

SEP 26

OFFICE OF THE  
SENATE COUNCIL

## Part II: Proposal to Revise the Curriculum and Graduate Ph.D. in Toxicology

### Programmatic Rationale

**6.1 Need for training in cancer.** Kentucky has the notoriety of being the worst ranked (50<sup>th</sup>) state in the U.S. in overall cancer deaths, due in part to the fact that Kentucky also has one of the highest incidences of smoking (ranked 48<sup>th</sup>). Another cause for concern is the increase in carcinogenic metals (e.g., arsenic, chromium and cadmium) found in the soil and water supply in Eastern Kentucky. These metals, which are byproducts of coal, are known to induce oxidative stress and have been linked to various cancers. The burden in Appalachian Kentucky, where the cancer mortality rate is 17% higher than the U.S. rate, raises considerable concern. Thus, the need for sustained support to develop scientists committed to the study of cancer in Kentucky is great. Currently, there is no dedicated Cancer Biology training program for predoctoral students and postdoctoral fellows at UK or in the state of Kentucky. Training of doctoral students and postdoctoral fellows in the GCT is currently supported by an NIEHS T32 Training Grant in "Molecular Mechanisms of Toxicity". This grant, first funded in 1990, currently supports students in the Ph.D. program in Toxicology. While one research focus relates to cancer and carcinogenesis, the training is not solely focused on cancer and does not emphasize the basic, translational and clinical aspects of cancer biology signaling mechanisms associated with tumor cell survival, progression and metastasis, or the tumor microenvironment as a contributing factor. The expansion of the GCT to include cancer biology will provide an excellent environment for training in these areas. A strong training program in cancer biology is a key component of the NCI supported Cancer Center Support Grant, and is absolutely essential to the competitive renewal of this Grant, due in 2017. Thus, a key feature of the proposed Department is a strong education and training component in mechanisms of environmentally induced cancers and cancer biology.

**6.2 Training program in Toxicology and Cancer Biology.** The proposed doctoral program continues to build on the first-year Integrated Biomedical Sciences (IBS) courses currently used by all doctoral programs in the COM. In the second year, the proposed curriculum provides strong basic training in both toxicology and cancer biology, that can be complemented by elective courses that focus on various aspects of these disciplines. Coursework in each of these areas has been and is being developed by faculty with the requisite expertise. The current and proposed curricula, designed to be fully implemented in Fall 2014, are provided in Part II, **Appendix H**.

Briefly, a 3-credit course in Biology and Therapy of Cancer (MI616) or Topics in Biochemistry-Advanced Concepts Signal Transduction (BCH 780) will be required of all doctoral students, as will Molecular Toxicology and Carcinogenesis (TOX 680), a 3-credit course that incorporates the strengths of the current Toxicology faculty on the role of oxidative stress and DNA damage and repair in chemical/metal carcinogenesis and cancer. This course is being revised from the current 5 credit course, to a 3 credit course (**Appendix I**). Environmental and Regulatory Toxicology (TOX 509) is retained as a required course. A fourth 2-credit course, Drug Metabolism and Disposition (TOX 663) covers the absorption, distribution, metabolism, elimination and transport of chemicals, with a focus on environmental carcinogens and cancer chemotherapeutic drugs, completes the required courses of all doctoral students for the PhD in Toxicology and Cancer Biology. Additional recommended elective courses include MI616 or BCH 780 (whichever has not already been taken), Systems Biochemistry (currently under development by new faculty members), and PHA 622, Molecular Drug Targets and Therapeutics (in Cancer). This list is not considered comprehensive, or intended to exclude other courses that Advisory Committees of doctoral students consider to be relevant for the training of a student. Current graduate students will continue to be subject to the current curricular requirements.

**Current Curriculum for Ph.D. in TOX 11-20-2013****Pre-qualifying**

Course No: Title	Credit Hour
✓IBS601: Biomolecules and Metabolism	3
✓JBS602: Molecular Biology	3
✓JBS603: Cell Biology	3
✓JBS604: Cell Signaling	3
✓JBS605: Genetics	2
✓JBS606: Integrated Biomedical Sciences	4
STA580: Biostatistics or STA570: Basic Statistical Analysis	3-4
✓TOX600: Ethics in Scientific Research	1
✓TOX770-001: Toxicology Seminar	0
✓TOX770-002: Toxicology Seminar/Orientation-Journal Club	1
✓PHA621 Advanced Pharmacodynamics	3
✓TOX509 Biochemical and Environmental Toxicology	3
✓TOX680 Molecular Mechanisms in Toxicology	5
✓TOX780 Special Problems in Toxicology/Grant Writing	2
Elective	2-3
<b>Total: 38-40</b>	

**Post-qualifying**

✓TOX767: Dissertation Residency Credit	2/semester
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**Proposed Curriculum for Ph.D. in TOX/Cancer Biology****Pre-qualifying**

Course No: Title	Credit Hour
✓IBS601: Biomolecules and Metabolism	3
✓JBS602: Biomolecules and Molecular Biology ✓	3
✓JBS603: Cell Biology ✓	3
✓JBS606: Integrated Biomedical Sciences ✓	3
✓JBS608: Special Topics in IBS (4 x 0.5 h mini-courses)	2
✓JBS610: Critical Scientific Readings	2
✓JBS611: Practical Statistics <sup>1</sup>	1
✓TOX770-001: Toxicology Seminar <sup>2</sup>	0
✓TOX770-002: Toxicology Seminar/Orientation-Journal Club	1
✓TOX600: Ethics in Scientific Research	1
✓TOX663: Drug Metabolism and Disposition <sup>3</sup>	2
✓TOX680: Molecular Toxicology and Carcinogenesis <sup>4</sup> ✓	3
✓TOX780: Special Problems in Toxicology/Grant Writing	2
✓TOX509: Environmental and Regulatory Toxicology <sup>4</sup> ✓	2
✓TOX790: Research in Toxicology (or IBS609) <sup>5</sup> ✓	2
✓MI616: Biology and Therapy of Cancer <b>or</b>	
✓BCH780: Topics in Biochemistry-Adv. Concepts Signal Transduction <sup>6</sup>	3
Elective related to Toxicology or Cancer Biology (or subject to DGS approval)	3
<b>Total: 36</b>	

**Post-qualifying**

✓TOX767: Dissertation Residency Credit <sup>7</sup>	2/semester
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**Footnotes:**<sup>1</sup>Replaces STA570/STA580.<sup>2</sup>Ph.D. students register for TOX770-001 until residency is completed and again in the semester in which they present a seminar (required for the degree).<sup>3</sup>Replaces PHA621.<sup>4</sup>Credit hours reduced compared to former curriculum to accommodate inclusion of MI616/BCH780 course requirement.

## Part II: Appendix H

- <sup>5</sup>Ph.D students entering directly into TOX/Cancer Biology program register for TOX790 for 1 h credit in their first two semesters in the program. Similarly, IBS students register for IBS609 for 1 h credit in their first two semesters.
- <sup>6</sup>Ph.D. students in the Cancer Biology track will be expected to enroll in both MI616 and BCH780, one as a required course and the other as an elective.
- <sup>7</sup>Ph.D. students register for TOX767 each semester post-residency until successful completion of their dissertation.

**Proposed TOX/Cancer Biology Core Courses**Course ID: Course Title (credit hours/semester)

- ✓ TOX509: Environmental and Regulatory Toxicology (2)
- ✓ TOX600: Ethics in Scientific Research (1)
- ✓ TOX663: Drug Metabolism and Disposition (2)
- ✓ TOX680: Molecular Toxicology and Carcinogenesis (3)
- ✓ TOX767: Dissertation Residency Credit (2)<sup>1</sup>
- ✓ TOX770-001: Toxicology Seminar (0)<sup>2</sup>
- ✓ TOX770-002: Toxicology Seminar/Orientation-Journal Club (1)
- ✓ TOX780: Special Problems in Toxicology/Grant Writing (2)
- ✓ TOX790: Research in Toxicology (1)<sup>3</sup>
- ✓ ML616: Biology and Therapy of Cancer or BCH780: Topics in Biochemistry-Adv. Concepts in Signal Transduction (3)

**List of Recommended Electives**Course ID: Course Title [Instructor] (credit hours/semester)

- ✓ BCH780: Topics in Biochemistry-Advanced Concepts in Signal Transduction [O'Connor] (3)
- ✓ ML616: Biology and Therapy of Cancer [Rangnekar] (3)
- ✓ BIO560/TOX560 Environmental Physiology and Toxicology [Unrine] (4)
- ✓ PHA622: Molecular Drug Targets and Therapeutics (in Cancer) [Piascik] (1)
- TBN: Systems Biochemistry [Lane]

**List of Acceptable Electives**Course ID: Course Title [Instructor] (credit hours/semester)

- ✓ ANA516: Select Topics in Advanced Neuroscience; Brain Body Mind [Gash] (3)
- ✓ ANA605/PGY605: Neurobiology of CNS Injury and Repair [Hall] (3)
- ✓ ANA636: Advanced Neuroanatomy [Maley et al.] (5)
- ✓ BCH604: Structural Biology [Fried] (3)
- ✓ BCH610: Biochemistry of Lipids and Membranes [Waechter; Whiteheart] (3)
- ✓ BCH611: Biochemistry and Cell Biology of Nucleic Acids [Noonan] (3)
- ✓ BCH612: Structure and Function of Proteins/Enzymes [Zhu] (3) ✓
- ✓ BCH615/BIO615/ MI615: Molecular Biology [Peterson] (3)
- ✓ BIO520/INF520: Bioinformatics [Smith] (3)
- ✓ BIO618: Molecular Neurobiology (4)
- ✓ BIO685/MI685: Immunobiology, Infection and Inflammation [Kaplan et al.](3)
- ✓ CHE565: Environmental Chemistry [Guzman] (3)
- ✓ CHE666: Proteomics and Mass Spectrometry
- ✓ CPH601: Environmental Health [Mannino] (3)
- ✓ CPH604: Public Health and Disease Prevention [Eddens] (3)
- ✓ CPH605: Epidemiology [Fleming] (3)
- ✓ CPH615: Cancer Epidemiology [Coker] (3)
- ✓ CPH620: Occupational and Environmental Health [Sanderson] (3)
- ✓ HES600: Research Methods in Human Environmental Science [Easter] (3)
- ✓ PGY617: Physiological Genomics [McClintock] (2)
- ✓ PHA649: Molecular Pharmacology (3) ✓
- ✓ PHA621: Advanced Pharmacodynamics (3)
- ✓ PHR612: Quantitative Pharmacodynamics [McNamara/Leggas](3)
- ✓ PHR664: Theory and Practice of Drug Metabolism (3) ✓

**TOX 680 – Molecular Toxicology and Carcinogenesis**  
**Spring 2015**

MWF, 11:00 – 11:50 AM, Room HSRB310, unless otherwise noted\*  
 Course Director: Dr. Hsin-Sheng Yang, 323-6684, [hyang3@uky.edu](mailto:hyang3@uky.edu)

**Section 1. Oxidative Stress (Yang, 323-6684; [hyang3@emai.uky.edu](mailto:hyang3@emai.uky.edu))**

- |   |           |
|---|-----------|
| 1. Principles of Oxidative Stress                           | Shi       |
| 2. Detection of Oxidative Stress                            | Shi       |
| 3. Cellular Antioxidant Defense Mechanisms                  | Wei       |
| 4. Antioxidant Enzymes                                      | Wei       |
| 5. Redox Regulation   | St. Clair |
| 6. Mitochondria and Cancer                                  | Izumi     |
| 7. Role of oxidative stress in toxicity and carcinogenicity | Shi       |
| 8. Metals and Human Disease I                               | Zhang     |
| 9. Metals and Human Disease II                              | Zhang     |
| 10. Disease prevention by oxidative stress prevention       | Shi       |
| 11. Nitrosative Stress                                      | TBA       |
| 12. Student Presentations of Relevant Literature            |           |
| 13. SECTION 1 EXAM  |           |

**Section 2. Genotoxicology (Wang, 323-5784; [zwang@email.uky.edu](mailto:zwang@email.uky.edu))**

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|--|--------|
| 14. DNA Damage                                   | Orren  |
| 15. DNA Damage                                   | Orren  |
| 16. Base Excision Repair                         | Izumi  |
| 17. Nucleotide Excision Repair                   | Mellon |
| 18. Mismatch Repair                              | Gu     |
| 19. Single- and Double-strand Break Repair       | Orren  |
| 20. Recombinational Repair and Crosslink Repair  | Orren  |
| 21. Measurement of Genotoxicity                  | Wang   |
| 22. DNA Damage-induced Mutagenesis               | Wang   |
| 23. Epigenetics and Toxicology                   | Li     |
| 24. Student Presentations of Relevant Literature |        |
| 25. SECTION 2 EXAM                               |        |

### **Section 3. Cellular Mechanisms in Toxicology and Carcinogenesis**

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|--|-----------|
| 26. Cell Cycle Checkpoints I                     | Orren     |
| 27. Cell Cycle Checkpoints II                    | Orren     |
| 28. Protein Translation in Cancer I              | Yang      |
| 29. Protein Translation in Cancer II             | Yang      |
| 30. ER and Cellular Stress                       | Yang      |
| 31. Cell-Intrinsic Apoptotic Pathways            | TBA       |
| 32. Extrinsic Apoptotic Pathways                 | Rangnekar |
| 33. Anoikis                                      | TBA       |
| 34. Proteosomal Degradation and Autophagy        | TBA       |
| 35. Student Presentations of Relevant Literature |           |
| 36. SECTION 3 EXAM                               |           |

### **Section 4. Toxic Insults and Disease**

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|--|-------------|
| 37. Chemical Carcinogenesis                          | Li          |
| 38. Tobacco Smoke and Air Pollutants                 | Orren       |
| 39. Occupational and Environmental Lung Disease      | Mannino     |
| 40. Cd, Cigarettes, Cellular Changes, COPD           | Mannino     |
| 41. Lung Toxicity and Animal Models                  | Fu          |
| 42. Lung Cancer                                      | Hirschowitz |
| 43. Environmental Agents in Gastrointestinal Cancers | TBA         |
| 44. Experimental Hepatocarcinogenesis                | Glauert     |
| 45. Skin Carcinogenesis I                            | D'Orazio    |
| 46. Skin Carcinogenesis I                            | D'Orazio    |
| 47. Renal Toxicology                                 | Fu          |
| 48. Student Presentations of Relevant Literature     |             |

SECTION 4 EXAM: HELD DURING FINAL EXAM PERIOD

**Course Description.** As a required course for the Ph.D. degree in Toxicology and Cancer Biology, the major goals of TOX680 are to provide a solid knowledge base as to: 1) the key molecular and cellular mechanisms related to toxicity and carcinogenesis, and 2) the established relationships between exposures to toxicants and development of cancer and other human diseases.

**Exams and Grading:** Final letter grades will be based on exams (80%), student presentations (15%) and attendance (5%). A 2-h exam will be given following each section. Each lecture will be tested and contribute 10 points to the final test score. Therefore, each lecture is equally weighed in the final course grade. All written exams will be in the form of closed book test.

**Attendance:** Attendance to the class is mandatory and is critical for success in this course. The first unexcused absence will result in a warning. For the second and each subsequent unexcused absence, you will lose 0.5% of your final grade, which may accumulate up to 5% of your final course grade. Unexcused late arrival for class is not allowed; nor is unexcused early departure from class. Arriving 10 minutes after the class starts will be considered a 50% attendance for the lecture and will subject to the attendance point deduction accordingly.

Officially recognized reasons for nonattendance (excused absence) may be found in the UK Senate Rules (SR 5.2.4.2), a copy of which is listed below.

"5.2.4.2 Excused Absences: (US: 11/11/85; 2/9/87) The following are defined as excused absences:

A. Illness of the student or serious illness of a member of the student's immediate family. The instructor shall have the right to request appropriate verification.

B. The death of a member of the student's immediate family. The instructor shall have the right to request appropriate verification.

\*Children of students are considered members of the immediate family (RC: 11/9/94)

C. Trips for members of student organizations sponsored by an academic unit, trips for University classes, and trips for participation in intercollegiate athletic events. When feasible, the student must notify the instructor prior to the occurrence of such absences, but in no case shall such notification occur more than one week after the absence. Instructors may request formal notification from appropriate university personnel to document the student's participation in such trips.

D. Major Religious Holidays. Students are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day for adding a class.

E. Any other circumstances which the instructor finds reasonable cause for nonattendance."

## Brothers, Sheila C

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**From:** Nikou, Roshan  
**Sent:** Friday, September 26, 2014 3:48 PM  
**To:** Brothers, Sheila C; Carvalho, Susan E; Ellis, Janie; Ett, Joanie M; Hippisley, Andrew R; Jackson, Brian A; Lindsay, Jim D.; Nikou, Roshan; Price, Cleo; Timoney, David M  
**Cc:** Badurdeen, Fazleena F; Schuer, Kevin M; Jones, Davy; Orren, David K; McCormick, Katherine; Perkins, Andrea L; Dupont-Versteegden, Esther E  
**Subject:** Transmittals  
**Attachments:** Establish Deptof Toxicology and Cancer Biology-signed.pdf; MastersPH-signed.pdf; Manufacturing.pdf; PhysicianAssistant.pdf

TO: Andrew Hippisley, Chair and Sheila Brothers, Coordinator  
Senate Council

FROM: Brian Jackson, Chair and Roshan Nikou, Coordinator  
Graduate Council

The Graduate Council approved the following proposals and is now forwarding them to the Senate Council to approve.

Please note, the courses listed below are accessible via e-Cats' workflow.

Establishment of the Department of Toxicology and Cancer Biology  
Change in Manufacturing Systems Engineering Masters Program (additional information is attached)  
Change in Public Health Masters program  
Change in Physician Assistant Masters program

HHS 402G Muscle Biology  
PPS 710 Techniques in Secondary Data Research  
BMI 730 Principles of Clinical Informatics  
BMI 731 Biomedical Information Retrieval  
BMI 732 Biomedical Ontologies and Semantic Web Techniques  
BMI 733 Biomedical Natural Language Processing  
BMI 734 Introduction to Biomedical Image Analysis  
BMI 735 Introduction to BioImage Informatics  
CPH 709 Global Health Internship  
PAS 656 Patient Evaluation and Management  
PA 775 Special Topics in Health Administration

Thank you,