

**INTERDISCIPLINARY
GRADUATE COURSE AND CURRICULUM CHANGES**

approved by the
Stem Cell Biotechnology Graduate Certificate
Interdisciplinary Faculty
via electronic vote
September 10, 2007

Contact Person: Shannon Fox
532-7927
email: gradinfo@ksu.edu

**Units outside the college, which may be directly
impacted by these changes are:**

**Anatomy and Physiology
Animal Sciences
Biology
Diagnostic Medicine/Pathobiology
Graduate School
Management
Plant Pathology**

**Please provide the sponsors of a proposed change with any information regarding
fiscal or programmatic impact on your department, program or students.**

Graduate Certificate in Stem Cell Biotechnology Request for Approval

Introduction

The Midwest Institute for Comparative Stem Cell Biotechnology (the Institute) was created in 2005 based upon emerging research and intellectual property development resulting from the discovery by Kansas State University personnel of a stem cell population in the matrix of the umbilical cord of humans and also domestic and laboratory animals. A website has been created for the institute: <http://www.vet.ksu.edu/research/stemcell/index.htm>

As is apparent from the website, stem cell research, development of related intellectual property and education in stem cell-related biotechnology are the primary goals. Significant progress has been made in research. All components of the pending patent have been licensed. Fees paid, while confidential under the licensing agreement, are the largest licensing fees ever received by the KSU research foundation by a large margin. The third element of the Institute's aims, education, is the subject of the present proposal.

Learning objectives

The overarching purpose of the proposed certificate program is to add value to other degrees in the biological and life sciences, specifically including animal sciences, veterinary medicine, biology and biochemistry.

Specific learning objectives are enumerated in the assessment plan.

Courses

The core courses in the certificate are:

AP 711. Stem Cells and Comparative Biomedicine. (2) II, S. Characteristics of major categories of stem cells. Applicable or potential clinical uses, including their utilization in tissue engineering or targeted delivery of therapeutics.

AP 850 Stem Cell Techniques. (2) I, S. Cellular and molecular techniques and techniques on tissue culture. Lecture and laboratory hours to be determined.

ASI 802. Gametes, Embryos, and Stem Cells in Farm Animals. (2) I, in odd years. A study of gametes, embryos, pregnancy, and stem cells in farm species including supporting information from laboratory species and humans. Emphasis will be on the regulation of stem cells, gametes, and embryos and on the conceptus-maternal interactions to establish and maintain pregnancy and program conceptus and postnatal development. Two hours lec. a week. Pr.: BIOCH 521.

ASI 902 Topics in Stem Cell Biotechnology. (1) A journal club course in stem cell biotechnology in fall semesters. One semester is required. It can be repeated twice for a total of three credits in the stem cell certificate. Students will evaluate the contribution of scientific papers to the field of stem

cell biology, present scientific data, lead discussions of scientific literature, and become familiar with current concepts in the field of stem cell biology and biotechnology.

Elective courses for emphasis in research or entrepreneurship are:

AP 710 Microanatomy. Origin, development and microscopic structure of the cells and tissues for the animal body. Three hours lecture and six hours lab/week. Pr: First year standing in college of veterinary medicine. Fall semester.

AP 995. Problems in Physiology. (Var.) I, II, S. Special problem-involving techniques utilized in studying the function of various organ systems of the body. Pr.: Consent of instructor.

ASI 600. Applied Animal Biotechnology. (2) II. Emphasis will be placed on the current and future of animals in biotechnology related to food production as well as human medicine applications. Rec. Pr.: Senior standing, BIOCH 521 and ASI 500.

ASI 961. Graduate Problem in Animal Sciences and Industry. (1-3) I, II, S. In-depth study of a topic supervised by a member of the graduate faculty. Pr.: Permission of supervising faculty member.

BIOL 510. Developmental Biology. (3) II. Introduction to the stages and mechanisms of embryonic animal development. Integrated approach that includes classic experimental embryology and the genetic and molecular regulation of invertebrate and vertebrate animal development. Three hours lec. per week. Pr.: BIOL 450.

BIOL 670. Immunology. (4) II. Chemical, genetic, and biological properties of the immune response, acquired immunity, and antibody production. Pr.: Two courses in biology; and a course in biochemistry or equiv.

BIOL 671. Immunology Lab. (2) II. Laboratory exercises in immunology. Pr.: BIOL 670 or conc. enrollment. Three-hour lab a week plus one hour rec.

BIOL 705. Eukaryotic Genetics. (3) I. An integrated exploration of transmission genetics and molecular genetics of eukaryotic organisms. The focus will be on genetic model organisms and their contributions to our understanding of mechanisms of genetic transmission and exchange, mutagenesis, gene expression, and regulation of cell division and development. Modern approaches to genomic analysis will be discussed. Pr.: BIOL 450 and BIOCH 521.

BIOL 707. Advanced Cell Biology. (3) I. Selected current topics in cell biology which reflect recent advances in the field. Major topics include membranes and transport, protein sorting, signal transduction, cell adhesion and motility, cell cycle, apoptosis, and specialized cell functions. Pr.: BIOL 541.

BIOL 886. Confocal, Fluorescence and Light Microscopy. (3) I, in odd years. An introduction to theories, functions and applications of confocal, fluorescence and light microscopy, and fluorescent

molecules. Lab emphasis on students working on independent research projects requiring microscopy. Two hours of lecture and three hours of lab per week.

DMP 705. Principles of Veterinary Immunology. (2) II. Innate and adaptive defense mechanisms in domestic animals. Topics include vaccinology, immunopathology, autoimmunity, immunodeficiency, and immunomodulation. Pr.: BIOCH 521 and BIOL 455

DMP 850. Immunology of Domestic Animals. (3) I. This course is designed to introduce graduate students to immune responses of domestic animals to pathogens and parasites. Pr.: BIOL 541.

DMP 878. Applications of Flow Cytometry. (1-3) I, II, S. Theory and practical experience in the use of flow cytometry in diagnosis and research. Pr.: Graduate standing.

MANGT 845 Technology Entrepreneurship and Strategies. (3)

No pre-requisites other than enrollment in graduate school. This is an evening course taught by Professor Katz and two practitioners in the technology entrepreneurship field.

GRAD 820. Leadership Practicum. (3) I, II. Develops the connections between leadership theory and practice. By conducting a practicum project, students demonstrate the ability to apply concepts and ideas from the study of leadership to a practical leadership problem within an organization. Pr.: GRAD 801 and MANGT 845. The practicum will be developed for stem cell certificate students with the theme “Leading an innovation to market”.

PLPTH 610. Biotechnology. (3) I. The use of biotechnology and molecular genetic approaches in plant and animal sciences. Emphasis is on the use of molecular techniques for plant and animal improvement. Three hours lec. per week. Pr.: ASI 500. Same as AGRON 610.

Requirements

Students with graduate standing and a 3.0 GPA in a field in the biological sciences or with a cumulative GPA of 3.0 or higher in the DVM curriculum are eligible to enroll. Exceptions are possible upon approval by the coordinator in consultation with the faculty.

Fifteen hours are required:

AP850, ASI802, ASI902 and AP711 are required. ASI 902 may be taken either two or three times.

Any three of the remaining courses qualify for the remaining credit hour requirements. If BIOL707 is taken, BIOL541 may be required as a pre-requisite.

Meeting learning objectives

The core courses (AP711, AP850, ASI802, ASI902) are designed to ensure a benchmark level of knowledge about stem cell biotechnology. Elective courses are intended to allow for: (1) specific advancement toward research competence in the field or (2) commercialization of stem cell and related technology.

Courses in the certificate may be included in graduate programs upon approval of the student's major professor and advisory committee. Inclusion of courses from other institutions and programs may be substituted for credit in the certificate in stem cell biotechnology with the approval of the program director in consultation with associated faculty.

Need for the proposed program

Stem cell biotechnology and regenerative medicine are emerging as central to the future of human and animal medicine and animal production. A supply of new scientists in basic disciplines with orientation to, or specific training in, stem cell biotechnology will be a necessary part of advancing this area of science, especially as political and social issues are untangled. The research and entrepreneurship tracks provided in the program will allow career flexibility that is becoming an ever-greater necessity for students.

It seems evident that, at this stage of the Institute's development, a graduate level certificate is best suited to capitalize upon the on-going research and intellectual property development. Once a certificate program is successfully established and a significant track record has accrued, consideration will be given to proposal of an interdisciplinary degree. However that would be premature at this juncture and in the near future.

The target audience for the proposed certificate includes graduate students in all the biological sciences, specifically including animal science, veterinary medicine, biology and biochemistry. Also some residents in clinical medicine and surgery may find it advantageous to gain increased expertise in the rising field of regenerative medicine. In addition students in the DVM curriculum that have aspirations toward research or corporate careers would find the certificate in stem cell biotechnology valuable.

Organization and Administration

The governing faculty for the certificate in stem cell biotechnology is comprised of the Kansas State University Founding Fellows of the Midwest Institute for Comparative Stem Cell Biology (see website <http://www.vet.ksu.edu/research/stemcell/index.htm>). The program director will be Duane L. Davis.

The administrative home of the certificate program will be the Institute. The governance of the Institute is explained on the website. Briefly, the Institute is situated administratively in the Office of the Vice President for Research. Oversight is provided by a liaison committee comprised of the Vice President for Research, the Dean of the College of Veterinary Medicine, the Dean of the College of Agriculture and the Vice Chancellor for Research of the University of Kansas Medical Center and an Executive Committee described in the website.

An extensive list of scientists and other faculty members are affiliated with the institute and are listed in the website. These individuals provide a ready source of highly qualified advisors to students in the certificate program.

Budget

The budget is anticipated to be nominal in that all of these courses in the program will be taught for other purposes also.

Faculty

The Founding Fellows of the institute at Kansas State University are Dr. Duane Davis, ASI; Dr. Deryl Troyer, AP; Dr. Mark Weiss, AP. These individuals, along with the program director, will supervise the program.

Program Director

The program director will be Dr. Duane L. Davis, Professor of Animal Sciences and Industry.

Learning outcomes and assessment

Learning outcomes and an assessment plan is attached.

Cover Sheet for Student Learning Outcomes

Directions: For each program (e.g., degree, certificate, minor, secondary major, etc.) and level (undergraduate and graduate), please complete separate cover sheets. Feel free to make copies of this sheet if needed. Those graduate programs with an integrated master's and doctoral program may provide one set of cover sheets.

Department / Unit: Midwest Institute for Comparative Stem Cell Biology

Title of Academic Program: Graduate Certificate in Stem Cell Biotechnology

Faculty contact(s) for the list of student learning outcomes for this academic program:

Duane Davis _____

Type of Degree (check one):

- ☐ Bachelor's ☐ Master's ☐ Ph.D. ☐ Ed.D.
☐ U. Certificate ☐ Minor ☐ Secondary major ☐ Associate
☒ G. Certificate
☐ Joint Degree (list the degree types): _____
☐ Other: _____

List of Student Learning Outcomes for this Degree Program

Please provide an attached list of learning outcomes or copy and insert them below.

1. Students completing the Graduate Certificate in Stem Cell Biotechnology will know cellular and molecular qualities that define stem cells; where stem cells may be found; and how stem cells can be isolated.
2. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess the knowledge and skills that allow them to critically evaluate the peer-reviewed literature in stem cell biology.
3. Students completing the Graduate Certificate in Stem Cell Biotechnology will understand the emerging areas of application of stem cells in regenerative medicine and food animal health and production.

4. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess skills in culture of mammalian stem cells.

5. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess the knowledge, skills and social understanding to critically evaluate and articulate the range of ethical issues associated with stem cell biology.

Please check the description(s) that best reflect the information being submitted.

☐

Faculty for The Midwest Institute for Comparative Stem Cell Biology have reviewed and endorse the list of student learning outcomes being submitted.

Date of Endorsement:

Director, Midwest for Comparative Stem Cell Biology
Signature

Date

Dean of the Graduate School's Signature
(Required for Graduate Degree Programs)

Date

Template
Degree Program
Assessment of Student Learning Plan
Kansas State University

- X Check the box if your program's student learning outcomes have been modified since November 2003. If so, please email (apr@ksu.edu) or attach a hard copy to this document.

College, Department, and Date

Colleges: Veterinary Medicine and Agriculture
Department: Anatomy and Physiology; Animal Sciences and Industry
Date: February 23, 2007

Contact Person(s) for the Assessment Plans

Dr. Duane Davis

Degree Program

Graduate Certificate in Stem Cell Biotechnology

Assessment of Student Learning Three-Year Plan
Student learning outcomes:

- 1. Students completing the Graduate Certificate in Stem Cell Biotechnology will know cellular and molecular qualities that define stem cells; where stem cells may be found; and how stem cells can be isolated.*
- 2. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess the knowledge and skills that allow them to critically evaluate the peer-reviewed literature in stem cell biology.*
- 5. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess the knowledge, skills and social understanding to critically evaluate and articulate the range of ethical issues associated with stem cell biotechnology.*

Relationship to K-State Student Learning Outcomes (insert the program SLOs and check all that apply):

Program SLOs	University-wide SLOs (Graduate Programs)			Program SLO is conceptually different from university SLOs
	Knowledge	Skills	Attitudes and Professional Conduct	
1. Know cellular and molecular qualities that define stem cells; where stem cells may be found; and how stem cells can be isolated.	X			Program SLO is consistent with University SLO.
2. Posses the knowledge and skills that allow them to critically evaluate the peer-reviewed literature in stem cell biology.	X	X		Program SLO is consistent with University SLO.
5. Posses the knowledge, skills and social understanding to critically evaluate and articulate the range of ethical issues associated with stem cell biology.			X	Program SLO is consistent with University SLO.

How will the learning outcomes be assessed? What groups will be included in the assessment?

Program SLOs	University-wide SLOs (Graduate Programs)			Program SLO is conceptually different from university SLOs
	Knowledge	Skills	Attitudes and Professional Conduct	
1. Know cellular and molecular qualities that define stem cells; where stem cells may be found; and how stem cells can be isolated.	1. Direct measure—Capstone exam. 2. Indirect measure—Career placement of certificate graduates.			Program SLO is consistent with University SLO.
2. Posses the knowledge and skills that allow them to critically evaluate the peer-reviewed literature in stem cell biology.	1. Direct measure—Paper presentations and participation in paper discussions in ASI 902 Topic/Stem Cell Biotechnology.	1. Direct measure—Oral paper presentations and participation in paper discussions in ASI 902 Topic/Stem Cell Biotechnology.		Program SLO is consistent with University SLO.
5. Posses the knowledge, skills and social understanding to critically evaluate and articulate the range of ethical issues associated with stem cell Biotechnology.			1. Direct measure—Attitude survey administered in ASI 902 Topics/Stem Cell Biotechnology	Program SLO is consistent with University SLO.

When will these outcomes be assessed? When and in what format will the results of the assessment be discussed?

1. Students completing the Graduate Certificate in Stem Cell Biotechnology will know cellular and molecular qualities that define stem cells; where stem cells may be found; and how stem cells can be isolated.

a. Upon completion of the coursework requirements for the Graduate Certificate in Stem Cell Biotechnology, all certificate seeking students will be expected to take a web-based comprehensive capstone exam covering fundamental aspects of stem cell biology (exam will be updated annually to reflect new developments in the field). Results of the exam will be shared with individual students upon completion. It is expected that students completing the Certificate will score 80 % or greater on the capstone exam. It is recommended that Ph.D. students take the exam prior to, or as a part of, their preliminary examinations and, at the discretion of their graduate committee, it could serve as a part of the determination of their readiness to enter candidacy for the Ph. D. degree.

b. Core scientists in teaching courses and conducting research through the Midwest Institute for Comparative Stem Cell Biology will be heavily engaged in training students that ultimately are awarded the Graduate Certificate in Stem Cell Biotechnology. It is expected that these students will secure employment in academia or allied industries in biomedical sciences. Therefore, placement of all graduate and DVM students after completion of their degrees will be tracked to gain indirect evidence that the Certificate may be adding value to master, doctoral and DVM degrees. Data will be gathered via a web-based survey of graduates administered within 12 months of graduation.

2. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess the knowledge and skills that allow them to critically evaluate the peer-reviewed literature in stem cell biology.

a. All students completing the Graduate Certificate will be required to enroll in ASI 902 Topics/Stem Cell Biotechnology. A rubric has been developed (attached) to assess student's working knowledge of stem cell biology as well as their oral communication skills in discussing stem cell biology.

3. Students completing the Graduate Certificate in Stem Cell Biotechnology will understand and have the skills to articulate the emerging areas of application of stem cells in regenerative medicine and food animal health and production.

4. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess skills in culture of mammalian stem cells.

5. Students completing the Graduate Certificate in Stem Cell Biotechnology will possess the knowledge, skills and social understanding to critically evaluate and articulate the range of ethical issues associated with stem cell biology.

a. All students will complete a survey that evaluates attitudes toward the diversity of ethical views surrounding the use of stem cells in animal research and therapeutics. The ability of

students to be tolerant and understanding of diverse views will make them more effective professionals once in the workplace. This web-based survey will be updated annually to include developing concerns and views and will be administered to all students in their first semester of enrollment in ASI 802 and again in their final semester in ASI 902 (coincident with completion of the coursework requirements for the Certificate). Completion of both surveys will be a requirement for successful completion of the Certificate.

What is the unit's process for using assessment results to improve student learning?

The faculty coordinator for ASI 902 in each fall semester offering of the course will be responsible for summarizing assessment data for Certificate graduates from the previous academic year, as well as comprehensive data accumulated from all Certificate graduates (at least three years may be required to accumulate sufficient numbers of Certificate graduates to obtain some measure of reliability of the data). The data will be presented to both core faculty and graduate students sometime during the first four meetings of ASI 902. The data will be discussed (among faculty and students) and where results of assessment point to failure to attain the expected outcome, a corrective course of action will be recommended. This course of action may point to appropriate changes in curriculum and(or) fine tuning of assessment tools.