 through 2/20**	
2/22	Hypothalamus – General Organization	Obrietan
2/23	Circadian Rhythms	Obrietan
2/27	Reticular Formation – General Overview and Chemically Defined Pathways	Bishop
3/1	Disruptions of Circadian Rhythms	Nelson
3/2	Cerebral Cortex: Functional Organization of Association Areas	Givens

3/6	Neuroendocrine Function	Leuner
3/8	Limbic System: Overview and Aggression	Weil
3/9	Hippocampus: Current concepts on function (Memory, Epilepsy)	Weil
3/13-3/17	**SPRING BREAK NO CLASS**	
3/20	Psychiatric Disorders: Schizophrenia	Coutellier
3/22	Behavioral Genetics	Motti
3/23	Gene Therapy	Motti
3/27	**EXAM 3 Covers Material from 2/22 through 3/22**	
3/29	Sexual Dimorphism	Lenz
3/30	Sleep Circuits	Weil
4/3	Neurobiology of Learning and Memory	Lindquist
4/5	Stress – Overview of Neural Systems	DeVries
4/6	Stress – Autonomic control	DeVries
4/10	Interactions between Nervous System and Immune System	Godbout
4/12	The Aging Nervous System	Wenk
4/13	Drugs of Abuse	Gu
4/17	fMRI studies in Behavior	Leber
4/19	**Study Day**	
4/20	**EXAM 4 Covers material from 3/23 through 4/17**	

NEUROSCI 7200.01 NEUROSCIENCE LABORATORY

LAB/DISCUSSION SCHEDULE

Course Directors: Dr. Georgia Bishop and Dr. Susan Travers

Lab Sessions will be in room **285 Hamilton Hall**, unless otherwise noted. They will be held on Wednesdays from 10:15-noon. Gloves will be provided. Students should bring a probe, scissors, forceps, Nolte textbook which will be the reference atlas. You also will be provided with a video on brain dissection that will be used primarily for the laboratory on Feb. 15. This video must be returned before the practical exam.

Grades will be based on the following:
90% of your grade will be based on your score on the Laboratory Practical Exam. In this exam you will be asked to identify structures on whole brains, cross sections, dissected brains, and photographic images. Details on the format of the examination will be given during the lab session.

10% of your grade will be based on attendance and participation in identification of listed structures. This will also include participation and presentation of the Clinical Correlations. All members of the team assigned to a case study are expected to fully participate in presenting the case and in discussing the relevant neuroanatomical data needed to answer specific questions related to the case. You should be prepared to include pictures, cross sections, or gross brains as part of your presentation.

Details on what is covered in each lab is described in the Lab Manual.

Case Studies: Groups will be given a case study of a neurological disorder/trauma. Questions will follow the case which the group is expected to answer using whatever anatomical material or images they need. A computer and monitor will be available if students want to make up a short (3-4 slides) Powerpoint presentation. In addition, an overhead style projector will be available for demonstrating site of lesion, blood vessel involvement, etc. on gross brain/spinal cord material to the group. These sessions will be held on Feb. 1 and Feb. 8, 2017.

Jan. 11, 2017
Room 1024 Graves Hall Video – Dural sinuses, brain *in situ* ~ 45 minutes
Major Subdivisions of CNS
Venous Sinuses and Dural Folds

Jan. 18, 2017- 285 HAMILTON HALL:
Cranial Nerves – Origin on the brainstem
Arterial Supply of Brain
Meninges, Dural Folds, and Venous sinuses

Jan.25, 2017 - 285 HAMILTON HALL:
Gross anatomy of spinal cord (cadaver)
Major landmarks on medulla, pons, midbrain on gross brain and cross sections

Feb. 1, 2017 - 285 HAMILTON HALL:
Case Studies – Spinal cord, cranial Nerve and medullary involvement
Gross anatomy of the Diencephalon, and Forebrain including cerebral cortex and subcortical nuclei

Feb. 8, 2017 - 285 HAMILTON HALL:
Case Studies – Pons and Midbrain Involvement
Sagittal View Brain
Cross Sections/Atlas Images of diencephalon and forebrain

Feb. 15, 2017 - 285 HAMILTON HALL:
Continue - Cross Sections/Atlas Images of diencephalon and forebrain.
Dissection of specific region of brain selected by group. A copy of the brain video will be provided to guide you in this dissection. The video will need to be returned at the end of this lab session.

Feb. 22 , 2017- 285 HAMILTON HALL:
REVIEW

March 1, 2017 – 285 Hamilton Hall
LAB PRACTICAL EXAM

NeuroSc 7050
Neurobiology of Disease

3 semester credits

Class schedule:

Class meets 2 times/week (Tuesday 9:00-9:55 am and Thursday 9:00-10:55 am)
1st meeting (Thursday): 2 lectures
2nd meeting (Tuesday): discussion of assigned paper

Course Director:

Dr. Chien-liang Glenn Lin
Phone: 688-5433
Office: 4130 Graves Hall
E-mail: lin.492@osu.edu

Dr. Andrej Rotter
Phone: 292-7747
Office: 5142 Graves Hall
E-mail: rotter.1@osu.edu

Course description:

Neurobiology of Disease will explore the basis of major disease affecting the nervous system. Experts from throughout the university will provide state of the art overviews on the clinical, neuropathological, physiological and molecular features of diseases. Lecturers will also discuss key areas that hold promise for future research, including the development of rational therapies. Diseases to be discussed will include: neurodegenerative diseases, neurodevelopmental disorders, neurotrauma, brain tumors, seizure disorder, and multiple sclerosis. There will be a paper discussion following the lectures for each subject. Students will be required to write a 5-page research proposal and the proposals will be discussed on the final week of this course.

Grading:

The grade will be based on a research proposal, participation in paper discussion and class attendance.

Research Proposal	40 points
Paper discussion	40 points
Class attendance	20 points

Grade	Total points
A	90-100
B	80-89
C	70-79
D	60-69
E	<60

Schedule:

Week 1: Alzheimer's disease I
Lecture 1: Clinical and neuropathological features of Alzheimer's disease
Lecture 2: Molecular mechanisms and therapeutic approaches of Alzheimer's disease
Paper discussion

Week 2: Alzheimer's disease II
Lecture 1: Molecular mechanisms and therapeutic approaches of Alzheimer's disease
Lecture 2: Molecular mechanisms and therapeutic approaches of Alzheimer's disease
Paper discussion

Week 3: Motor neuron diseases
Lecture 1: Clinical and neuropathological features of ALS and SMA
Lecture 2: Molecular mechanisms and therapeutic approaches of SMA and ALS
Paper discussion

Week 4: Expanded repeat diseases
Lecture 1: Clinical and neuropathological features of Huntington's disease
Lecture 2: Molecular mechanisms and therapeutic approaches of expanded repeat diseases
Paper discussion

Week 5: Seizure disorder
Lecture 1: Clinical and neuropathological features of epilepsy
Lecture 2: Molecular mechanisms and therapeutic approaches of epilepsy
Paper discussion

Week 6: Neurotrauma
Lecture 1: Clinical and neuropathological features of brain and spinal cord trauma
Lecture 2: Molecular features and therapeutic approaches of spinal cord trauma
Paper discussion

Week 7: Parkinson's disease
Lecture 1: Clinical and neuropathological features of Parkinson's disease
Lecture 2: Molecular mechanisms and therapeutic approaches of Parkinson's disease
Paper discussion

Week 8: Neurodevelopmental disorders
Lecture 1: Clinical and neuropathological features of autism
Lecture 2: Molecular mechanisms and therapeutic approaches of autism
Paper discussion

Week 9: Brain tumors
Lecture 1: Clinical and neuropathological features of brain tumors
Lecture 2: Molecular mechanisms and therapeutic approaches of brain tumors
Paper discussion

Week 10: no class, spring break

Week 11: Multiple sclerosis
Lecture 1: Clinical and neuropathological features of multiple sclerosis
Lecture 2: Molecular mechanisms and therapeutic approaches of multiple sclerosis
Paper discussion

Week 12: Stroke
Lecture 1: Clinical and neuropathological features of stroke
Lecture 2: Molecular mechanisms and therapeutic approaches of stroke
Paper discussion

Week 13: Mental disorders
Lecture 1: Clinical and neuropathological features of mental disorders
Lecture 2: Molecular mechanisms and therapeutic approaches of mental disorders
Paper discussion

Week 14: proposal discussion

Week 15: proposal discussion

COURSES TO BE CREATED

NeuroSc 7530: Bioethics

1 semester hour

Class Schedule: 90 minute period meets once a week

COURSE DIRECTOR
Dr. Georgia Bishop
292-8363
3187W Graves Hall
bishop.9@osu.edu

OTHER FACULTY
Whereas, Dr. Bishop serves as course director and primary instructor, additional faculty will provide lectures in this course as noted on the class schedule below. They will provide contact information at the time of the lecture if there are questions.

COURSE DESCRIPTION:
The goal of the **Bioethics Course** is to discuss issues related to the ethical conduct related to research, medicine, undergraduate teaching, working with animals, working with minors. Case studies will be presented and discussed by the class.

ACADEMIC INTEGRITY (ACADEMIC MISCONDUCT)
Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct." The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct. If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include suspension or dismissal from the University and a failing grade in this course. If you have any questions about the above policy, please contact me. Other sources of information on academic misconduct (integrity) include: COAM's web page (<http://oaa.osu.edu/coam/home.html>) "Eight Cardinal Rules of Academic Integrity" (<http://www.northwestern.edu/uacc/8cards.html>)

GRADING:
Readings will be assigned prior to each class. A short quiz worth 5 points will be given at the beginning of the lecture (~ 10 minutes) on the assigned readings with the exception of the first lecture. It is possible to earn a cumulative total of 70 points. A grade of S/U will be given based on cumulative score on the quizzes (90%), attendance (5%) and class participation (5%).

OFFICE HOURS: By appointment.

ACCOMODATIONS FOR DISABLED STUDENTS: Everything possible will be done to make every reasonable program or facility adjustment to assure success for each student.

SCHEDULE

Week 1: Research and research misconduct

Week 2: OSHA regulations

Week 3: Ethical issues involving human subjects; IRB

Week 4: Ethical issues involving animal subjects; IACUC

Week 5: Ethics in Industry

Week 6: Applied ethics – examples and discussion

Week 7: Applied ethics – examples and discussion

Week 8: Authorship and publication issues

Week 9: Data management and record keeping

Week 10: Confidentiality

Week 11: Ethics of Collaboration

Week 12: Conflict of interest

Week 13: FERPA/HIPPA regulations

Week 14: Working with minors

Week 15: Summary and Discussion

NeuroSc 7000.x
RESEARCH/EDUCATION TECHNIQUES

Course goals:

NeuroSc 7000.1: This will provide the necessary skills for students who have a goal to work in a basic science or clinical research laboratory either in academia or industry. They will be assigned to laboratories where they will become competent in various lab skills including but not limited to animal handling, PCR, immunohistochemistry, genetic screening, CRISPR, maintenance of lab notebooks, basic data analysis, microscopy, etc. This will be a letter graded course.

Students will be assigned to a mentor who will guide them through research techniques. Each mentor will set up a schedule to introduce students to the research topic of their laboratory, assign them to a project under the mentor's supervision or an individual of their designation (senior graduate student, postdoctoral fellow). Student will be taught techniques relevant to an individual who will continue on in a research environment. They will be taught to troubleshoot issues when an experiment fails.

The student cannot learn every biomedical technique. However, they will be taught basic skills on how to research a technique they are not familiar with, go over established protocols for a procedure, describe the process to their mentor. In this way, they will know how to approach new techniques as they move through their career.

The student will be given their own project during Spring semester which will serve as the basis for their Capstone project.

General Schedule:

Summer Semester: Introduction to the lab and on-going projects.
Reading assignments related to research
Participate in lab meetings
Learn and carry out basic techniques used by the laboratory under supervision

Autumn Semester: More in depth appreciation of research and how it relates to other studies
Develop critical thinking on research project
Participate in lab meeting and give reports
Begin to establish independence in carrying out projects
Assist in preparation of presentations/give presentation at local venues
Participate in preparation of manuscripts from members of the lab.

Spring Semester: Design their own project with input from the mentor
Carry out the project
Participate in lab meetings and give reports
Establish independence in carrying out and trouble-shooting project
Present data at local or national meeting
If possible, prepare their own manuscript for publication with guidance

Summer Semester: Complete Capstone Project by writing a manuscript with introduction to the research topic, methods, results, and discussion.

NeuroSc 7000.2: Education Techniques. Students intent on a career in an education setting (e.g., high school science, neuroscience courses at community or small liberal arts colleges) would be paired with a faculty member engaged in didactic teaching at the undergraduate and/or graduate level. These students will be assigned to a mentor with a primary focus in education where they will become competent in developing courses, giving lectures, grading exams, counseling students, etc. These will be a letter graded course.

Students will be assigned to a mentor with primary teaching responsibilities.

Summer Semester: Work with mentor on preparing syllabi, setting up Carmen websites, preparing lecture material

Autumn Semester: Participate in the course(s) taught by mentor by preparing and giving their own lectures
Set up review sessions or be available for student consultation
Assist in setting up, administering, and grading exams.
Begin to develop a course of their own
Attend UCAT workshops on course development

Spring Semester: Take on more responsibility for the established course by giving more lectures, more student consultation, setting up Carmen site
Attend advanced UCAT workshops or take an elective in course development (see above)
Create a syllabus and lecture material for their own course that is reviewed by their mentor.

Summer Semester: Complete Capstone Project by completing development of a course, including lecture material, exams, evaluation strategies, setting up course objectives and learning goals.

NeuroSC 7600.X
CAPSTONE PROJECT

NeuroSc 7600.1 (Research Track)

Course Description: This course is designed to provide a platform where students will demonstrate what they have learned from working in a research laboratory. It will be organized into three 4 week sessions. In the first session of the Summer Semester, students will design their own research projects and present them to a panel of their peers and faculty members in the program. This includes identifying an independent research project, presenting the rationale for carrying out the project including background (review of the literature), techniques to be used, and statistical technique to be applied to determine if results are significant. In addition to presenting their own project, students are expected to provide objective feedback to others in the course regarding their project. In the second Summer Session, students will give a report on the status of their project. They also will be expected to prepare a poster for presentation at a session that will include presentations from all students completing the Applied Master's in Neuroscience – Research Track. In the final session, they will prepare for their Master's Defense.

Course Goal: The Capstone course should allow the student to demonstrate basic skills of a research technician in the field of Neuroscience. This course will provide the students with an opportunity to demonstrate their knowledge and ability to design and carry out a research project.

Schedule:
The course will be divided into two 4 week sessions. The final exam will be carried out in the third 4 week session to meet Graduate School Deadlines for graduation summer term. Students will be divided into working subgroups to support each other and to provide feedback.

Session 1:
Week 1: Identify research question to be addressed. Include background leading to study and its significance. Describe techniques to be used.

Week 2: Discussion of statistical tests to be applied to obtain significance. For example, how many animals are needed, how many repetitions, etc.

Week 3: Describe potential problems and how they will be addressed.

Week 4: Discuss potential interpretation of data.

Session 2:
Week 1: Preliminary results from experiments carried out.

Week 2: Draft of poster presentation summarizing project

Week 3: Preparation of poster presentation summarizing project.

Week4: Poster presentation to peers and faculty. Prepare peer evaluation of assigned presentation.

Session 3:
Weeks 1- 3: Finalize manuscript and schedule Master's Defense including presentation of project to Master's committee and oral exam in accordance with graduate school schedule for graduation during summer semester.

NeuroSc 7600.2 (Education Track)

Course Description:
In this course students will demonstrate how the knowledge and skills learned throughout the semester is applicable to development of an original course at the graduate or undergraduate level. It will be organized into three 4 week sessions. In the first session, students in the education track will prepare a sample class that covers 3 weeks of their curriculum. The students should demonstrate competency in understanding educational theory by their ability to define learning goals and objectives and mechanisms for assessing these goals. Material developed for the course should reflect defined learning goals and objectives. Students will prepare a syllabus and lecture material that will be reviewed by the mentor and the student's Master's committee. The student should be able to incorporate suggestions to improve their teaching skills. In the second session, they will demonstrate the ability to present a selected lecture to a class at an appropriate level for the student audience.(i.e., undergraduate students, graduate students). Other students in the track will serve as the "class" for each other's presentations. In the final session, they will prepare for their Master's Defense.

Course Goal: The Capstone course should allow the student to demonstrate basic skills of an educator in the field of Neuroscience. This course will provide the students with an opportunity to demonstrate their knowledge and ability to design and deliver course material.

Schedule:
The course will be divided into two 4 week sessions. The final exam will be carried out in the third 4 week session to meet Graduate School Deadlines for graduation summer term. Students will be divided into working subgroups to support each other and to provide feedback. Each week during the semester, students will submit a draft of the course they are developing. Feedback will be provided by their peer group and the mentor. Specific aspects of the course will be discussed each week.

Session 1:
Week 1: Name of the course, level of instruction, need for this type of course, class size, prerequisites.

Week 2: Learning Objectives and goals and how these are to be assessed.

Week 3: Revision of course and/or learning objectives/goals based on peer and mentor feedback.

Week 4: Syllabus preparation including all components that need to be included (https://ucat.osu.edu/bookshelf/teaching-topics/designing-a-course/what-did-you-put-in-your-syllabus/)

Session 2:
Week 1: Example lecture in PPT format and example of assessment tool (i.e. examination over material in the sample course). Fill out form for submission of a course addressing all information needed.

Week 2: Presentation of sample lecture to peers. Prepare peer evaluation of assigned presentations.

Week 3: Presentation of sample lecture to peers. Prepare peer evaluation of assigned presentations.

Week4: Presentation of sample lecture to peers. Prepare peer evaluation of assigned presentations.

Session 3:
Weeks 1- 3: Finalize course and schedule Master's Defense including presentation of course development, lecture material, learning objectives and goals, and assessment tools to Master's committee and oral exam in accordance with graduate school schedule for graduation during summer semester.

THE OHIO STATE UNIVERSITY

Daniel M. Clinchot, MD
College of Medicine
Vice Dean for Education
Associate Vice President for Health Sciences Education
260 Meiling Hall
370 West 9th Avenue
Columbus, OH 43210-1238
614-688-3104 Work
614-292-4499 Fax
Dan.Clinchot@osumc.edu

September 1, 2015

M . Scott Herness, Ph.D.
Interim Vice Provost for Graduate Studies and
Dean of the Graduate School
250 University Hall
230 North Oval Mall
Columbus, Ohio 43210-1366

Dear Scott:

The College of Medicine has reviewed and fully endorses the proposed Master's Degree in Applied Neuroscience. The degree was unanimously endorsed by the College Education Review Committee on June 30, 2015. The consensus of the committee was that the proposed program is well thought out and sequenced and that the degree will facilitate advancement within the field of neuroscience. The program is designed to provide a clear pathway for students interested in a career related to neuroscience after they complete their undergraduate degree. The specific and unique design of this program as a post-baccalaureate degree that has an integrated Career Development and Pathways in Neuroscience components will allow students within the program to firmly explore and solidify the next phase along their career path.

In summary the College of Medicine fully endorses the proposed Master's Degree in Applied Neuroscience. The proposed Master's Degree in Applied Neuroscience has been appropriately approved by the College of Medicine and has the full support and endorsement of the Dean. We feel strongly that it will be a highly sought after program.

Sincerely,

Daniel M. Clinchot, MD
Vice Dean for Education
College of Medicine

E. Christopher Ellison, MD
Interim Dean, College of Medicine

THE OHIO STATE UNIVERSITY

Neuroscience Graduate Program

John Oberdick, Ph.D.
4073 Graves Hall
333 W. 10th Ave.
Columbus, Ohio 43210

Phone: 614-292-8714
Fax: 614-688-8742

August 3, 2017

RE: NGP concurrence with new Masters in Applied Neuroscience

Dr. Georgia Bishop, PhD
Professor, Department of Neuroscience
The Ohio State University Wexner Medical Center

Dear Georgia;

Thank you for discussing with me your plans for a new graduate program entitled Masters in Applied Neuroscience. As Co-Director of the Neuroscience Graduate Program (NGP), one of the four PhD-granting Interdisciplinary Graduate Programs in the Life Sciences at Ohio State, I have a deep interest in graduate-level training. Your plan for a new masters program meets an important critical need that is currently lacking at Ohio State. There are many students for whom a five-year PhD training program is not an option, and your proposed program would allow such students to demonstrate a graduate-level understanding of neuroscience principles and research, and better prepare them for the growing availability of neuroscience-related career opportunities.

Do not hesitate to contact me should any further input be needed as you move forward with plans for your new program.

Sincerely,

John Oberdick, Associate Professor of Neuroscience &
Co-Director, Neuroscience Graduate Program (NGP)
Ohio State University Wexner Medical Center

From:	Bishop, Georgia
To:	Schlueter, Jennifer
Cc:	Nelson, Randy; DeVries, Courtney; Herness, Scott; Toft, Jill A.; Clinchot, Dan
Subject:	Re: proposed Master"s in Applied Neuroscience
Date:	Tuesday, February 7, 2017 2:35:12 PM

Jennifer,

Thank you for the quick turn around. We tried to be very specific in defining the focus of the program. What is the committee really looking for? Some of the comments are a bit confusing. For example, the issue with the resume preparation. One goal of the program is to help students get jobs after completing the program. The intent of the Master's degree is to give them lab and teaching skills which qualifies them to work in a lab or in academia. However they also have to know how to prepare an excellent resume and to learn proper interview skills. My experience with undergrads, and even some grads is that these are skills that often are lacking or less than well-developed. With respect to the S/U grade, we have graduate courses in the Ph. D. Neuroscience Graduate Program with that grade designation such as journal clubs, seminars and independent studies. The 7520 course would fall into that category. Our major didactic courses all have letter grades. as would be expected If necessary, we can change these courses to a letter grade. We would be happy to work with someone from UCAT. Just let me know if they are willing to help and who to contact. Are there any other specific comments we need to address? I do appreciate your help with this.

Georgia

From: Schlueter, Jennifer <schlueter.10@osu.edu>
Sent: Tuesday, February 7, 2017 10:17 AM
To: Bishop, Georgia
Cc: Toft, Jill A.; Herness, Scott
Subject: Re: proposed Master's in Applied Neuroscience

Dear Georgia:

At our Feb 6 meeting, the combined Grad School/CAA curriculum subcommittee met and reviewed your revised proposal for a tagged master's in neuroscience. We noted the many ways in which you had revised the proposal to address our concerns, and I want you to know how grateful we are for that work.

However, the committee is still unsatisfied with some of the fundamental aspects of the proposal, including the focus of the program and its learning goals and assessment strategies. We talked at length about how much time you have put in to this proposal, how certain we are that this will, ultimately, be a valuable tagged master's, and how much we want it to succeed. But, because the proposal must still be vetted at several levels above us, we are concerned that it will not move through without a more complete overhaul. And so we are returning it to you for another pass.

My sense is that you have been striving to address our feedback in contained ways when the issues that have been raised by the subcommittee will require a more global overhaul of the proposal, with especially careful reflection on—and articulation of—its goals and aims. For one small example: the narrative in the revised proposal has worked to minimize the job market prep aspects (such as learning goals focused on resume creation) but the syllabus for Neuroscience 7520 is still a course that, as it stands, appears to be entirely about resume creation and interview preparation (and also

graded S/U, which seems less than rigorous for a tagged master's). In this way, the verbiage about the program seems not to fit with its developing content.

I have reached out to Alan Kalish.3, director of the University Center for the Advancement of Teaching, to see if his office could be approached for assistance in curriculum and program development. This is something they do all the time for various departments and programs across campus. He—or Teresa Johnson.674—would be delighted to work one on one with you and your colleagues to think through the aspirations you have for this tagged master's, to guide you toward a strengthened vision of your program, and to help you get that vision onto paper. I think that seeking his assistance is the right next step in your revision process, and I am happy to make the initial introduction if you would like.

The subcommittee and I thank you for your work on this proposal, and look forward to reading a revision. Let me know if you have questions.

Best,
Jen

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From: "Schlueter, Jennifer" <schlueter.10@osu.edu>
Date: Tuesday, December 20, 2016 at 2:17 PM
To: "Bishop, Georgia" <bishop.9@osu.edu>
Cc: "Toft, Jill A." <toft.20@osu.edu>, "Herness, Scott" <herness.1@osu.edu>
Subject: proposed Master's in Applied Neuroscience

Dear Professor Bishop:

At our November meeting, the combined Grad School/CAA Curriculum Subcommittee (which I chair as Faculty Fellow) reviewed your revised request to approve the new Master of Applied Neuroscience.

The committee is grateful for your work to respond to the feedback from the Subcommittee last year on the first version of this proposal. On several points we still need further clarification and reframing, however.

1. **The looming issue is still the focus of the program**. As Catherine Montalto, last year's chair of

the GS/CAA Curriculum Subcommittee, wrote to you in item 2 of the attached notes here, "the focus, as currently written, appears to be on students who are unsuccessful in getting accepted to medical school, and the post-baccalaureate program is posited to somehow result in a strengthened re-application to professional school…. Yet, a tagged master's degree is usually viewed as a terminal degree that produces content and skills that lead to employment…. The committee struggled with identifying that goal." This revised proposal is still very soft in these respects. We note your statement, on page 1, that "potential career paths includ[e] medicine, research, academia, or industry." But more specifics throughout the proposal—indeed, in its bedrock aims—are needed to clarify that the true intent of the program is that of a terminal degree focused on employment. This is to say: what are you training students to *do*? At present, it seems as though the program's primary goal is still acceptance to medical school. To help this become clearer to the Subcommittees (and subsequent committees), specific job titles beyond "professions that are seeking applicants with some form of clinical and/or research experience…" are needed.

2. **Learning goals and assessment.** Learning Goals should express the core educational aims of the tagged Master's program at a level appropriate for graduate student, which usually expects that students have added new scholarship to the area (a thesis) or demonstrated mastery by applying this new knowledge to a unique situation (a capstone project, exam, or case study). Currently, the Learning Goals as articulated continue to be a mix of aims that are appropriate to a Master's program and that are merely skills that should be obtained along the way. For example: Learning Goal 5 ("Prepare a proper resume and demonstrate excellent interview skills") is merely a skill to be obtained. It is not an appropriate Learning Goal for a Master's program. And the fact that it continues to be included as such is part of what leads the Subcommittee to view this tagged Master's as focused on acceptance to medical school and not, as framed, as truly terminal.

In some cases, your Learning Goals mix Goals with Assessment strategies. For example: "2. Develop lab/clinical skills best suited for their individual goals as demonstrated by positive evaluations from their rotation mentors" combines an assessment strategy (positive evaluations) with the goal itself (development of lab/clinical skills). In addition, the inclusion of a phrase like "best suited for their individual goals" suggests a lack of innate focus on clear outcomes in the program itself. You may consider reaching out to Thomas Mitchell.815 or Amy Ferketich.1, Graduate School Faculty Fellows focused on assessment for assistance in this process.

Once your Learning Goals are reframed, Assessment strategies will need revision. The Subcommittee wondered if you were considering piloting the program in some way to assess its efficacy?

The Subcommittee wants to encourage you and your colleagues to spend time revisiting, reviewing, and revising this material because clarifying Master's-appropriate Learning Goals and Assessment strategies will, we believe, help you reframe this program (and therefore the proposal) to more effective ends than currently articulated.

The rest of the concerns raised by the Subcommittee really spin out from these two larger concerns. They include:

1. **Neuroscience 6193**. This course will be repeated 3 times in the program for a total of 8-12 credits. We recognize your desire to keep the course flexible and emphasizing student interests and needs. However, this contributes to the sense that the overall tagged Master's is unfocused. It

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August 18, 2016

Dr. Scott Herness, Interim Vice Provost and Dean
Graduate School
250D University Hall
230 N Oval Mall
Columbus, OH 43210

Dear Dr. Herness,

The Department of Neuroscience would like to resubmit our proposal for a Master of Applied Neuroscience to the Council on Academic Affairs Curriculum Subcommittee. We have responded to the feedback and requests provided by the committee following our initial submission as follows.

1. We have deleted all references to a Master of Science in the proposal and refer to it as a Master of Applied Neuroscience.

2. We have clarified the focus of the program and clearly indicate that it is not a post-baccalaureate bridge program. We have now indicated how the degree will produce content and skill that leads to employment or advanced training.

3. The academic content for the lab rotations has been more clearly defined.

4. We have included a description of how the program will prepare students for specific positions in industry or advanced degree programs.

5. We have included a syllabus in the appendix of the document for the proposed new courses.

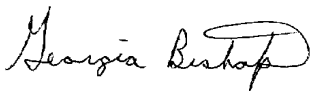
6. We have contacted the Registrar's office and are in the process of developing a Degree Audit rather than using advising sheets. This will provide both the students and faculty access to information related to an individual's progress in the program. A draft is included in the Appendix.

7. We have described our special efforts to enroll and retain underrepresented groups in this proposal and will elaborate in the full proposal when it moves forward to the Ohio Department of Higher Education.

8. Learning goals have been revised as requested.

   If you have any further questions, feel free to contact me. We thank you for your reconsideration of our proposal.

Sincerely yours,



Georgia Bishop, Ph.D.
Professor and Vice Chair
Department of Neuroscience

bishop.9@osu.edu
614-292-8363

DRAFT Proposal for Master of Applied Neuroscience
To: Georgia Bishop and Courtney DeVries
cc: Daniel M. Clinchot

Good afternoon,

The Graduate School/Council on Academic Affairs Curriculum Subcommittee met on Friday, December 4, 2015 and reviewed the proposal for a Master of Applied Neuroscience.

The committee's feedback and requests are summarized below.

1. The committee assumes that the proposed program is a tagged master's degree, specifically a Master of Applied Neuroscience, but this should be clearly stated in the proposal. The last page of the proposal refers to a "Master of Science in Applied Neuroscience" in the "Assessment of Goals" section. If indeed the program is a tagged master's degree, the reference to a "Master of Science in Applied Neuroscience" should be removed.
2. The committee expressed concern that the focus of the Master of Applied Neuroscience program is under developed and not clearly articulated. Further, the focus, as currently written, appears to be on students who are unsuccessful in getting accepted to medical school, and the post-baccalaureate program is posited to somehow result in a strengthened re-application to professional school (for example, the program includes "teaching strategies for raising scores on standardized exams"). Yet, a tagged master's degree is usually viewed as a terminal degree that produces content and skill that leads to employment. The degree's name, Applied Neuroscience, suggests that the focus of the degree is to acquire advanced knowledge in the content area of neuroscience and be able to apply that knowledge towards some applied goal. The committee struggled with identifying that goal. The preparation of application to another professional program through a Master's degree is in itself not an academic goal. At times the proposal seemed more of a post-baccalaureate bridge program than a graduate program. Please clearly articulate the academic content of and the expertise in neuroscience developed through completion of this academic program.
3. Elaborate on the academic content students are likely to develop through the lab rotations in the first and second semesters (total of 6-10 credit hours). The final semester of enrollment includes 2-credit hours of independent studies "with focus on exam/dossier/application" -- please elaborate on how the focus of this concluding experience is determined.
4. Additionally, describe the relationship between the content of the tagged master's degree program and specific positions in industry, allowing us to understand the "return" these students will receive to two more years of education, or the "value added" of this investment.
5. For each of the proposed new courses, please provide a course syllabus; at a minimum the one page OAA syllabus template should be developed for each new course.
6. Please provide an advising sheet clearly communicating program requirements.
7. When this proposal moves forward to the Ohio Department of Higher Education, the special efforts to enroll and retain underrepresented groups will need to be fully developed and the special efforts that will be taken by faculty associated with the tagged master in applied neuroscience degree will need to be described. The guidelines for the full proposal can be accessed at this
   link http://regents.ohio.gov/rgp/pdfs/RACGS%20Guidelines%20Approved%20102403.pdf

8. Please review the materials previously provided by Dean Herness to guide the development of learning goals and assessment that are measureable and appropriate to the level of instruction. The content in the learning goals, as currently written, appears to re-iterate the program focus, rather than outcomes for student learning. The expectation of a Master's degree is that a student has successfully demonstrated advanced knowledge in a specialized academic area. At the graduate level, the student should not only have successfully demonstrated the acquisition of new knowledge but additionally have added new scholarship to that area (a thesis) or been able to demonstrate mastery of this new knowledge by applying it to a new and unique situation (e.g. a capstone project). An assessment plan can clearly articulate these goals, i.e. what should the student be able to know or do by time s/he graduates?; where does the student acquire this knowledge?; how is the student expected to demonstrate competence/mastery of this knowledge?.

Please incorporate changes into a revised proposal and summarize these changes in a cover letter. Once this information is received, the committee will return to the review of the proposal.

Please let me know if you have additional questions.

Thank you.

Catherine Montalto

Chair
Graduate School/Council on Academic Affairs Curriculum Subcommittee

1. DESIGNATION OF NEW DEGREE PROGRAM: Tagged Master's in Applied Neuroscience

RATIONALE FOR NEED FOR THE NEW DEGREE PROGRAM

The goal of the proposed Master's in Applied Neuroscience is to provide students with a Master's level curriculum that will provide both the didactic course work as well as research and clinical experiences that will prepare students for advanced training in a career in the biomedical field. Students who graduate with a Bachelor's Degree in Neuroscience may go into several different fields. A recent survey by the Undergraduate Neuroscience Major at The Ohio State University (OSU) determined that graduates of the program, (https://neurosciencemajor.osu.edu/careers-neuroscience) found employment in several areas including, Pharmaceutical Sales, Laboratory Technician, Science Writer, Science Advocacy, Lab Animal Care Technician, Sales Engineer, Special Education Assistant, Health Educator/Community Health Workers, Public Policy and several other areas. In general these positions have salaries ranging from $25,000 to $44,000 per year. A few positions had higher salaries, such as advertising, promotions and marketing managers ($124,850) however, these required additional training and or additional work experience.

Students who had obtained a master's level education in Neuroscience had additional career opportunities including Nurse Practitioner, Physician's Assistant, Genetic Counselor, Biostatistician, Speech-Language Pathologist, and Public Health. Although many of these positions required additional training, the typical entry-level education requirement was a Master's Degree in a relevant scientific field (e.g., Neuroscience). Salaries increased significantly in these fields ($73,000 to $104,000). Finally, many students majoring in neuroscience are interested in pursuing an advanced degree in medicine, dentistry, veterinary medicine, neuropsychology, social work, clinical psychology, and academia, with the goal of becoming a professional research scientist, practitioner, and/or college professor. A Bachelor's degree in neuroscience can provide students with an excellent background for these programs and many easily make the transition from undergraduate to professional school. These students would not be the target population for this Master's degree. However, for others, decisions on a career path are not as clear and they may be in a position of deciding which career path is best for them. Further, many programs have additional requirements, beyond academics, such as clinical or research experience. The proposed tagged Masters in Applied Neuroscience is designed to prepare students for careers that require a Master's degree as the basis for acceptance into their programs as well as for students who want to enhance their marketability for professions that are seeking applicants with some form of clinical and/or research experience as well as an advanced knowledge base in a relevant scientific area.

The major focus will be on having candidates take graduate level courses which already have been developed for students in the Ph.D. program in Neuroscience. However, in addition to course work, there are additional factors that will make a student a more competitive candidate for these programs or positions. A key factor that will enhance their marketability is research or clinical experience at a level beyond what they may have carried out as undergraduate students as described below under Curriculum. The intent is not to make this a post-baccalaureate program, but rather to make it a rigorous program involving courses, as well as lab or clinical rotations.

The Master's in Applied Neuroscience at OSU will have a core curriculum that is Neuroscience based. However, it also will have components that would specifically focus on potential career paths including medicine, research, academia, or industry. Depending on individual student interests, we will propose different rotations that they could enter to further help them decide the proper career choice. For example, a student that might be interested in graduate school in Neuroscience to further pursue a career in academia would be placed in a research lab. A student considering medical school or physician assistant school would be assigned to a Neurologist or Neurosurgeon for a shadowing experience.

2. DESCRIPTION OF THE PROPOSED CURRICULUM

The proposal is to make this a 4 semester program. A minimum of 30 semester credit hours is required. To be in good standing in the Graduate School, a student must maintain a graduate cumulative point-hour ratio (CPHR) of 3.0 or better in all graduate credit courses and must maintain reasonable progress toward Graduate School or graduate program requirements. All instructors have been approved by the

Neuroscience Graduate Program and have P status in the Graduate School. All of the following are core courses that all students in the program will take. No Specializations are intended to appear on the student transcript. The proposed sequence of core courses is as follows.

Summer Semester: **(3 Credit Hours)**
NeuroSc xxxx: Pathways in Neuroscience – 3 Credit Hours (See description below)

Autumn Semester (12 – 14 Credit Hours):
NeuroSc 7001 Foundations of Neuroscience I – 6 credit hours
NeuroSc 7100 – Current Readings in Neuroscience – 1 Credit hour
NeuroSc 7510 – Pathways in Neuroscience– 2 Credit Hours (See description below)
NeuroSc 6193 – Individual Studies in Neuroscience (e.g., lab rotations, shadowing) – 3-5 credit hours

Spring Semester (12 – 14 Credit Hours)
NeuroSc 7002 Foundations of Neuroscience II – 6 credit hours
NeuroSc 7200.01 Neuroanatomy Laboratory (half semester) - 1 Credit Hour
NeuroSc 7050 – Neurobiology of Disease – 3 Credit Hours
NeuroSc 7520–Career Development – 2 credit hours
NeuroSc 6193 – Individual Studies in Neuroscience (e.g., lab Rotations, shadowing) – 3-5 credit Hours

Summer Semester (7 credit hours):
NeuroSc 7530 - Bioethics – 1 credit hour (see description below)
NeuroSc 6193 – Individual Studies in Neuroscience with a focus on preparation of written and oral examination – 2 credit hours
NeuroSc 7890 – Seminar Topics in Neuroscience – 2 Credit Hours

This core curriculum (NeuroSc 7001, 7100, 7002, 7200.01, 7050, and 7890) is made up of well-established courses taken by students enrolled in the Neuroscience Graduate Program. These courses also are available to students in other graduate programs as well as undergraduate students in the Honor's Program. Finally, they are applicable for students seeking a graduate minor in Neuroscience. Thus, requiring them for students in the Master's of Applied Neuroscience underscores that this program is designed to provide a strong Neuroscience core curriculum as well as providing individualized career exploration opportunities.

In the NeuroSc 6193 course, lab rotation content will be designed by the student and their rotation mentor. As noted above, for students interested in an academic career, the goal is to have them demonstrate that they can design an experiment, carry it out, analyze data, present data to peers and faculty, and to produce a publication. They need to demonstrate that they have basic lab skills, are able to take direction, show attention to details and, most importantly, show critical thinking skills. Other students intent on a career in a clinical setting (e.g., medicine, clinical psychology, dentistry, nurse practitioner, physician assistant, etc.). For students interested in these careers, we would expect them to identify a clinical mentor (from a list of faculty willing to take on these students) and to work with him/her. This would not be a simple shadowing experience. The students would identify a specific area of interest or a subset of patients with a specific medical condition to research.

Mentor Evaluation: In addition to their letter grades in the core courses, students will receive a written evaluation from their rotation mentor at the end of each semester.

DESCRIPTION OF NEW COURSES TO BE DEVELOPED

Three new courses are to be developed. These include, Pathways in Neuroscience, Career Development, and Bioethics. Although students will have different career goals, they will all participate in

these courses as this is designed to provide students with the basic skills needed to succeed at the next level regardless of their chosen career pathway. A description of these new courses follows.

The intent of the **Pathways in Neuroscience** course is to have it serve as a gateway that would expose students to faculty from different biomedical disciplines including Ph.D.s whose primary focus is research, Medical Doctors, Physician Assistants, Allied Medical Professionals, and other health related professionals as well as representatives from different biomedical-related industries, and faculty from small colleges. The intent is to make this an interactive course where discussions of pros and cons and future projections of workforce need for each career are discussed. Students would have the opportunity to ask questions and explore their interests. This course would be taught during the first summer semester in which the student is enrolled. Many students come in with a fairly firm idea of specifically what they want to do. However, this course would allow them to be exposed to other potential paths in case they decide to move their careers in a different direction. This would be an S/U graded course. Grading will be based on attendance and participation. See syllabus in Appendix.

The goal of the **Career Development** course is to provide students with the necessary skills needed to pursue a specific career path. Although students will have different career goals, they will participate in all sessions as this is designed to provide them with the basic skills needed to succeed at the next level regardless of their chosen career pathway. Skills to be taught include, but are not limited to:

1. Development of the skills needed to prepare a resume/application for professional or graduate school. Students will develop their own resume which will be reviewed and critiqued by other students in the course.
2. Development of interviewing skills. Students will learn the art of having a successful interview through in-class sessions as well by participating in mock interviews. The mock interviews will be set up for the students and conducted by expert faculty in their chosen career track.
3. Development of strategies to improve test taking skills. Faculty skilled in the art of performing well on national standardized exams will provide insight on how different exams are designed and how students can develop strategies for studying and organizing material so that they improve their performance.
4. Development of excellent presentation skills by facilitating discussion/presentations of what they are doing during their individualized career rotations.

See syllabus in Appendix.

The goal of the **Bioethics Course** is to discuss issues related to:

Research and Research Misconduct
Ethical issues involving human and/or animal subjects
HIPPA regulations
Applied Medical Ethics
IRB/IACUC regulations
Authorship and publication issues
Data management and record keeping
Peer review; Confidentiality
Issues of collaboration
Conflict of interest

See syllabus in Appendix

3. FINAL EVALUATION OF STUDENTS - MASTER'S EXAMINATION

Committee: The Master's Examination Committee will be composed of at least two Graduate Faculty members including the student's advisor. The student's advisor may invite other graduate faculty members to participate as members of the committee. The advisor of each master's student will hold membership at the category P level in the Neuroscience Graduate Program. All members of the Master's Examination Committee will be present during the oral portion of the examination and will participate fully in questioning the student as well as in the discussion and decision on the result.

Examination: The final examination will consists of both written and oral components to evaluate students. For the written portion, students will be asked to write a substantial paper that is specifically related to their professional goals. They will submit a draft to the Master's Examination Committee which must be approved by all members. Once the draft is approved the students will write the formal document. For those interested in academia, industry, or research positons, the written portion of the examination will consist of a detailed report of research they carried out in their advisor's lab. This would include hypothesis development, background of the project, methods used to test the hypothesis, results and discussion of the findings. For those interested in clinical professions (medicine, occupational therapy, physical therapy, physician assistant, nurse practioner, etc) the document would be based on presentation of a neurological disorder based on their clinical rotation that provides details on the background of a patient's diagnosis, treatments carried out by the physician, prognosis, and research being carried out on the disease/disorder. All HIPPA guidelines will be followed to ensure anonymity of the selected patients.

Evaluation: After submission, the full paper will be reviewed by members of the Master's Examination Committee. When it is approved, students will have 2 weeks to prepare for an oral defense of their paper. At the oral defense, the focus will be on the paper itself, but topics from any of the courses they have taken may be included. The advisor will serve as the chair of the oral defense. Upon completion of the oral examination the Examination Committee will determine if the student has adequately addressed all questions and vote to pass or not pass the student.

4. ADMINISTRATIVE ARRANGEMENTS FOR THE PROPOSED PROGRAM

The Department of Neuroscience within the College of Medicine will be the administrative unit that has primary responsibility for administering the program. The Director, co-director, and a committee of graduate faculty will have primary responsibility for developing a handbook that specifically defines the requirements and responsibilities of faculty and students in accordance with Graduate School Handbook. They also would be responsible for monitoring student progress. In addition to those duties specified in the Graduate School Handbook, the Neuroscience Master's Committee will develop and evaluate the curriculum, establish program policies, standards, and procedures, screen applicants for admission to the program and make final determinations on admission, approve programs of study (as to general program requirements) for students in the program, conduct reviews of students at the end of each semester, receive and act on petitions from graduate students, hear and respond to graduate student grievances, and conduct any other program business that may arise.

5. EVIDENCE OF THE NEED FOR THE PROGRAM

Whereas several Ohio Universities offer Ph.D. degrees in Neuroscience that are primarily focused on a career in research, there are few Master's degree programs. Two of note are

Kent State University offers a Master's of Science in Neuroscience. Although it is defined as a Master's degree, preference is given to students applying for the Ph.D. Program. The description suggests that the Master's degree is given as a terminal degree for students that complete the core course work and who also have some research experience but for whatever reason choose to end their graduate training at that point.

Wright State University offers a Master's of Science in Physiology and Neuroscience. The purpose of the master's degree is to provide the student with a strong research-oriented background in one of several areas of physiology, biophysics, or neuroscience.

The Master's in Applied Neuroscience at OSU would have a core curriculum that is Neuroscience based. However, it also will have components that would specifically focus on individual student needs. Depending on individual student interests, we will propose different rotations that they could enter to further help them in achieving their future career goals, as described above.

In summary, this would be a unique program. It does not guarantee placement in a professional program but allows students to explore different possibilities in biomedical careers. Successful students would receive a Master's degree at the end of the program which is a tangible acknowledgement that they have

a certain level of expertise in a very important and rising biomedical field of study increasing their marketability and their likelihood of being admitted to a professional program, lab position, or industry related position. Students successfully completing the program would receive a letter of recommendation and a personal assessment.

6. PROSPECTIVE ADMISSION TO THE PROGRAM

Admission to the program would be limited to students with a baccalaureate from accredited institutions. Additional criteria would include demonstration of high promise based on their current professional activities. The minimum GPA for admission would be 3.0, although on average we would expect higher GPAs in the area of 3.4 – 4.0. GRE scores would be expected to be >70% in verbal and quantitative examinations. The proposed class size is initially 30 – 50 students. This likely would grow as the program becomes established.

7. SPECIAL EFFORTS TO ENROLL AND RETAIN UNDERREPRESENTED GROUPS

Individuals in underrepresented groups often have the greatest difficulty in enrolling in professional schools. The proposed major would critically evaluate applications from these individuals and make every effort to ensure they are included in the class. In addition, there are several colleges within Ohio (e.g., Central State University, Wilberforce) that are Historically Black Colleges and these would be the targets of selective mailings and visitations at career days to discuss the degree and encourage qualified students to apply.

8. AVAILABILITY AND ADEQUACY OF THE FACULTY AND FACILITIES AVAILABLE FOR THE NEW DEGREE PROGRAM.

No new facilities are required. We would need to recruit existing clinical faculty that are willing to serve as mentors to the students and to allow them to rotate with them in the clinics. Research faculty will be those with graduate status in the Neuroscience Graduate Program. Clinical faculty will be those with M or P graduate status. They will have TIUs in Departments such as Neurology, Neurosurgery, Psychiatry, Neuroradiology, Neuropathology, Anesthesia, Oral Biology, Orthodontics, University Laboratory Animal Resources (ULAR), Veterinary Biosciences, Veterinary Clinical Sciences, or Veterinary Preventive Medicine. Individual faculty will be identified based on the needs of the program each year.

9. NEED FOR ADDITIONAL FACILITIES AND STAFF AND THE PLANS TO MEET THIS NEED.

The program would need Administrative Associate assistance to support the operational aspects of the program. This individual would be a staff member in the Department of Neuroscience. In addition, we will need to support 4-5 Teaching Assistants. As the program grows, we may need to hire part-time lecturers.

10. PROJECTED ADDITIONAL COSTS ASSOCIATED WITH THE PROGRAM AND EVIDENCE OF INSTITUTIONAL COMMITMENT AND CAPACITY TO MEET THESE COSTS.

No additional costs are anticipated at this time. Attached is a letter of support and commitment from the Dean for Medical Education in the College of Medicine.

APPENDIX 1

LEARNING GOALS

Upon completion of the Master's of Applied Neuroscience, students should:

1. Demonstrate an advanced knowledge base in the field of Neuroscience including cell and molecular neuroscience, neuroanatomy, neurophysiology, behavioral science, and translational neuroscience based on grades obtained in the core courses.

2. Develop lab/clinical skills that are best suited for their individual goals as demonstrated by positive evaluations from their rotation mentors.

3. Develop presentation skills to demonstrate their ability to communicate their research/clinical experience to their peers and to faculty in the program. The ultimate goal is to successfully defend their written document at the time of their Master's examination.

4. Achieve a Master's Degree which will allow them to be more competitive for a positions in academia, medical schools, graduate schools, dental schools, veterinary schools, or industry.

5. Prepare a proper resume and demonstrate excellent interview skills by receiving a passing score in the Career Development Course.

Assessment of goals will be accomplished as follows.

1. Based on the written and oral portion of their final examination, the students should be able to convey to their Master's Examination Committee their neuroscience knowledge base. The written portion also allows them to convey to the Committee what they have accomplished during their rotations in a clear, concise and professional format. The Committee will determine if this goal is met following the oral portion of their examination.

2. Students will demonstrate competency in the broad discipline of neuroscience based on grades obtained in the core curriculum which covers each of these topics.

3. We will track students to identify what positions they take after successfully completing the Master's of Applied Neuroscience.

4. Resume preparation and interview skills will be evaluated in the Pathways in Neuroscience and Career Development courses that all students will be required to complete. Written feedback will be presented to the students on both their resumes and interview skills. They will not be given credit for the course until faculty determine these skills are achieved.

5. If students maintain a minimum 3.0 GPA in their courses and pass their oral and written examination, they will be awarded a Master's of Applied Neuroscience degree. We will track their success in being accepted into various professional programs. This will be essential for evaluating the effectiveness of the program.

6. Student success rates in being accepted into their chosen career path will be calculated and used as a measure to improve the career focused aspects of the program.

7. Periodically, alumni survey will be sent to graduates of the program requesting information on their current positions.

Appendix 2

NEUROSC 7510: Pathways in Neuroscience

2 semester hours

Class Schedule: 90 minute period meets once a week

COURSE DIRECTOR
Dr. Georgia Bishop
292-8363
3187W Graves Hall
bishop.9@osu.edu

OTHER FACULTY
Whereas, Dr. Bishop serves as course director and primary instructor, additional faculty will provide lectures in this course as noted on the class schedule below. They will provide contact information at the time of the lecture if there are questions.

WEBSITE: http://carmen.osu.edu

ACADEMIC INTEGRITY (ACADEMIC MISCONDUCT)
Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct." The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct. If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include suspension or dismissal from the University and a failing grade in this course. If you have any questions about the above policy, please contact me. Other sources of information on academic misconduct (integrity) include: COAM's web page (<http://oaa.osu.edu/coam/home.html>) "Eight Cardinal Rules of Academic Integrity" (<http://www.northwestern.edu/uacc/8cards.html>)

GRADING:
A grade of S/U will be given based on attendance and class participation.

OFFICE HOURS: By appointment.

ACCOMODATIONS FOR DISABLED STUDENTS: Everything possible will be done to make every reasonable program or facility adjustment to assure success for each student.

COURSE DESCRIPTION:

The intent of the Pathways in Neuroscience course is to have it serve as a gateway that would expose students to faculty from different biomedical disciplines including Ph.D.s whose primary focus is research, Medical Doctors, Physician Assistants, Allied Medical Professionals, and other health related professionals as well as representatives from different biomedical-related industries, and faculty from small colleges. The intent is to make this an interactive course where discussions of pros and cons and future projections of workforce need for each career are discussed. Students would have the opportunity to ask questions and explore their interests. This course would be taught during the first summer semester in which the student is enrolled.

Week 1: Introduction and Overview of course

Week 2: Ph. D. in Neuroscience - Research

Week 3: Ph. D. in Neuroscience - Research

Week 4: M.D. - Clinical

Week 5: M. D. - Clinical

Week 6: Physician Assistant/Nurse Practitioner

Week 7: Physical Therapist/Occupational Therapist

Week 8: Batelle (industry)

Week 9: Industry (e.g., pharmaceutical, biotechnology)

Week 10: Industry (e.g., pharmaceutical, biotechnology)

Week 11: Veterinarian/Dentist

Week 12: Faculty from small college

Week 13: Faculty from small college

Week 14: Dean for Admissions to Medical School

Week 15: Summary and Discussion

Syllabus
NeuroSc 7520: Career Development in Neuroscience

2 semester hours

Class Schedule: 90 minute period meets once a week

COURSE DIRECTOR
Dr. Georgia Bishop
292-8363
3187W Graves Hall
bishop.9@osu.edu

OTHER FACULTY
Whereas, Dr. Bishop serves as course director and primary instructor, additional faculty will provide lectures in this course as noted on the class schedule below. They will provide contact information at the time of the lecture if there are questions.

WEBSITE: http://carmen.osu.edu

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OFFICE HOURS: By appointment.

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COURSE DESCRIPTION:
The goal of the **Career Development** course is to provide students with the necessary skills needed to pursue a specific career path. Although students will have different career goals, they will participate in all sessions as this is designed to provide them with the basic skills needed to succeed at the next level regardless of their chosen career pathway.

Week 1: Introduction and Overview of course

Week 2: Resume preparation.

Week 3: Resume preparation and in-class review

Week 4: Art of the Interview

Week 5: Art of the Interview

Week 6: In-class practice interview

Week 7: In-class practice interview

Week 8: In-class practice interview.

Week 9: Development of strategies to improve test taking skills.

Week 10: Development of strategies to improve test taking skills.

Week 11: Student Presentations

Week 12: Student Presentations

Week 13: Student Presentations

Week 14: Student Presentations

Week 15: Summary and Discussion

Syllabus
NeuroSc 7530: Bioethics

2 semester hours

Class Schedule: 90 minute period meets once a week

COURSE DIRECTOR
Dr. Georgia Bishop
292-8363
3187W Graves Hall
bishop.9@osu.edu

OTHER FACULTY
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COURSE DESCRIPTION:
The goal of the **Bioethics Course** is to discuss issues related to the ethical conduct related to research, medicine, undergraduate teaching, working with animals, working with minors. Case studies will be presented and discussed by the class.

Week 1: Research and research misconduct

Week 2: HIPPA regulations

Week 3: Ethical issues involving human subjects; IRB

Week 4: Ethical issues involving animal subjects; IACUC

Week 5: Ethics in Industry

Week 6: Applied ethics – examples and discussion

Week 7: Applied ethics – examples and discussion

Week 8: Authorship and publication issues

Week 9: Data management and record keeping

Week 10: Confidentiality

Week 11: Ethics of Collaboration

Week 12: Conflict of interest

Week 13: FERPA regulations

Week 14: Working with minors

Week 15: Summary and Discussion

Wexner Medical Center

Department of Neuroscience

Randy J. Nelson, Ph.D.
Distinguished University Professor
Dr. John D. and E. Olive Brumbaugh Chair in Brain Research and Teaching
Department Of Neuroscience
Professor and Chair
4084 Graves Hall
333 West 10th Avenue
Columbus, OH 43210
Phone: 614-688-8327
Fax: 614-688-8742

26 August 2015

Office of Academic Affairs
203 Bricker Hall
190 North Oval Mall
Columbus, OH 43210-1358

To whom it may concern,

I am writing this letter in strong support of the proposed Master's in Applied Neuroscience that will be offered by the Department of Neuroscience.

Existing Programs:

The Department does not have specific undergraduate or graduate major programs. We actively participate in the Undergraduate Major in Neuroscience in conjunction with the Department of Psychology. As noted on the website for this major "The Neuroscience Signature Program is a joint venture by the College of Arts and Sciences and the College of Medicine." Faculty in the Department play a major role in the curriculum for this major, including teaching two of the required core courses (NeuroSc 3000: Introduction to Neuroscience and NeuroSc 3050: Structure and Function of the Nervous System). In addition, to these core courses, electives developed by faculty in the Department of Neuroscience include: NeuroSc 3010: Introduction to Neurophysiology; NeuroSc. 22025: History of Neuroscience; NeuroSc 4050: Neurogenetics; NeuroSc 4100: Basic and Clinical Foundations of Neurological Disease; NeuroSc 4623: Biological Clocks and Behavior; NeuroSc 4640: Neuronal Signal Transduction; NeuroSc 4850: Contemporary Topics in Neuroscience; NeuroSc 5644: Behavioral Endocrinology; NeuroSc 5790H: Developmental Neuroscience. In addition students can sign up for internships and research hours with individual faculty in the Department.

In addition to undergraduate teaching, we are also an integral part of the interdisciplinary Neuroscience Graduate Program. Several courses have been developed and are taught by faculty in this program including NeuroSc7001: Fundamentals of Neuroscience I; NeuroSc 7002: Fundamentals of Neuroscience II; NeuroSc 7050: Neurobiology of Disease; NeuroSc 7100: Current Topics in Neuroscience; NeuroSc 7200.01 and 7200.02: Neuroscience Laboratory; NeuroSc 7500: Neuroimmunlogy. In

addition, students register for research for their dissertation (NeuroSc 8999) with faculty in the department.

Through the Neuroscience Graduate Program, students in other graduate programs may apply for a minor in Neuroscience. They are required to take 12 hours of graduate level Neuroscience courses offered by the Department of Neuroscience.

Finally, faculty also participate in teaching medical students. One member of the faculty currently serves as Block Leader for the Neurological Block. Some of the students in this block are in a combined MD/Ph.D. program.

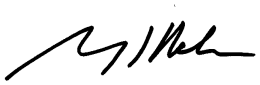
Taken together, the Department of Neuroscience has extensive experience in didactic teaching and research training of students at the undergraduate, graduate, and professional levels through interactions with existing programs.

Review Process

The faculty review student and peer evaluations of instruction annually. These evaluations are included in the annual review of faculty and where needed, steps needed to improve the curriculum are discussed with the faculty member's mentoring committee and me. In addition, faculty teaching in courses review student performance at each examination, and adjust material as needed when areas of difficulty are identified. Student input, especially at the graduate level, is sought during their annual review process. Peer evaluation is an essential component of this evaluation and faculty ask members of their mentoring committee to evaluate their teaching at least annually. If problems are identified, then they work together, with the course directors, to correct them.

Based on our experience at multiple student levels, I strongly support this proposed Master's in Applied Neuroscience Degree. I believe that it will fill a needed niche to help students identify the correct career path after completing their undergraduate degrees. I approve the proposed program.

Sincerely,



Randy J. Nelson,
Distinguished University Professor
Brumbaugh Chair in Brain Research and Teaching
Professor and Chair, Department of Neuroscience

PREPARED: 08/12/16 - 08:49 AM 888018888
GENED MASTER AUDIT CATALOG YEAR: 99993
PROGRAM CODE: NEURO-TEST

MASTER OF SCIENCE
APPLIED NEUROSCIENCE

AT LEAST ONE REQUIREMENT HAS NOT BEEN SATISFIED

NO MASTER OF SCIENCE REQUIREMENTS
APPLIED NEUROSCIENCE

- APPLIED NEUROSCIENCE CORE - COMPLETE 9 COURSES
  FROM: NEUROSC 7001,7002,7050,7100,7200.01,7890

- INDIVIDUAL STUDIES I - COMPLETE 3-5 HOURS
  FROM: NEUROSC 6193

- INDIVIDUAL STUDIES II - COMPLETE 3-5 HOURS
  FROM: NEUROSC 6193

- INDIVIDUAL STUDIES III - COMPLETE 2 HOURS
  FROM: NEUROSC 6193

***** END OF ANALYSIS *****