The University of Georgia

University Council
Athens, Georgia 30602

April 22, 2010

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Dear Colleagues:

The attached proposal to offer the major in Veterinary and Biomedical Sciences under the Doctor of Philosophy degree (Ph.D.) will be an agenda item for the April 29, 2010, Full University Curriculum Committee meeting.

Sincerely,

David E. Shipley, Chair
University Curriculum Committee

cc: Professor Jere W. Morehead
Dr. Laura D. Jolly

University of Georgia
New Program Proposal

Date:	April 14, 2010
Institution:	University of Georgia
School/Division:	College of Veterinary Medicine
Departments:	Dean's Office
Name of Proposed Program:	Doctorate of Philosophy in Veterinary and Biomedical Sciences
Degree:	Ph.D.
Major:	Veterinary and Biomedical Sciences (VBS)
CIP code:	
Starting Date:	August 2010

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1. Program Description and Objectives

The Ph.D. degree program in Veterinary and Biomedical Sciences (VBS) emphasizes interdisciplinary training and education in veterinary sciences and biomedicine, recognizing the importance of integrating foundational sciences with clinical research to translate the latest discoveries at the bench to their application in the clinic and field. ***The translational aspect of this program sets it apart from Ph.D. programs focused more narrowly on basic biomedical sciences.*** Graduates of this program will have the skills to effectively integrate conceptual and applied medicine. The objective is to recruit and train a cadre of highly-qualified graduate students with skills in translational biomedical research. This objective addresses the current UGA Strategic Plan's "Strategic Visions for UGA in 2010" in two ways: the recommended investment in research in the veterinary and biomedical sciences and the recommended growth of the quality and number of graduate students.

Our goal is to expand PhD graduate training to include the seven academic departments in the college. The College of Veterinary Medicine currently has three existing Ph.D. degree programs in Infectious Diseases, Physiology and Pharmacology, and Veterinary Pathology that are administered through each of these respective academic departments. These discipline-specific programs prepare and train individuals to become highly-qualified, biomedical scientists. The proposed VBS Ph.D. program is designed to expand and broaden the scope of biomedical training and research by including graduate faculty and resources in the additional four clinical departments in the college and to provide a more multidisciplinary and applied approach than that currently provided by the existing programs. The future of veterinary and human medicine requires scientists who can efficiently and effectively translate discoveries from the laboratory bench to medical and field applications, maximizing the societal value of biomedical research. A broader, multi-departmental, and patient-integrated training model will prepare interdisciplinary biomedical scientists, who can effectively address applied health-related problems.

2. Justification and Need for the Program

A. Societal Need

A report by the U.S. National Academies of Science National Research Council, "Critical Needs for Research in Veterinary Science", addressed the changing research and education needs in veterinary medicine and its impact on animal and human health (NRC; http://books.nap.edu/catalog.php?record_id=11366#toc). The report refers to the "One Medicine" approach, which emphasizes the commonalities among species and the fact that few diseases affect exclusively one group of animals. Discoveries made using spontaneous disease models in non-traditional research animals (e.g., domestic and wildlife species) and more traditional laboratory animals (e.g., rats and mice) translate into improvements in both veterinary and human medicine. The animal-human interface is a fundamentally important interaction that impacts public health, the environment, and the sustainability of domestic and wildlife populations. Therefore, research in veterinary sciences and veterinary medicine is highly relevant and important to both animal and human health.

Because it intersects human and animal health, veterinary research is interdisciplinary in nature. The goal of translational research is to accelerate laboratory discoveries to

applications for human and animal patient care. Thus, as stated in the National Research Council study: "To realize the potential for translating scientific advances into animal health, veterinarians, and animal scientists must bring their whole-animal understanding to every phase of research and development, from basic biological research to applied studies." The report recommended "an urgent need to provide adequate resources for investigators, training programs and facilities involved in veterinary research".

In a 2006 report commissioned by the American Association of Medical Colleges (AAMC) entitled, "Promoting Translational and Clinical Sciences: The Critical Role of Medical Schools and Teaching Hospital", a number of issues were brought to light, which included: a significant translational gap between research and the development of new interventions, a shortage of clinical investigators, and academic and financial impediments towards the training and retention of junior researchers. The AAMC recommendations were for medical schools to: (1) include translational and clinical research in their core mission; (2) train translational and clinical investigators as part of an advanced degree program; (3) re-structure existing programs so that research training can occur seamlessly through their medical and residency training; and (4) provide central oversight, administration, and support for the essential infrastructure for a successful translational/clinical research program.

Building on the arguments laid out in the NRC study on veterinary research and the AAMC report on human clinical research, the American Association of Veterinary Medical Colleges (AAVMC), which represents academic veterinary medicine and is analogous to the AAMC, recently reported on the need for more veterinarians and researchers in population health ("Veterinarians in Population Health and Public Practice: Meeting Critical National Needs"). In the AAVMC report, they identified "a critical need for infrastructure in our colleges and departments to support research and the graduate training of DVM/Ph.D. scientists in epidemiology, pathology and infectious diseases." Issues such as public health are not local or regional in nature but global, as illustrated with recent zoonotic outbreaks (SARS and avian influenza). Pandemic diseases can only be adequately addressed through collaborative partnerships that transcend departmental or disciplinary divisions, and that involve veterinary medical colleges, human medical colleges, departments of veterinary science/comparative medicine, and federal and state governments. Veterinarians trained in postgraduate research programs are well-prepared for these challenges due to the comparative medicine focus inherent in their professional educations and their understanding of species epidemiology and the ecology of zoonoses.

The AAVMC report goes on to state the urgency needed in building the infrastructure necessary to support research and graduate education in population health, and warns that a failure to do so could adversely affect national food security and public health. Colleges of veterinary medicine are faced with the challenge of replacing "graying" veterinary faculty. Similar concerns in agriculture have spurred the United States Department of Agriculture to create a "national needs" program to train new scientists to work in the agricultural sector of the federal government. The same situation exists in the animal and human health industries.

Ph.D. programs in the UGA College of Veterinary Medicine ideally should serve several purposes, namely: to train scientists who understand the pathogenesis, treatment and

assessment of diseases, as well as the normal biological and physiological functions of animals; to prepare clinical researchers who bring rigorous scientific methods to the assessment of clinical problems and their solution; to teach research professionals who are knowledgeable in epidemiology and ecology; and finally, to educate scientists who can integrate bench and clinical scientific methods and translate discoveries efficiently into new diagnostics and therapies. The basic science Ph.D. programs at the university and the college, however, while important in the training of highly specialized research scientists, do not meet completely the changing needs of veterinary and medical research professionals in the 21st century, which include interdisciplinary research and the translation of research findings to patient applications. Several veterinary and medical colleges have recognized this need and have adopted "umbrella" programs for cross-disciplinary biomedical training of graduate students. For example, the University of Tennessee has created a comparative medicine research program, which is a joint venture between the Schools of Medicine and Veterinary Medicine.

The Ph.D. degree program in Veterinary and Biomedical Sciences, which is proposed here, fulfills a societal need to provide the training sought by students and the expertise required by their future employers. We expect that the pharmaceutical industry, the animal health industry, manufacturers of medical devices, biotechnology companies, and other biomedical industries will seek to employ scientists with the interdisciplinary skills provided by Ph.D. training in veterinary and biomedical sciences.

B. Student Demand

Undergraduate degree students often apply directly to higher degree programs (Ph.D., MS, and DVM) in the College of Veterinary Medicine. On average, there are approximately 54 students per year who apply for enrollment in the basic science Ph.D. programs. Based on this, we expect that there will be sufficient student demand for the existing Ph.D. programs as well as the proposed new interdisciplinary degree program in Veterinary and Biomedical Sciences with its enhanced focus on translational biomedical research.

C. Additional Factors

Traditional doctoral-level training at veterinary or human medical colleges has historically focused along discipline lines and primarily produced scientists with the skills necessary to conduct fundamental biomedical research in areas such as molecular and cellular biology, neurobiology, pathology, physiology, toxicology, and infectious diseases. In today's market, however, it is necessary to broaden the training model. Persons being trained as doctoral-level biomedical scientists often expect to receive comprehensive and integrated training across a range of related disciplines. Further, the market calls for an increasing number of scientists to work in translational research and the development of applications. For example, large multi-national pharmaceutical companies have been laying off discovery research scientists in record numbers for the past 5 years, and changing their focus to translational and development programs. It appears that this trend will continue and that scientists in small "start-up" companies and academia will carry out discovery research, which can then be acquired and developed by larger companies that manufacture and distribute products. Thus, training for both the scientists who make discoveries and for the scientists who

are focused on application of discoveries is required in our programs. The scientists who focus on discovery will need more experience in the area of translation to optimize their research opportunities and the revenue stream for the academic institutions. Veterinary biomedicine needs individuals knowledgeable in infectious diseases, epidemiology, ecology, animal production and computational sciences.

D. Consultant Reports

None

E. Public and Private Institutions in the State of Georgia with Similar Programs:

None

F. Public and Private Institutions in the Southeast Region with Similar Programs:

The programs listed below have separate Preventive Medicine Ph.D. programs, similar to the proposed VBS Population-Based Research emphasis, and Clinical Sciences Ph.D. programs comparable to the proposed VBS Applied Clinical Research emphasis at their respective institutes.

- Auburn University
- The University of Tennessee, Knoxville
- Mississippi State University
- North Carolina State University
- University of Florida
- Tuskegee University

Note: Auburn University has what would be considered separate Ph.D. programs as emphases within a broader, umbrella program. The University of Tennessee is unusual among Ph.D. programs in Biomedical Sciences in that it has a Ph.D. in Comparative Medicine with participation of both the Medical School and the College of Veterinary Medicine.

3. The Process Used to Develop the Ph.D. Program in Veterinary and Biomedical Sciences

In November 2008, Dean Sheila Allen charged the College of Veterinary Medicine Graduate Affairs committee with developing a new interdisciplinary Ph.D. program that would broaden the college's biomedical training opportunities and provide more flexibility for both students and graduate faculty. The CVM Graduate Affairs committee consists of graduate faculty members from each of the College's seven academic departments, which are: Anatomy and Radiology, Infectious Diseases; Large Animal Medicine; Physiology and Pharmacology;

Population Health; Small Animal Medicine and Surgery; and Veterinary Pathology. The departments with existing Ph.D. programs are: Infectious Diseases, Physiology and Pharmacology and Veterinary Pathology. The clinical departments without Ph.D. programs are: Anatomy and Radiology; Population Health; Large Animal Medicine; and Small Animal Medicine. Dr. Allen recommended the creation of an umbrella program with areas of emphasis that would immediately accommodate these four departments, and also with the capacity to add future areas of emphasis as needed. An open meeting was held in December of 2008 to allow the graduate faculty in the college to voice their concerns and recommendations in the development of a new Ph.D. program. In July 2009, a sub-committee submitted a proposed Ph.D. program named Veterinary and Translational Biomedical Sciences, which included two areas of emphasis: 1) population-based research, and 2) applied clinical research. This document was given to the members of the Graduate Affairs committee who distributed it to their respective departments for input. Relevant changes were made based on departmental feedback and submitted to the dean's office in October 2009. The document was edited for composition and reviewed for content by the associate dean for Research and Graduate Affairs and forwarded to the dean in November 2009. After further review and editing by the dean and the college's department heads, which included shortening the title to "Veterinary and Biomedical Sciences", the document was forwarded to the college's graduate faculty for a vote to accept or reject. Ninety-four votes were cast of the 113 ballots emailed (83% participation). Eighty-one (86%) voted to approve the proposal and 13 (14%) voted against it, which signifies graduate faculty approval.

4. Curriculum

A. The Ph.D. Program in Veterinary and Biomedical Sciences

Our intention is to establish and sustain a rigorous doctoral program within the existing educational and research environment at the UGA College of Veterinary Medicine. Course offerings will be expanded to include vital topics for training scientists in the Veterinary and Biomedical Sciences program. Students will be required to establish an appropriate program of study that includes basic science, quantitative science, and clinical coursework focusing on one of the proposed areas of emphasis: 1) population based research 2) applied clinical research.

B. Requirements for the Ph.D. Program in Veterinary and Biomedical Sciences

Admission requirements

Students will be recruited and admitted following the guidelines of the Graduate School. They must hold at least a baccalaureate degree accredited by the appropriate regional accrediting association or its international equivalent prior to the expected semester of enrollment. All foreign students, whose native language is other than English, must meet the minimum TOEFL score established by the university's Graduate School. Applications will be assessed by the college graduate coordinator and the graduate affairs committee based on GRE scores, grade point average, and any additional materials including letters of reference.

Degree and Program of study

The goal of this program is to train interdisciplinary and multidisciplinary translational scientists. Trainees will need to possess a uniform knowledge of the core concepts in applied clinical research or population-based research in order to be effective. After completing the program of study (described on pages 10-20), the student will be tested in a written and oral comprehensive examination, administered by the student's doctoral advisory committee in accordance with UGA Graduate School policy. Successful performance on the comprehensive examinations will result in the student being admitted to candidacy.

In accordance with UGA Graduate School policy, the granting of this degree presupposes a minimum of three full years of study beyond the bachelor's degree. At least two consecutive semesters of full-time work (i.e., enrollment for a minimum of 30 hours of consecutive course work included on the program of study) must be spent in resident study on this campus. Undergraduate courses taken either to fulfill research skills requirements or to remove deficiencies may not be calculated in the 30 consecutive hours of resident credit and may not be used on the Program of Study.

A preliminary program of study, developed by the major professor and the doctoral student and approved by a majority of the Ph.D. advisory committee, will be submitted to the graduate coordinator by the end of the student's first year of residence. The program of study will consist of 16 or more hours of 8000- and 9000-level courses in addition to research, dissertation, and directed study. The program of study for a student who bypasses the master's degree must contain 4 additional semester hours of University of Georgia courses open only to graduate students in addition to 16 semester hours of 8000 and 9000 level courses. Doctoral research (9000), independent study courses, and dissertation (9300) may not be counted in these 20 hours. The program of study must carry a minimum of 30 hours of course work, three hours of which must be dissertation writing (9300). The 20 hours of required course work in a student's program of study must be completed prior to taking the comprehensive examination.

To be eligible for admission to candidacy and graduation, a student must maintain an average of 3.0 (B) both on the graduate transcript and on all courses on the program of study. No grade below C (2.0) will be accepted as part of a program of study for a graduate degree. When a graduate course is repeated, the last grade received will be used in calculating the cumulative graduate average that is used for probation, dismissal, admission to candidacy, and graduation. Grades received in all graduate courses will be included in the graduate cumulative average.

All requirements for the degree, except the dissertation and final oral examination, must be completed within a period of six years or within the time frame specified by the UGA Graduate School. This time requirement dates from the first registration for graduate courses on a student's program of study. A Ph.D. candidate, who fails to complete all degree requirements within five years after passing the comprehensive examination and being admitted to candidacy, will be required to take the comprehensive examinations again and be admitted to candidacy for a second time.

Doctoral Advisory Committee

The doctoral advisory committee will be comprised of a major professor and at least three additional voting members. The major professor must be a member of the College of Veterinary Medicine and on the UGA Graduate Faculty. The majority of the committee members must be members of the UGA Graduate Faculty and possess a Ph.D. degree. All committee members must hold the rank of at least assistant professor or equivalent.

Prospectus

Each graduate student in the Veterinary and Biomedical Sciences program will submit a written prospectus of planned research to their doctoral advisory committee by the end of their second year. The prospectus will include a literature review on the area of study, and the hypotheses, objectives, and detailed materials and methods for the planned research. All committee members must approve the prospectus by signature.

Comprehensive Examinations

After completion of 30 hours of required course work for residency and upon approval of the doctoral advisory committee, the student will take a written examination with sections that are administered individually by each member of the committee. The contents of each individual committee member's examination will be determined by that committee member and expectations thereof will be conveyed to the student prior to examination. Once the student satisfactorily passes each committee member's written examination, the committee will give an oral comprehensive examination. The candidate will be given at least two weeks to prepare for the oral examination. The written and oral comprehensive examinations must be passed prior to admission into candidacy.

Admission to Candidacy

Admission into candidacy takes place at least one semester prior to graduation and must be approved by the Graduate School. The following requirements must be fulfilled for the graduate student to be admitted into candidacy:

- The student must have maintained an average GPA of at least 3.0 on all graduate courses taken.
- The research prospectus has been approved by the doctoral advisory committee.
- The final program of study requires approval by the doctoral advisory committee and the Graduate School.
- Written and oral comprehensive examinations have been passed and reported to the Graduate School.

Note: The Graduate School requires the application for graduation one semester prior to graduation.

Dissertation

The student must be registered for at least 3 hours of graduate level work (dissertation hours) the semester in which the dissertation is completed and submitted to the Graduate School. The dissertation must be submitted to the doctoral advisory committee at least one month before defense. The defense must be scheduled with the College of Veterinary Medicine at least two weeks prior to examination. The defense will be administered by the doctoral advisory committee, but is open to all university members of the faculty.

Program of Study

There will be 2 core courses required of all Ph.D. students in the Veterinary and Biomedical Sciences Program. These include: (1) "Research Issues - Ethics, Safety and Compliance" (1 cr.) or an equivalent course, and (2) a seminar course taken for a minimum of 4 semesters. The seminar requirement can be satisfied by any existing graduate level seminar course in the sciences offered at the University and approved by the student's doctoral advisory committee. Students then would take additional graduate level courses focusing on expanding their knowledge within their area of emphasis: Population-Based Research or Applied Clinical Research.

Depending on the area of emphasis, the courses are listed as the following:

C. POPULATION-BASED RESEARCH EMPHASIS

The population-based research emphasis provides an interdisciplinary research approach directed towards problems and issues confronting the health and management of animal populations. A population-based research approach to the management and prevention of diseases transcends individual departments at the College. This emphasis seeks to expand graduate and post-DVM training programs for researchers focused on population health, epidemiology, and public health. No traditional Ph.D. program in the College provides a population-based approach for the training of future veterinary researchers needed in confronting important animal health issues in the 21st century. The following elective courses include fundamental science topics needed for a student's understanding of specific disease mechanisms. Courses in computational sciences, ecology, or epidemiology will be required to understand disease dynamics, management or prevention of animal diseases, zoonoses, disease transmission, natural history of infectious agents, and disease ecology.

Ph.D. students trained under this emphasis need to be facile in integrating concepts of disease pathogenesis, epidemiology, ecology and disease management and control in animal populations. The program of study and elective course offerings reflect the basic principles important to understanding and managing population health. In addition to the core courses listed on page 10, the UGA course catalog contains 11 disease pathogenesis courses, 14 epidemiology and 12 ecology/disease management courses offered at the doctoral level. There are additional doctoral level courses available for a student's program of study that include but are not limited to statistics, bioinformatics, genetics, biochemistry and cell biology. After completing the Program of Study, the student will be tested in a written and oral comprehensive examination administered by the student's doctoral advisory committee in

accordance with UGA Graduate School policy. Successful performance on the comprehensive examinations will result in the student being admitted to candidacy.

i. Additional Core Requirements

In addition to the required core courses listed on page 10, students in the Population-Based Research emphasis will also have to take Communication Skills for Researchers (1 cr.) or equivalent course.

ii Sample Programs of Study

Epidemiology of Infectious Diseases

Year 1		
GRSC 8550	Responsible Conduct of Research	1 cr
VETM xxxx[$]	Communication Skills in Research	1 cr.
VETM xxxx[+,#]	Seminar	2 cr.
IDIS 8591[$]	Advanced Concepts in Virology	3 cr.
EPID 8500[$]	Infectious Diseases Epidemiology	3 cr.
POPH 8310L[$]	Population Health Statistics I	3 cr.
POPH 8320L[$]	Population Health Statistics II	3 cr.
VETM 9000	Research	16 cr.
Year 2		
VETM xxxx[+]	Seminar	2 cr.
POPH 8200[$]	Molecular Virology and Experimental Design	4 cr.
GENE 8950	Molecular Evolution	3 cr.
VETM 9000	Research	28 cr.
Year 3+ until graduation		
VETM xxxx[+]	Seminar	2 cr.
VETM 9000	Research	31 cr.
Final Semester		
VETM xxxx[+]	Seminar	1 cr.
VETM 9000	Research	8 cr.
VETM 9300	Dissertation	3 cr.

[+]Or an equivalent course
[#]Seminar course do not need be taken in the order presented nor taken consecutive semesters. However, students must meet the minimum requirement of enrollment for 4 semesters.
[$]Courses do not need to be taken all in year one, as long as students have completed them before the comprehensive examination.

Disease Ecology and Environmental Health

Year 1

VETM xxxx[$]	Ethics, Safety and Compliance	1 cr.
VETM xxxx[$]	Communication Skills in Research	1 cr.
VETM xxxx[+,#]	Seminar	2 cr.
VPHY 6050	Animal Physiological Chemistry	2 cr.
EHSC 8630L[$]	Quantitative Ecological Toxicology	4 cr.
ECOL 8322[$]	Concepts and Approaches in Ecosystem Ecology	3 cr.
GENE 8300[$]	Research Methods in Population Biology	3 cr.
VETM 9000	Research	16 cr.

Year 2

VETM xxxx[+]	Seminar	2 cr.
ECOL 8325-8325L[$]	Modeling Population Ecology	4 cr.
EPID 8500	Infectious Diseases Epidemiology	3 cr.
VETM 9000	Research	24 cr.

Year 3+ until graduation

VETM xxxx[+]	Seminar	2 cr.
VETM 9000	Research	31 cr.

Final Semester

VETM xxxx[+]	Seminar	1 cr.
VETM 9000	Research	8 cr.
VETM 9300	Dissertation	3 cr.

[+]Or an equivalent course
[#]Seminar courses do not need be taken in the order presented nor taken consecutive semesters. However, students must meet the minimum requirement of enrollment for 4 semesters.
[$]Courses do not need to be taken all in year one, as long as students have completed them before the comprehensive examination.

Years 1 and 2 are guidelines and not intended as a core curriculum. The program is designed with some flexibility to allow DVM/Ph.D. students and residents to coordinate requirements of the DVM and residency programs within the College of Veterinary Medicine with their Ph.D. program of study. The program of study is designed with considerable flexibility in the training of our Ph.D. students in this area of emphasis. However, the 30 hours of required course work for residency in a student's program of study must be completed prior to taking the comprehensive examination.

iii Course Description

In addition to core requirements the following courses are available to fulfill the minimum course work requirement:

VETM 8160	Seminar	1 cr.
POPH xxxx	Population Health Seminar	1 cr.
POPH 8150	Avian Medicine Seminar	1 cr.
POPH 8050	Avian Virus Diseases	3 cr.
POPH 8050L	Avian Virus Diseases Laboratory	1 cr.
POPH 8220	Avian Histopathology	3 cr.
POPH 8110	Problems in Poultry Diseases and Parasites	3 cr.
POPH 8300	Biology and Care of Lab Animals	3 cr.
POPH 8580	Current Topics in Wildlife Health	3 cr.
POPH 8200	Molecular Virology and Experimental Design	4 cr.
IDIS 8591	Advanced Concepts in Virology	3 cr.
VPAT 8150	Virology and Viral Pathogenesis	3 cr.
IDIS 8100	Advanced Infectious Diseases	3 cr.
CBIO 8500	Biology of Parasitism	4 cr.
PBHL 8100	Current Topics in Public Health	3 cr.
VPAT 7200-7200L	General Animal Pathology	3.7 cr.
VPAT 8020	Cellular Pathology	4 cr.
VPAT 8030	Tumor Biology	3 cr.
CBIO 8100	Advanced Immunology	3 cr.
IDIS 8900	Special Problems- Vaccinology	2 cr.
PBHL 8260	Global Perspectives on Tropical and Emerging Infectious Diseases	3 cr.
ECOL 8310	Population Ecology	3 cr.
ECOL 8325-8325L	Modeling Population Ecology	4 cr.
ECOL 8322	Concepts and Approaches in Ecosystem Ecology	3 cr.
FORS 8500-8500L	Diseases of Wildlife	4 cr.
GENE 8400	Ecological Genetics	3 cr.
MIBO 8610	Advanced Microbial Diversity	3 cr.
GENE 8840	Advanced Topics in Population Genetics	3 cr.
GENE 8500	Research Methods in Population Biology	3 cr.
POPH 8230	Special Topics in Population Health	3 cr.
POPH 8900	Problems in Population Health	3 cr.
POPH 8310L	Population Health Statistics I	3 cr.
POPH 8320L	Population Health Statistics II	3 cr.
BIOS 8100	Case Studies in Nonlinear Biostatistics	3 cr.
BIOS 8110	Categorical Data Analysis	3 cr.
BIOS 8120	Applied Nonparametric Biostatistical Methods	3 cr.
EPID 8500	Infectious Diseases Epidemiology	3 cr.
EHSC 8630L	Quantitative Ecological Toxicology	4 cr.
VPHY 8930	Chemical Toxicology	3 cr.
VPHY 6050	Animal Physiological Chemistry	2 cr.
EPID 8200	Molecular Epidemiology	3 cr.
EHSC 8220L	Predictive Toxicology Using Mathematical Models	4 cr.
EPID(EHSC) 8070	Environmental and Occupational Epidemiology	3 cr.
EHSC 8450	Microbial Quantitative Risk Assessment	3 cr.

EHSC 8550	Developmental and Reproductive Toxicology	3cr.
GENE 8920	Nucleic Acids	3 cr.
GENE 8930	Adv. Molecular Genetics	3 cr.
GENE 8940	Genome Analysis	3 cr.
BCMB 8140	Advanced Topics in Genomics and Bioinformatics	2 cr.
GENE 8950	Molecular Evolution	3 cr.
VETM 9000	Doctoral Research	Varied
VETM 9300	Doctoral Dissertation in VBS	3 cr.

D. APPLIED CLINICAL RESEARCH EMPHASIS

Two reports from the U.S. National Academies of Science's National Research Council, "Critical Needs for Research in Veterinary Science" (completed in 2001) and "National Need and Priorities for Veterinarians in Biomedical Research" (completed in 2004) have summarized the critical nature of the emerging deficit of veterinary clinician scientists. Veterinary clinician scientists are veterinarians who use their doctor of veterinary medicine (DVM) degree to diagnose, manage, and treat patients in a clinical setting while simultaneously utilizing their specialized research (Ph.D.) degree to investigate diseases that affect their patients.

The global mission of the College of Veterinary Medicine is to promote the art and science of veterinary medicine through the acquisition, application, and dissemination of scientific advances that help diagnose and treat disease and maintain the health of animals and humans through scholarly inquiry into the nature of health and disease. Successful pursuit of this mission requires more effective and efficient translation of bench-top discoveries into diagnostic and patient-care tools. This "translational step" requires an expansion of the training and retention of veterinary clinicians in animal health research.

Because of their direct involvement in patient-oriented clinical service, the departments of Small Animal Medicine and Surgery, Large Animal Medicine, and Anatomy/Radiology are uniquely poised to train scientists in veterinary translational research. In addition to graduate students who hold an undergraduate degree, it is anticipated that this program will attract graduate students who have a DVM degree and also may be enrolled concurrently in advanced clinical training programs (i.e. residencies) that culminate in board certification within a defined clinical specialty.

The core mission of this area of emphasis is to train graduate students in areas that address: the pathogenesis of disease, therapeutic interventions, clinical trials, the adaptation of new technologies to medicine, and the social and behavioral mechanisms of health and disease.

i Additional Core Requirements

There will be 2 additional core courses required of all Ph.D. students in the Applied Clinical Research emphasis: 1) graduate level biochemistry (3-4 cr.), and 2) Statistics or Biostatistics (3 cr.).

Individual doctoral advisory committees will determine whether or not graduate level courses previously taken by the candidate can replace any of the core requirements. In addition to the core courses, students enrolled in the Applied Clinical Research emphasis may be required to participate in a grant-writing course or workshop that the doctoral advisory committee deems acceptable.

ii Sample Programs of Study

For the Applied Clinical Research Track of the Veterinary and Biomedical Sciences Ph.D., we anticipate training three types of students including: 1) individuals who previously have completed a bachelor's or master's degree, 2) individuals who in addition to a bachelor's or master's degree have completed a doctor of veterinary medicine degree, and 3) individuals who in addition to a bachelor's or master's degree have completed a doctor in veterinary medicine degree and are in a combined clinical residency and Ph.D. program.

Therefore, three sample programs of study are provided.

Sample Program of Study for Graduate Students with a Bachelor's or Master's Degree

Year 1		
VETM 8160[+,#]	Seminar	1 cr.
GRSC 8550	Responsible Conduct of Research	1 cr.
VPHY 6910	Introductory Toxicology	3 cr.
BCHM 6010	Biochemistry/Molecular Biology I	3 cr.
BCHM 6020	Biochemistry/Molecular Biology II	3 cr.
IDIS 5150	Veterinary Immunology	3 cr.
POPH 8310L	Population Health Statistics I	3 cr.
OR		
[STAT 8040	Environmental Statistics]	[3 cr.]
VETM 9000	Research	4 cr./semester
Year 2		
VETM 8160[+,#]	Seminar	1 cr.
VPHY 8930	Chemical Toxicology	3 cr.
VPHY 8940	Organ Systems Toxicology	5 cr.
VPHY 6090	Comparative Mammalian Physiology	3 cr.
VETM 9000	Research	8-10 cr./semester
Year 3+ until graduation		
VETM 8160[+,#]	Seminar	1 cr.
VETM 9000	Research	24 cr./semester
Final Semester		
VETM 8160[+,#]	Seminar	1 cr.
VETM 9000	Research	5-6 cr.
VETM 9300	Dissertation	3 cr.

[+]Or an equivalent course
[#]Seminar courses do not need be taken in the order presented nor taken consecutive semesters. However, students must meet the minimum requirement of enrollment for 4 semesters.
[$]Courses do not need to be taken all in year one, as long as students have completed them before the comprehensive examination.

Sample Program of Study for Graduate Students with a DVM Degree

Year 1		
GRSC 8550	Responsible Conduct of Research	1 cr.
STAT 6210	Statistical Methods I	3 cr.
BCMB 8020	Advanced Biochemistry & Molecular Biology	4 cr.
VPHY 8900[#]	Physiology and Pharmacology Seminar	1 cr.
CBIO 6100	Immunology	3 cr.
VPHY 8460	Molecular Pharmacology	3 cr.
POUL 8120	Scientific Writing	3 cr.
VETM 9000	Research	10 cr.
Year 2		
VPHY 8900 [#]	Physiology and Pharmacology Seminar	2 cr.
STAT 6220	Statistical Methods II	3 cr.
CBIO 8080	Write and Speak	2 cr.
VPHY 8010	Mammalian Cell Physiology	3 cr.
STAT 8200	Experimental Design	3 cr.
VETM 9000	Doctoral Research	14 cr.
Year 3+ until graduation		
VPHY 8900[#]	Physiology and Pharmacology Seminar	1 cr.
VETM 9000	Doctoral Research	24 cr.
Final Semester		
VPHY 8900	Physiology and Pharmacology Seminar	1 cr.
VETM 9000	Doctoral Research	6 cr.
VETM 9300	Dissertation	3 cr.

[+]Or an equivalent course
[#]Seminar courses do not need be taken in the order presented nor taken consecutive semesters. However, students must meet the minimum requirement of enrollment for 4 semesters.
[$]Courses do not need to be taken all in year one, as long as students have completed them before the comprehensive examination.

Sample Program of Study for Graduate Students with a DVM degree who are concurrently enrolled in a Clinical Residency Program

A DVM who is pursuing a Ph.D. in the clinical science departments may also wish to concurrently obtain board certification within a clinical specialty, such as internal medicine, surgery, pathology, cardiology, ophthalmology, oncology, neurology, behavior,

theriogenology, or radiology. This program of study would enable a DVM graduate student to fulfill the clinical certification requirements within their designated clinical specialty, as well as pursue a Ph.D. The requirements for each program (Ph.D. and residency) are separate; however the programs can run concurrently. The requirements for certification within a clinical specialty are set by the American Board of Veterinary Specialties and vary by clinical discipline and thus are not included within this document. The clinical departments at the College of Veterinary Medicine have a broad range of board-certified diplomats to mentor the clinical training component.

A major strength of the proposed program design is that throughout the student's training, the candidate maintains a crucial link between research and clinical activity. For example, during the clinical training portion of the program, a candidate may be involved in the collection of samples and data from clinical cases that are related to their area of research. Likewise, during time designated for research, a candidate may participate in clinically oriented discussion rounds, but will not participate in primary case responsibility or emergency duty. The duality and simultaneous design of this training atmosphere will successfully prepare candidates for their intended path as a clinician scientist.

Year 1

GRSC 8550	Responsible Conduct of Research	1 cr.
STAT 6210	Statistical Methods I	3 cr.
BCMB 8020	Advanced Biochemistry & Molecular Biology	4 cr.
VPHY 8900[#]	Physiology and Pharmacology Seminar	2 cr.
VPHY 8450	Advanced Clinical Pharmacology	2 cr.
POUL 8120	Scientific Writing	3 cr.
VPHY 6930	Research Methods	3 cr.
STAT 6220	Statistical Methods II	3 cr.
CBIO 6100	Immunology	3 cr.
VPHY 8010	Comparative Mammalian Physiology	3 cr.
VETM 9000	Doctoral Research	3 cr.

Years 2 through graduation

VPHY 8900	Physiology and Pharmacology Seminar	1 cr.
VPHY 6930	Research Methods	3 cr.
VPHY 9000	Doctoral Research	20 cr.

Final Semester

VPHY 8900[+, #]	Physiology and Pharmacology Seminar	1 cr.
VETM 9000	Doctoral Research	6 cr.
VETM 9300	Dissertation	3 cr.

[+]Or an equivalent course

[#]Seminar courses do not need be taken in the order presented nor taken consecutive semesters. However, students must meet the minimum requirement of enrollment for 4 semesters.

[$]Courses do not need to be taken all in year one, as long as students have completed them before the comprehensive examination.

iii Course Description

In addition to core requirements the following courses provide examples available to fulfill the minimum course work requirement:

Applied Clinical Research Course Electives

SAMS 7650	Seminar in Small Animal Medicine in Surgery	1 cr.
SAMS 8010	Seminar in Medicine and Surgery	1 cr.
POPH 7060/7060L	Avian Diagnostic Microbiology	4 cr.
POPH 8050/8050L	Avian Virus Diseases	4 cr.
POPH 8150	Avian Medicine Seminar	1 cr.
POPH 8200	Molecular Virology and Experimental Design	4 cr.
POPH 8310L	Population Health Statistics I	3 cr.
POPH 8320L	Population Health Statistics II	3 cr.
POPH 8050L	Avian Virus Diseases Laboratory	1 cr.
POPH 8220	Avian Histopathology	3 cr.
POPH 8110	Problems in Poultry Diseases and Parasites	3 cr.
POPH 8300	Biology and Care of Lab Animals	3 cr.
POPH 8580	Current Topics in Wildlife Health	3 cr.
POPH 8200	Molecular Virology and Experimental Design	4 cr.
POPH 8230	Special Topics in Population Health	3 cr.
POPH 8900	Problems in Population Health	3 cr.
POPH 8310L	Population Health Statistics I	3 cr.
POPH 8320L	Population Health Statistics II	3 cr.
MIBO/POPH 4650/6650	Viral Zoonoses	3 cr.
VPAT 8150	Virology and Viral Pathogenesis	3 cr.
VPAT 7200-7200L	General Animal Pathology	3.7 cr.
VPAT 8020	Cellular Pathology	4 cr.
VPAT 8030	Tumor Biology	3 cr.
PBHL 8100	Current Topics in Public Health	3 cr.
PBHL 8260	Global Perspectives on Tropical and Emerging Infectious Diseases	3 cr.
BCMB 8140	Advanced Topics in Genomics and Bioinformatics	2 cr.
BIOS 7020	Introductory Biostatistics II	3 cr.
BIOS 8100	Case Studies in Nonlinear Biostatistics	3 cr.
BIOS 8110	Categorical Data Analysis	3 cr.
BIOS 8120	Applied Nonparametric Biostatistical Methods	3 cr.
EPID 8500	Infectious Diseases Epidemiology	3 cr.
EPID 8200	Molecular Epidemiology	3 cr.
EHSC 8450	Microbial Quantitative Risk Assessment	3 cr.
EHSC 8630L	Quantitative Ecological Toxicology	4 cr.
EHSC 8220L	Predictive Toxicology Using Mathematical Models	4 cr.
EPID(EHSC) 8070	Environmental and Occupational Epidemiology	3 cr.
EHSC 8450	Microbial Quantitative Risk Assessment	3 cr.
EHSC 8550	Developmental and Reproductive Toxicology	3 cr.
GENE 8920	Nucleic Acids	3 cr.

GENE 8930	Adv. Molecular Genetics	3 cr.
GENE 8940	Genome Analysis	3 cr.
GENE 8400	Ecological Genetics	3 cr.
GENE 8840	Advanced Topics in Population Genetics	3 cr.
GENE 8500	Research Methods in Population Biology	3 cr.
GENE 8950	Molecular Evolution	3 cr.
VPHY 6090	Comparative Mammalian Physiology	3 cr.
VPHY 6100	Comparative Mammalian Physiology.	3 cr.
VPHY 6910	Introductory Toxicology.	3 cr.
VPHY 8100	Comparative Medical Endocrinology.	2 cr.
VPHY 8120	Molecular Basis of Renal Physiology	2 cr.
VPHY 8200	Animal Molecular Biology: Concepts and Current Literature.	2 cr.
VPHY 8400	Neurophysiology.	3 cr.
VPHY 8450	Advanced Clinical Pharmacology	2 cr.
VPHY 8460	Molecular Pharmacology	3 cr.
VPHY 8900	Physiology-Pharmacology Seminar	1 cr.
VPHY 8930	Chemical Toxicology	3 cr.
VPHY 8940	Organ Systems Toxicology	3 cr.
ECOL 8310	Population Ecology	3 cr.
ECOL 8325-8325L	Modeling Population Ecology	4 cr.
ECOL 8322	Concepts and Approaches in Ecosystem Ecology	3 cr.
FORS 8500-8500L	Diseases of Wildlife	4 cr.
IDIS 8591	Advanced Concepts in Virology	3 cr.
IDIS 8160	Seminar in Infectious Disease	1 cr.
IDIS 8550	Special Topics in Immunology	1 cr.
IDIS 8010	Advanced Studies in Infectious Diseases	4 cr.
IDIS 8590	Special Topics in Diseases Intervention	1 cr.
IDIS 8540	Special Topics in Bacterial Pathogenesis	1 cr.
IDIS 8250	Special Topics in Parasitology	1 cr.
IDIS 8100	Advanced Infectious Diseases	3 cr.
IDIS 6450	Microbial Genetics and Genomics	4 cr.
IDIS 8030	Helminthology	3 cr.
VPAT 8150	Virology and Viral Pathogenesis	3 cr.
POPH 8200	Molecular Virology and Experimental Design	5 cr.
IDIS 8080L	Advanced Molecular Techniques	3 cr.
IDIS 8300	Advanced Immunology II	3 cr.
IDIS 8350	Principles and Research Applications of Flow Cytometry	3 cr.
IDIS 8591	Advanced Concepts of Virology	3 cr.
IDIS 8900	Problems in Infectious Diseases	1 cr.
CBIO 8010	Molecular Cell Biology	3 cr.
CBIO/IDIS 6100	Immunology	3 cr.
CBIO 8100	Advanced Immunology I	3 cr.
CBIO 8400	Advanced Cell Biology	3 cr.
CBIO 8500	Biology of Parasitism	4 cr.
CBIO 8080	Biomedical Grant Writing	3 cr.

VARB 8340	Seminar in Applied Behavior	1 cr.
PSYCH 8300	Neuroanatomy for Behavioral Scientists	3 cr.
PSYCH 8330	Laboratory Apprenticeship in Biopsychology	3 cr.
PSYCH 8900	Psychopharmacology Seminar	3 cr.
ANTH 8060	Primate and Human Ecology	3 cr.
VETM 9000	Doctoral Research	Varied
VETM 9300	Doctoral Dissertation	3 cr.

5. Inventory of Faculty Directly Involved

Graduate faculty in the College of Veterinary Medicine are eligible to participate in and direct training of students in the Veterinary and Biomedical Sciences, Ph.D. program. The following table provides a listing of departments and graduate faculty members (including adjunct faculty) in the college.

ANATOMY AND RADIOLOGY	Sharon L. Crowell-Davis, D.V.M., Ph.D. - Human-animal bond, animal behavior. Robert M. Gogal, D.V.M. - Immunology & Immunotoxicology. Steven Holladay, M.S., Ph.D. – Immunotoxicology. & Department Head Jeff Hogan, Ph.D. - Infectious Diseases, Virology. Shannon Holmes, D.V.M., M.Sc – Radiology. Thomas M. Krunkosky, D.V.M., M.S., Ph.D. – Molecular mechanisms of inflammation and disease in the lung. Michelle Turek, D.V.M., Diplomate ACVIM, Diplomate ACVR – Radiology.
POPULATION HEALTH	Leanne Alworth, B.S., D.V.M., M.S., Ph.D. - Laboratory animal medicine Roy Berghaus, D.V.M., Ph.D. – Infectious disease epidemiology. Stephen Collett, D.V.M., Ph.D. – Clinical avian medicine. Joe Corn, Ph.D. - Tick Ecology and wildlife diseases. Roger Ellis, D.V.M., M.V.S.c. – Beef Production Medicine. John R. Fischer, D.V.M., Ph.D. - Pathology, virulence mechanism's., and population effects of diseases in wildlife. Maricarmen Garcia, Ph.D. - Avian virology, molecular virology. Saad Gharaibeh, B.V.S.c., Ph.D – Histopathology. John R. Glisson, D.V.M., M.A.M., Ph.D. - Clinical avian medicine, mycoplasmosis and bacteriology. Stephen Harvey, B.S., M.S., D.V.M. - Laboratory Animal medicine. Charles L. Hofacre, D.V.M., M.A.M., Ph.D. - Clinical avian medicine, mycoplasmosis and bacteriology. David J. Hurley, Ph.D. - Veterinary Immunology and Vaccine Development. Mark Jackwood, Ph.D. - Molecular biotechnology, molecular virology. Michael Keel, BS, M.S., D.V.M., PhD - Infectious diseases of wildlife; pathology of diseases. Christopher King, B.S, D.V.M., Ph.D. – Laboratory Animal medicine. Margie Lee, D.V.M., Ph.D. – Microbial Pathogenesis, microbial ecology. John J. Maurer, Ph.D. - Molecular bacteriology. Daniel G. Mead, Ph.D. - Vector-borne viral diseases. Egbert Mundt, D.V.M., Ph.D. – Molecular virology, viral pathogenesis, vaccinology, birnaviruses and avian influenza. Naola Noel-Ferguson, D.V.M., M.A.M., Ph.D. – Mycoplasmosis. Michael Overton, D.V.M., MPVM – Production Animal Medicine. Melvin Pence, D.V.M., M.S. – Beef production medicine. David Reeves, D.V.M., M.S. – Swine production medicine. Holly Sellers, M.S., Ph.D. – Avian virology. David E. Stallknecht, Ph.D. - Wildlife diseases, epidemiology. Stephen G. Thayer, Ph.D. – Diagnostic veterinary microbiology, viral serology. Susan Williams, D.V.M., M.A.M., Ph.D. – Avian histopathology. Michael Yabsley, B.S., D.V.M., M.S., Ph.D. – Wildlife disease ecology. Guillermo Zavala, M.S., D.V.M., M.A.M., Ph.D. – Clinical avian medicine.
LARGE ANIMAL MEDICINE	Michelle H. Barton, D.V.M., Ph.D. - Endotoxemia, neonatology, internal Medicine, and cardiology Richard A. Fayrer-Hosken, B.V.Sc., Ph.D. Theriogenology, reproductive physiology, immunocontraception, exotic reproductive physiology. Steeve Giguiere, D.V.M., Ph.D., - Internal Medicine, cardiology, respiratory immunity and bacteriology James N. Moore, D.V.M., Ph.D. - Endotoxemia & laminitis. John Peroni, D.V.M., M.S., Dip ACVS - Microvascular dysfunction in equine laminitis, regulation of equine pulmonary blood flow, and small vessel myography, stem cell biology. Jakob Scherzer, Mag.med.vet, Dr.med.vet, Dip ECAR - genesiology Michel Vandenplas, B.Sc., M.Sc., Ph.D. - Modulation of endotoxin signal transduction in human and equine monocytes. Amelia Woolums, M.V.Sc., D.V.M., Ph.D. - Bovine respiratory disease and respiratory immunity.

INFECTIOUS DISEASES	Myriam Belanger, M.Sc., Ph.D. - *Porphyromonas gingivalis* Harry W. Dickerson, B.V.Sc., Ph.D. - Comparative immunoparasitology. Donald L. Evans, Ph.D. - Cellular immunology and immunoregulation. Liliana Jaso-Friedmann, Ph.D. - Molecular immunology. Don Harn, M.A., Ph.D. - vaccines and therapeutics for HIV-1 and schistosomiasis Biao He, Ph.D - Paramyxovirus-host interactions Mary Hondalus, D.V.M., Ph.D. - Tuberculosis, vaccines and Rhodococcus pathogenesis. Ray M. Kaplan, D.V.M., Ph.D. - Parasitic diseases of livestock. Russ Karls, Ph.D. - Pathogenic Mycobacteria. Eric Lafontaine, B.S., Ph.D. – Microbiology and Infectious Diseases. Julie M. Moore, Ph.D. - Malarial immunology. Andrew Moorhead, D.V.M., M.S., Ph.D., - Small Animal Parasitology. David S. Peterson, Ph.D. - Molecular parasitology. Frederick D. Quinn, Ph.D. - Tuberculosis/mycobacterial pathogenesis. Sreekumari Rajeev, BVSc, Ph.D., DACVM – Infectious Diseases, Leptospirosis and Johne's disease in cattle. Jeremiah Saliki, D.V.M., Ph.D., Dipl. ACVM – Virology, vaccine development. Susan Sanchez, Ph.D. - Molecular mechanisms and epidemiology of antibiotic resistance. Bruce Seal, Ph.D. – Microbiology, Poultry Microbiogical Safety. David Suarez, Ph.D. - Influenza pathogenesis. Matt Sylte, D.V.M., Ph.D., DACVM – Infectious Diseases, Virology. Mark S. Tompkins, Ph.D. – Immune response to influenza virus infection. Ralph A. Tripp, Ph.D. - Viral immunology and vaccine development. Wendy Watford, Ph.D. - Regulation of host defense and tolerance by Stat transcription factors Adrian Wolstenholme, Ph.D. - Molecular helminthology
VETERINARY PATHOLOGY	Frederick Almy, D.V.M., M.S., Dipl ACVP – Infectious Diseases. Uriel Blas-Machado, D.V.M., Ph.D. - Immunohistochemistry of Infectious Diseases. Cathy A. Brown, V.M.D., Ph.D. - Progression of chronic renal disease, infectious diseases, and diagnostic pathology. Gregory Bossart, V.M.D., M.S., Ph.D. – Immunology and Pathology of Marine Animals. Corrie C. Brown, D.V.M., Ph.D. - Infectious diseases of food-producing animals, foreign animal diseases. Richard Bruner, D.V.M., Ph.D. - Lab animal pathology. Alvin Camus, D.V.M., Ph.D. - Comparative Immunology, Microbiology, and Infectious Diseases. K. Paige Carmichael, D.V.M., Ph.D. - Spontaneous animal models of human neurologic disease; neuropathology, ocular diseases. Alistair Dove, B.S., D.M.Ph.D. - Aquatic medicine. Angela Ellis, D.V.M., Ph.D - Ophthamologic Pathology Paula J. Fedorka - Cray, B.S., M.S., Ph.D. - Food and Production Animal Microbiology. Nicole L. Gottdenker, D.V.M., M.S., Ph.D - Zhen Fu, D.V.M., Ph.D. - Molecular pathogenesis of rabies. Jaroslava T. Halper, M.D., Ph.D. - Growth factors and neoplasia, wound healing. Keith Harris, D.V.M., - Veterinary Pathology & Department Head Elizabeth W. Howerth, D.V.M., Ph.D. - Wildlife diseases, pathogenesis of viral diseases. Paula M. Krimer, DVM, DVSc – Clinical Pathology Bruce LeRoy, D.V.M., Ph.D. - Clinical Pathology, Prostate Cancer, Bone Metastises. Debra Miller, M.S., D.V.M., Ph.D. – Wildlife rehabilitation, wildlife diseases. Tamas Nagy, D.V.M. Ph.D. - Comparative mammary pathology Mary Pantin-Jackwood, D.V.M., Ph.D. – Avian Pathology. Pauline Rakich, D.V.M., Ph.D. – Clinical Pathology. Sherif Ramzy Zaki, M.S., Ph.D. - Infectious Diseases, Zoonoses, Pathology. Kaori Sakamoto, D.V.M., Ph.D. – Comparative Biomedical Science David Swayne, D.V.M., M.S., Ph.D. - Renal diseases associated with infectious and non-infectious etiologies. Elizabeth Uhl, D.V.M., Ph.D. - Molecular pathology; role of transcription factors in susceptibility and resistance to disease.
PHYSIOLOGY & PHARMACOLOGY	Shiyou Chen, D.V.M., Ph.D. - Molecular genetics, DNA structure and function Julie A. Coffield, D.V.M., Ph.D. - Toxicology, neurology. Gaylen L. Edwards, D.V.M., Ph.D. - Neural control of ingestive behavior, motivation and reward. Nick Filipov, Ph.D. - *Neurotoxicology; Neuroimmunology* Royal A. McGraw, Ph.D. - Mammalian molecular genetics, DNA technology. Thomas Robertson B.Sc., Ph.D. - Heterogeneity of the cardiovascular system in health and disease. Sherry L. Sanderson, D.V.M., Ph.D. – Nutritional management in health and disease, urology and nephrology. John J. Wagner, Ph.D. - MechanisM.S. of neuroplasticity and drugs of abuse. Xiaoqin Ye, M.D., Ph.D. - Lysophospholipid signaling in reproduction, and reproductive toxicology.
SMALL ANIMAL MEDICINE & SURGERY	Scott A. Brown, V.M.D., Ph.D. - Biology of renal microvasculature. Benjamin Brainard, V.M.D., DACVA, DACVECC – Emergency/Critical Care. Steven C. Budsberg, D.V.M., M.S. - Gait analysis and osteoarthritis. Karen Cornell, D.V.M., Ph.D. – Cancer research, mechanism's. of metastasis. Oncology. Kate Creevy, D.V.M., M.S., DACVIM – Internal Medicine. Stephen Divers, BVetMed, MRCVS – Zoological medicine (exotic pets, wildlife, zoo and aquatic). Christine Fiorello, D.V.M., M.S., Ph.D., DACZM. - Exotic Animal, Wildlife & Zoological Medicine. Patrick Hensel, D.V.M., DACVD – Dermatology. Erik Hofmeister, D.V.M., B.S., DACVA – Anesthesia. Anthony Moore, D.V.M., B.S., DACVO – Ophthalmology. Simon Platt, BVM&S, DAVCIM – Neurology. Gregg Rapoport, D.V.M., DACVIM – Cardiology. Branson Ritchie D.V.M., Ph.D. - Viral diseases of companion birds, Zoo animal medicine. Scott Schatzberg, D.V.M., Ph.D., DACVIM – Neurology. Chad Schmiedt, D.V.M., DACVS – Surgery. Jo Smith, M.A., VetMB, Ph.D., DACVIM – Internal Medicine. Cynthia R. Ward, V.M.D., Ph.D. - General endocrinology, feline hyperthyroidism. Internal Medicine.

6. Three Outstanding Programs of this Nature in Other Institutions

See F, above (pg. 6).

7. Inventory of Pertinent Library Resources

The University of Georgia has the largest library in the state, with more than 3.8 million volumes. The UGA Libraries are members of the Association of Research Libraries and ranked 35th in total volumes held and 9th in current periodicals owned in 2000. Moreover, UGA is a Regional Depository library to the U.S. Superintendent of Documents and U.S. Government Printing Office.

A. Print Materials

The libraries of the University of Georgia have an impressive print collection in the sciences and rank very high for a research university that does not have an affiliated medical school. The science library contains approximately 750,000 total volumes, owns 1044 periodical titles in medicine and 1326 periodical titles in basic life sciences. There are additional titles located in the main library that are relevant to some research areas.

B. Electronic Materials

Like the print materials, the libraries of the University of Georgia offer very impressive access to electronic resources, including full text journal articles. Among these resources are the *Web of Science* from the Institute of Scientific Information, *Science Citation Index* with back files to 1945 and *Journal Citation Reports*. Hundreds of additional databases are available. Among these are CABI, Agricola, BIOSIS, Biological and Agricultural Index, MEDLINE, Cambridge Scientific Abstracts, PsychInfo, Sport DISCUS and Chemical Abstracts SciFinder Scholar. Important to the IBS Program is the electronic access to full-text journal articles via Elsevier's ScienceDirect (over 900 titles), Springer-Verlag, Academic Press, Lippincott/Williams and Wilkins, Cell Press and several individual bioscience related titles such as Annual Reviews. GALILEO also allows access to other full-text resources such as AHFS Drug Information, CRC Handbook of Chemistry and Physics, Stedman's Medical Dictionary and USP/DI Drug Information. In summary, no new library support will be needed to implement the Ph.D. Program in Veterinary and Biomedical Sciences.

8. Facilities

The College of Veterinary Medicine will house the administrative offices for the Ph.D. Program in Veterinary and Biomedical Sciences. Faculty involved in the Ph.D. Program in Veterinary and Biomedical Sciences throughout the College of Veterinary Medicine have well equipped laboratories to sustain their current research load. It is expected that students will be trained in existing facilities. These include laboratories for genomics, proteomics, molecular biology, physiology and pharmacology, toxicology, infectious diseases, microbiology, virology, parasitology, and immunology. Hence, there are ample existing research facilities for the program.

9. Administration

The Ph.D. Program in Veterinary and Biomedical Sciences will be administered through the College's Office of the Associate Dean, Research and Graduate Affairs. The Office of the Associate Dean will coordinate the development of detailed policies concerning student financial support. In this effort, UGA has several strong graduate programs to use as models, including the existing graduate programs in the college.

10. Assessment

A. Direct Student Assessment:

At the completion of the Veterinary and Biomedical Sciences Program, the College graduate co-coordinator will interview students regarding their overall graduate experience. Web-based questionnaires (an exit questionnaire and 5-year and 10-year post graduation questionnaire) will be also sent to those who graduate from this program to assess its effectiveness. Input will also be sought from graduates on what were the most helpful aspects of the program and where improvement could be made. Examples of specific questions to be asked include the following: 1) educational experiences and climate; 2) the effectiveness of Ph.D. advisor and the advisory committee; 3) guidance in the preparation for scientific meetings and writing of scientific manuscripts or grants; 4) adequacy of resources; 5) the effectiveness of the Ph.D. program in preparing students for the workplace; and 6) the number and sources of job offers received by students near completion and after graduation. VBS graduates will also be asked about their academic successes including: 1) research grants as primary investigator/co-investigator, source of funding, amount and duration of grants; 2) research publications, reviews, books and book chapters; 3) other publications; and 4) awards, honors and other noteworthy achievements. Responses will be compiled and reviewed by relevant graduate faculty and proper adjustments will be made to the program.

B. Learning Outcomes Assessment:

Parameters to be measured will include: 1) completion of the degree within a desirable time range; 2) student-authored publications in peer-reviewed journals; 3) student-presented posters and seminars; 4) graduate student fellowships/scholarships/awards and extramural funding; and 5) post-graduation employment and salaries.

When problems or areas of weakness are identified through any of the above-described methods, the College graduate co-coordinator will call a meeting of the program faculty to discuss ways of correcting the problems. Once the problem has been discussed, and the faculty who need to address the problem have been identified, a plan of action will be developed, and subsequently implemented, to correct the problem.

11. Accreditation

N/A

12. Affirmative Action Impact

No expected change.

13. Degree Inscription

Doctorate of Philosophy in Veterinary and Biomedical Sciences

14. Fiscal and Enrollment Impact and Estimated Budget

Total Enrollment of PhD graduate students in the college is expected to increase initially by approximately 10-15 students per year. The dean's office currently provides an

administrative supplement for a faculty member who coordinates college-wide graduate programs. A full-time administrative assistant position will be established to oversee the administration of the proposed VBS PhD program and the existing VBS MS program. The college has stipend support for up to 36 graduate students from various intra- and extra-mural sources, and students enrolled in the VBS program will be eligible to apply for these funds. We expect that the VBS PhD program will attract a higher percentage of post-DVM graduate students and students who apply to the dual DVM/PhD. Program. These individuals are highly competitive academically and they will be encouraged to apply for competitive Graduate School assistantships. Faculty research grants and extramurally-funded institutional training grants will provide additional stipend support as the program develops and student numbers increase.